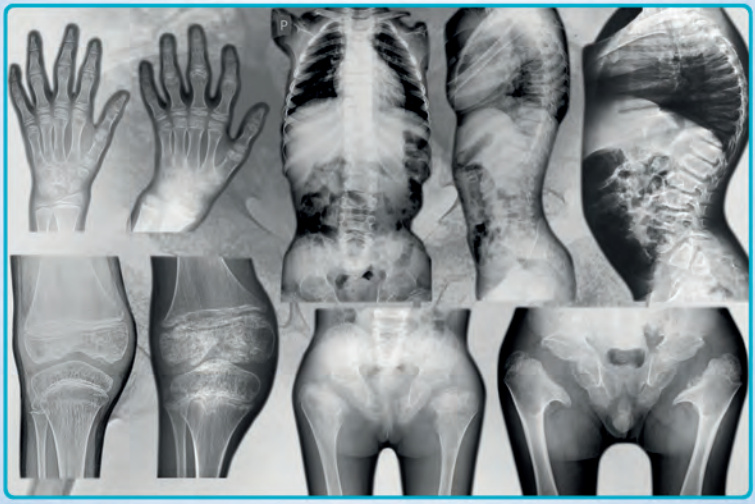
# Pohybové ústrojí

## Pokroky ve výzkumu, diagnostice a terapii



**Vydává**
**Ambulantní centrum pro vady pohybového aparátu, s.r.o.**
**Odborná společnost ortopedicko-protetická ČLS J. E. Purkyně**
**Společnost pro pojivové tkáně ČLS J. E. Purkyně**

ročník 21/2014 číslo 3-4

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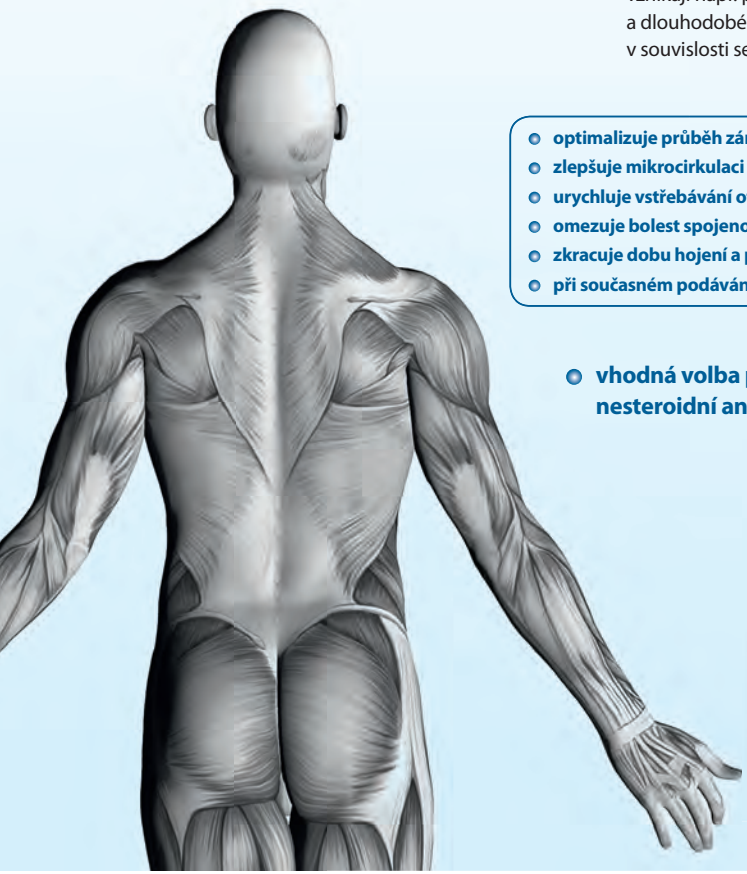

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Volně prodejný lék. Bez úhrady VZP. Datum poslední revize SPC: 30. 12. 2010.

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*Dvojčíslo časopisu 3–4, 21. ročníku časopisu Pohybové ústrojí*

*je věnováno*

***panu profesorovi Tomaszi Karskemu, MD, PhD.***

*a*

***panu profesorovi Mikhailu Dudinovi, MD, PhD, DSc.***

*The double issue of 21st volume of the Locomotor System journal*

*is dedicated to*

***Professor Tomasz Karski, MD, PhD.***

*and*

***Professor Mikhail Dudin, MD, PhD, DSc.***

# POHYBOVÉ ÚSTROJÍ

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& Odborná společnost ortopedicko – protetická ČLS J. E. Purkyně
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# LOCOMOTOR SYSTEM

**Advances in Research, Diagnostics and Therapy**

Published by The Society for Connective Tissues, Czech Medical Association of J. E. Purkyně, Prague, Society for Prosthetics and Orthotics, Czech Medical Association of J. E. Purkyně, Prague, Czech Republic & Ambulant Centre for Defects of Locomotor Apparatus Prague, Czech Republic

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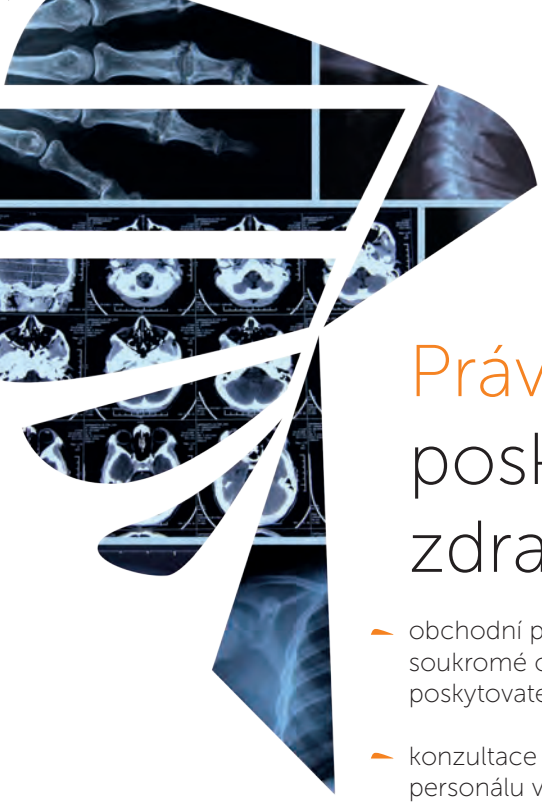
Both papers on progress in research of connective tissue diagnostics, medical and surgical therapy of multiple congenital abnormalities of skeleton mainly in the fields of paediatric orthopaedic surgery and plastic surgery, orthotics and prosthetics treatment, and papers dealing with biomechanics, clinical anthropology and paleopathology are appreaciated.

The journal has an interdisciplinary character which gives possibilities for complex approach to the problematics of locomotor system. The journal belongs to clinical, preclinical and theoretical medical branches which connect various up-to-date results and discoveries concerned with locomotor system. You can find the volumes of Locomotor System journal at http://www.pojivo.cz/cz/pohybove-ustroji/ since 1997 (free of charge). Since 2013 only electronic edition of the journal is available. That is why we recommend to all subscribers and those interested apply at http://www.pojivo.cz/en/newsletter, enter personal data, titles and e-mail address where the journal will be mailed.

Abstracts of presented papers are excerpted in EMBASE/Excerpta Medica (from the year 1994) and in the Bibliographia medica Čechoslovaca (from the year 2010). We prefer the manuscripts to be prepared according to Uniform Requirements for Manuscripts Submitted to Biomedical Journals (Vancouver Declaration, Brit med J 1988; 296, p. 401-405).



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- a všechny další otázky, s nimiž se poskytovatelé zdravotních služeb v praxi setkávají

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# POHYBOVÉ ÚSTROJÍ, 21, 2014, č. 3+4

Pokroky ve výzkumu, diagnostice a terapii

## OBSAH

# LOCOMOTOR SYSTEM, 21, 2014, No. 3+4

Advances in Research, Diagnostics and Therapy


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## METHODOLOGY



## NEWS



**Anniversary**



## SUPPLEMENTUM

**Vážení čtenáři, autoři a inzerenti,**

děkujeme za Vaši pomoc při tvorbě mezioborového odborného recenzovaného časopisu **„Pohybové ústrojí – pokroky ve výzkumu, diagnostice a terapii (dále PÚ)"**.

Znovu upozorňujeme, že od roku 2013 je časopis Pohybové ústrojí vydáván pouze v elektronické formě (v roce 2014 bylo přiděleno nové ISSN 2336-4777). Pro současné odběratele časopisu PÚ a další zájemce doporučujeme přihlásit se na http://www.pojivo.cz/en/newsletter/, zadat jméno a e-mailovou adresu, na kterou bude časopis posílán. Na webové doméně SPT ČLS JEP http://www.pojivo.cz/cz/pohybove-ustroji/ naleznete ve formátu PDF všechna jednotlivá čísla a dvojčísla časopisu (včetně Suplement) vydaná od roku 1997 (bezplatný přístup).

Dvojčíslo časopisu 3–4, 21. ročník časopisu Pohybové ústrojí je věnován dvěma členům redakční rady k významnému životnímu jubileu, a to panu Prof. Tomaszovi Karskému, MD, PhD (75 let) a panu Prof. Mikhailovi Georgiyevichi Dudinovi, MD, PhD, DSc (65 let).

V suplementu časopisu byla publikována abstrakta referátů přednesených na mezinárodním The 16th Prague-Lublin-Sydney-St.Petersburg Symposiu v Lublinu v Polsku ve dnech 21.–24. září 2014. Symposium, jehož hlavní téma bylo „Disorders of growth and defects of growth epiphysis", mělo velmi vysokou společenskou a odbornou úroveň. Symposia se zúčastnili zástupci z 12 zemí.

V rubrice zprávy jsou uvedeny 1. informace o jubilejním 20. Kubátově symposiu, které se bude konat v Lékařském domě v Praze 2 ve dnech 6.–7. 3. 2015 a The 17th Prague-Lublin-Sydney-St.Petersburg Symposiu, které plánujeme uskutečnit v Kroměříži (místo konání hotel Octárna) ve dnech 20.–24. září 2015. Hlavní organizace mezinárodního symposia se ujali doc. MUDr. Ivo Mařík, CSc. předseda Společnosti pro pojivové tkáně (SPT) ČLS JEP a MUDr. Petr Krawczyk, předseda Ortopedicko-protetické společnosti (OPS) ČLS JEP. Téma symposia je „Growth plate – Disorders of growth".

Jako v dřívějších letech je předmětem a posláním časopisu PÚ publikovat vědecké práce, týkající se diagnostiky a symptomatické mezioborové léčby kostních dysplazií, končetinových anomálií, dysmorfických vad pohybového aparátu a genetických syndromů, metabolických kostních chorob, sekundární osteoporózy, osteo/spondyloartrózy, ale i jiných chorob, které ve svých důsledcích negativně ovlivňují vývoj a kvalitu pohybové ústrojí v průběhu lidského života. Dále práce vycházející z výzkumu pojivových tkání, práce orientované na biochemickou, morfologickou, genetickou a molekulární diagnostiku chorob pohybového ústrojí. Zvláštní pozornost je přikládána pracím z oblasti biomechaniky, neuroadaptivním změnám skeletu, řízené remodelaci pojivových tkání v závislosti na léčebných metodách (kalciotropní léky, rehabilitace, ortoticko-protetické a operační léčení), v neposlední řadě studiím muskuloskeletálních a neuronálních interakcí i sdělením antropologickým a paleopatologickým. Oceňujeme především interdisciplinárně zaměřené práce. V anglickém jazyce jsou publikována sdělení zahraničních i našich autorů. Žádaným doplněním obsahu časopisu jsou zprávy ze sjezdů a konferencí. V rubrice zprávy zveřejňujeme oznámení o životním výročí členů RR časopisu, SPT ČLS JEP, OPS ČLS JEP a významných osobností, sdělení o prioritních pozorováních, ze studijních a poznávacích cest aj.

Opakovaně uvádíme směrnice pro autory příspěvků, kterým věnujte prosím pozornost při tvorbě Vašich vědeckých sdělení.

Časopis PÚ byl v roce 2008 zařazen Radou pro výzkum, vývoj a inovace vlády ČR na Seznam recenzovaných neimpaktovaných periodik vydávaných v České republice. V souvislosti se změnou v elektronickou formu vydávání v roce 2013 časopis nedopatřením vypadl ze Seznamu. Od roku 2015 je elektronická forma Pohybového ústrojí (ISSN 2336-4777) znovu na Seznamu recenzovaných neimpaktovaných periodik.

Souhrny prací publikovaných v časopisu jsou excerpovány v EMBASE / Excerpta Medica (od r. 1994) a v Bibliographia medica Čechoslovaca (od r. 2010).

K prosazení časopisu Pohybové ústrojí mezinárodně je velmi významné citovat práce uveřejněné v časopisu v příspěvcích posílaných do zahraničních časopisů. Pro zvýšení úrovně časopisu PÚ je nezbytné získávat původní kvalitní práce a kasuistiky, které doporučujeme publikovat v angličtině s cílem zvýšit zájem o náš časopis v odborném světě. Souhrny původních prací doporučujeme psát co nejvýstižněji, strukturovaně česky a anglicky (objectives, methods, results and discussion), s klíčovými slovy. Snahou redakční rady je zvýšit úroveň časopisu tak, aby byl přijat mezi časopisy citované v databázi SCOPUS.

Za mnohaletou spolupráci děkuje redakční rada panovi Prof. Dr. Med. Zoranovi Vukasinovicovi (Belgrade, Croatia).

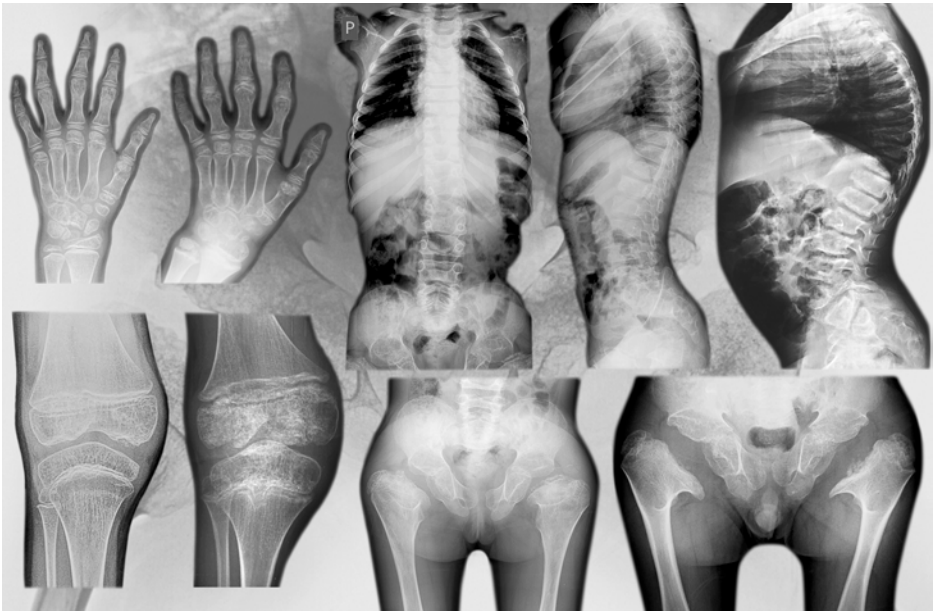
Těšíme se na Vaši spolupráci a tvůrčí připomínky v roce 2015.

Redakční rada

# OBRÁZEK NA TITULNÍ STRANĚ ČASOPISU DEMONSTRUJE KNIESTOVU DYSPLAZII

Obrázek na titulní straně časopisu demonstruje charakteristické rentgenologické projevy **Kniestovy dysplazie** (MIM No.156550), na základě kterých lze s jistotou potvrdit genetickou diagnózu (stejně jako např. u achondroplazie, spondylometafyzární dysplazie, typ Kozlowski aj.), ale i odlišit tuto spondylo-epi-metafyzární dysplazii od jiných kolagenopatií typu II (např. Spondyloepifyzární dysplazie vrozená, Spondylo-epifyzární dysplazie s krátkými metatarzy, dříve Česká dysplazie, Sticklerův syndrom typ 1) nebo metatropické dysplazie aj.). Určení správné diagnózy již v batolecím a předškolním věku je významné nejen pro další prognózu závažně postiženého dítěte, ale zabrání dalšímu finančně nákladnému vyšetřování. Určení správné klinicko-antropologicko-radiologické diagnózy je významné také pro vědecké pracovníky, zabývající se kostní biologií, protože mohou využít již známé informace o klinických korelacích genů a proteinů.

Na obrázku jsou zobrazeny patognomonicky významné rentgenologické změny na snímcích rukou, kyčlí, kolenních kloubech a páteři dvou nepříbuzných dětí dívky a chlapce. Diagnóza pacientů byla stanovena nebo potvrzena v Ambulantním centru pro vady pohybového aparátu s.r.o. v Praze ve spolupráci s panem Doc. Dr. Med. Kazimierzem S. Kozlowskim, M.R.A.C.R., Sydney, Australia



RTG snímky z archivu Ambulantního centra pro vady pohybového aparátu s.r.o., Olšanská 7, 130 00 Praha 3.
X-rays from archive of the Ambulantn Centre fo Defects of Locomotor Apparatus l.l.c. in Prague, Czech Republic.

## Ruka

Na obrázku vlevo nahoře jsou RTG snímky levé ruky dívky ve věku 5 let (vlevo) a chlapce (vpravo) ve věku 6,5 roku. Nápadné je zkrácení středních a zvláště distálních článků, krátký a široký 1. metakarp a rozšíření obou konců všech krátkých kostí. Epifýzy jsou ploché a mírně deformované. U chlapce (vpravo) jsou navíc osifikační centra na distálních koncích základního článku 1.–5. prstu, což je pro Kniestovu dysplazii typické (ale někdy přítomné též u Spondylepifyzární dysplazie vrozené). Karpální kosti mají abnormální nepravidelný tvar. Malá nadpočetná kůstka je přítomná mezi os naviculare a os lunatum u dívky (vlevo). U chlapce (vpravo) jsou os naviculare a os trapezoideum velmi malé, os lunatum chybí, distální konec radia a ulny je rozšířený, epifýzy jsou velké.

## Kolenní kloub

Na obrázku vlevo dole jsou RTG snímky pravého kolene v AP projekci dívky ve věku 5 let (vlevo) a chlapce ve věku 6,5 roku (vpravo). Epifýzy jsou lehce zploštělé a epifýzy distálního femuru široké. Proximální růstové fýzy tibie jsou zakřiveny proximálně ve tvaru obráceného „V". Fibuly jsou tenké, proximálně kratší.

## Pánev a kyčle

Na obrázku vpravo dole je RTG pánve a kyčlí – vlevo dívka 5 let, vpravo chlapec 6,5 roku. Pánev je malá. Bazální část pánevních lopat je zkrácená. Krčky femurů jsou velmi široké a velmi krátké. Epifýzy hlavic femurů jsou velmi malé a dysplastické.

## Páteř

Na obrázku vpravo nahoře je páteř a hrudník v AP projekci (dívka 5 let) a bočné projekci (vlevo dívka 5 let, vpravo chlapec 6,5 roku). Typická je generalizovaná platyspondylie a dopředu klínovitý tvar v torakolumbální oblasti, u chlapce je výrazná hrudní kyfóza a bederní lordóza. Hrudník je zvonovitý, předozadně rozšířený, rozšířené přední konce žeber (rachitický růženec).

**Rentgenologická diagnostika** Kniestovy dysplazie je možná v prvních letech života. Hlavní RTG příznaky jsou: platyspondylie s dopředu klínovitým tvarem v torakolumbální oblasti, široké lopaty kyčelní s hypoplazií bazálních částí a velmi široké a krátké krčky femurů s těžkou dysplazií až aplazií epifýz hlavic femurů. Krátké kosti mají široké metafýzy a velké deformované epifýzy.

Určení diagnózy radiologickým vyšetřením je možné u dětí (v období růstu) při současném zhodnocení klinického nálezu.

K typickým **klinickým projevům** patří: Zvláštní obličej s oploštěním střední části a vpáčeným kořenem nosu, mělké orbity s vyboulenými očními bulvami. Krátký trup s hrudní kyfózou a bederní lordózou, někdy i skoliózou páteře, hrudník je krátký s protruzí sterna. Končetiny jsou

relativně krátké s prominujícími velkými klouby a omezeným rozsahem pohybu. Někdy jsou přítomny pedes equinovari.

**Diferenciální diagnóza.** Podobné RTG změny skeletu jsou u Spondyloepifyzální dysplazie vrozené a metatropické dysplazie.

**Genetický přenos** onemocnění je autozomálně dominantní. Může se vyskytnout somatický a gonadální mozaicismus. Prenatální diagnostika je možná v postižené rodině průkazem mutace v genu COL2A1 v choriových klcích nebo v amniálních buňkách.

**Prognóza.** Vývoj inteligence u většiny postižených a životní prognóza jsou normální. Přibližně v 50 % případů bývá rozštěp patra, častá je myopie a převodní i neurální ztráta sluchu. Může se vyvinout katarakta. Kontraktury kloubů a páteře s epifyzární dysplazií vyústí v předčasnou osteoartrózu, spondylózu a spondylatrózu. Výška dospělých bývá mezi 106 až 145 cm.

## TITLE PICTURE DEMONSTRATES – KNIEST DYSPLASIA

This disorder is important for the radiologists because of distinctive radiographic findings usually in the first years of life. On the basis of these findings the genetic diagnosis can be definitely confirmed (identically as e.g. at Achondroplasia, Spondylometaphyseal Dysplasia, Kozlowski type and/or Metatropic dysplasia and Trichorhinophalangeal syndrome, type 1). Determination of genetic diagnosis in the first years of life is important not only for prognosis but prevent next financially expensive examination and help some researchers who are interested in bone biology.

At the title picture are shown pathognomonic skeletal changes at X-rays of the hands, knee and hip joints and spine of unrelated 5 years old girl and 6.5 years boy with Kniest dysplasia.

The major **clinical findings** are small stature – short trunk with dorsal kyphosis. The final body height ranges from 106 to 145cm, peculiar face with flat mid-face and depressed nasal bridge. Intellectual development and life expectancy are normal.

The major **radiographic features** are platyspondyly with anterior wedging of vertebral bodies, broad ilia with hypoplasia of basilar portions, very broad and short femoral necks, severe dysplasia and late ossification of the capital femoral epiphyses and short tubular bones with broad metaphyses and large and deformed epiphyses.

**Differential diagnosis** of Kniest disease in early childhood is with other spondylo-epi--metaphyseal dysplasias, particularly Strudwick type and allied disorders. In later childhood Collagen II osteopathies, especially Spondyloepiphyseal dysplasia congenita warrants consideration. Also we have to think on Metatropic dysplasia.

## Genetics and molecular pathology

The genetic transmission is autosomal dominant. Most of the patients are sporadic, representing new mutations of the determinant gene. The condition is a type 2 collagenopathy caused by mutations of the COL2A1 gene. Somatic and gonadal mosaicism occur.

## Course and prognosis

In severe cases, short stature, prominent knees, cleft palate and clubfeet are noted at birth. Chronic otitis media, hearing loss, myopia and retinal detachment are major complications. Joint contractures, spinal deformities and epiphyseal dysplasia with precocious development of osteoarhrosis need orthopaedic attention. The patients may lead active lives in spite of their severe handicap.

**Key words:** skeletal dysplasia, Kniest Dysplasia, radiologic diagnosis

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# ÚDAJNÁ IDIOPATICKÁ SKOLIÓZA. BIOMECHANICKÁ ETIOLOGIE. NOVÁ KLASIFIKACE.

# SO-CALLED IDIOPATHIC SCOLIOSIS. BIOMECHANICAL AETIOLOGY. NEW CLASSIFICATION. TREATMENT AND PROPHYLAXIS: A REPORT

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## SUMMARY

The biomechanical aetiology of so-called idiopathic scoliosis is based on material and observations from 1984 (scholarship one month of T. Karski in Invalid Foundation Hospital in Helsinki / Finland – operator of scoliosis Dr Olai Snellman) and on material of Paediatric Orthopaedic and Rehabilitation Department of Medical University in Lublin in the years 1984 – 2007/2014.

We found three group and four types of scoliosis. With the type of scoliosis is connected the method of treatment and possibility of causal prophylaxis.

All strengthened exercises of extensor muscles in therapy should be reject from the program of treatment. These exercises fortify mainly contracted paravertebral muscles and magnify curves of scoliosis. Only the stretching exercises are proper. The causal prophylaxis should be introduced to all patients in all countries.

**Key words:** idiopathic scoliosis, biomechanical causes, treatment, stretching exercises.

# INTRODUCTION

The biomechanical aetiology of so-called idiopathic scoliosis called AIS is described in Polish, English, German and in Spanish Journals in years 1995–2007 (T. Karski) and presented since 1995 in many Congresses and Symposia in Poland and abroad.

# MATERIAL

In 2012 the whole material gathered 1950 cases. Patients were 2 to 60 years old.

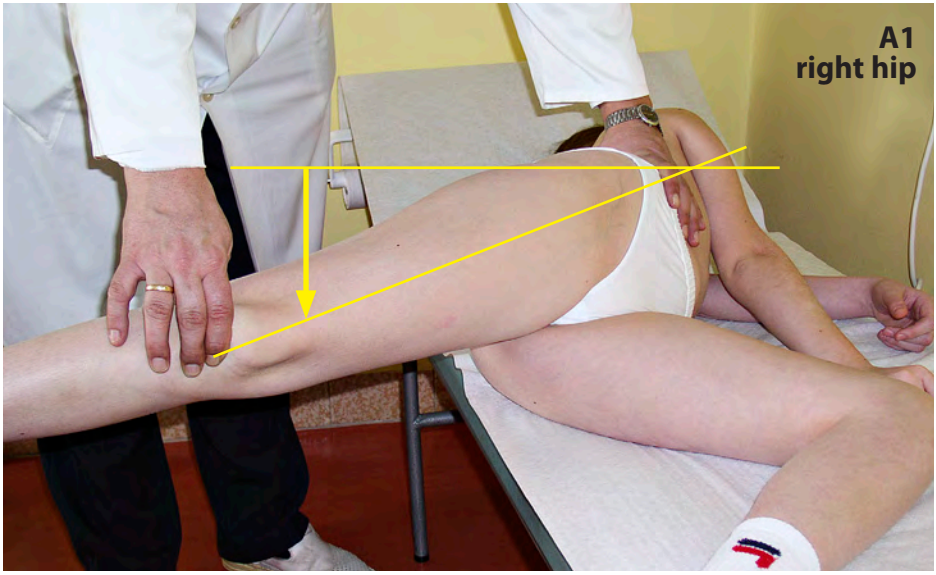
### Explanation of biomechanical aetiology of scoliosis in points

The spine deformity called adolescent idiopathic scoliosis (AIS) develop under the influence of biomechanical factors. This biomechanical factors / causes are: (A) permanent standing 'at ease' on the right leg and (B) influence appearing during gait. These both causal influences are based on (C) asymmetry of time standing – more on the right leg and on asymmetry left / right side of loading of body during walking.

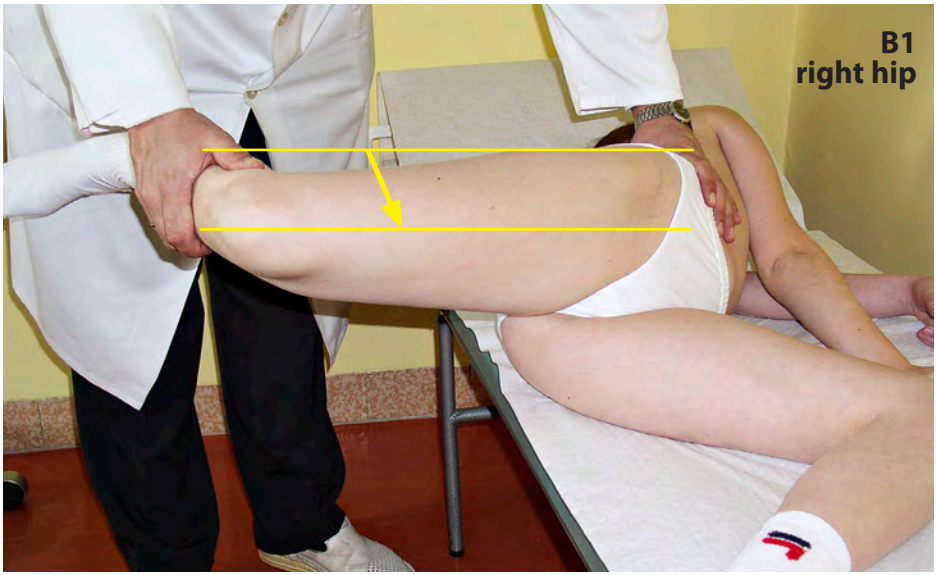
To understand these asymmetries we provide this explanation in points as follow:

1. "Syndrome of contractures" [SofC] (Siebenersyndrom) according to Prof. Hans Mau is the cause of asymmetries. In 2006 we add to this "Syndrome od Contractures" the varus deformity of shank and we called it "Syndrome of Contractures and Deformities" (SofCD – T. Karski and J. Karski). So, to the seven contractures according Prof. Hans Mau we added the extensive varus deformity of shank connected with the "inconvenient foetus position" – that's mean insufficient space in uterus for the child especially in three last months of gravidity **[1, 2, 3, 11, 12, 13, 14]**.
2. Asymmetry in movement of hips is connected with SofCD. In all scoliosis children the adduction of right hip is limited – is smaller than in left hip (see **Fig. 1**). To check this asymmetry the examination should be perform in straight position of hip joint. Please here to notice – that the checking in this position is similar / is the same like in "standing" and also similar in "stand phase of walking". In some children there is even abduction contracture of right hip, plus external rotation and flexion contracture (see later – in I epg).
3. Pathological influence on spine as mentioned above is coming by walking (gait) and because of habit of permanent standing 'at ease' on the right leg**.**
4. There are various types of scoliosis – some connected with "walking", other connected with "standing". The new classification is described in next chapter.
5. Every type of scoliosis start to develop in 2–3 year of life of children.

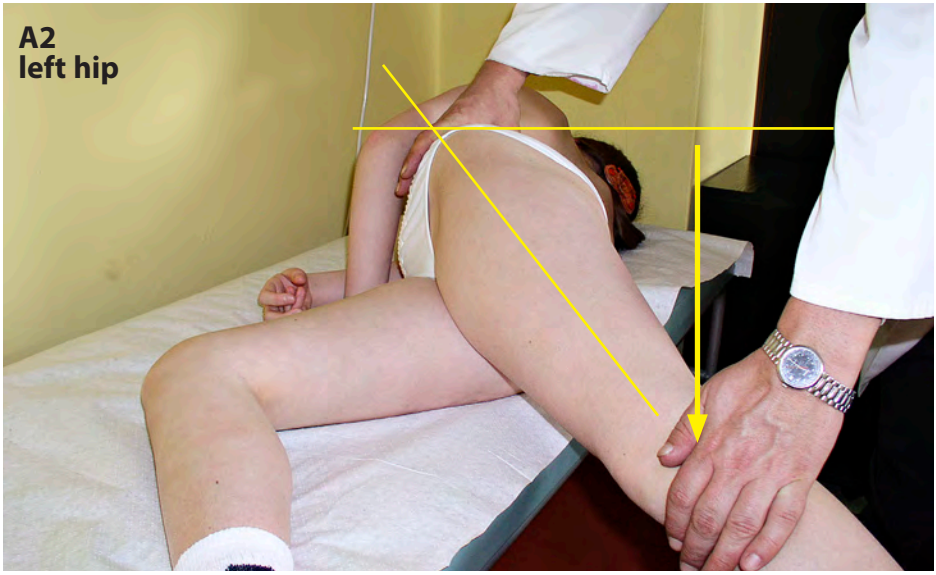
Difference of adduction of both hips – typical for I$^{st}$ epg / contracture of the right hip




Test of adduction of hips (similar to upper test). One child. Two method of examination. (test is more sensible).




(0 degree adduction). Because of this – right leg is chosen for permanent standing.




Examination in „extension position of hips". A1, A2 by extended knee. B1, B2 in flexed knee.

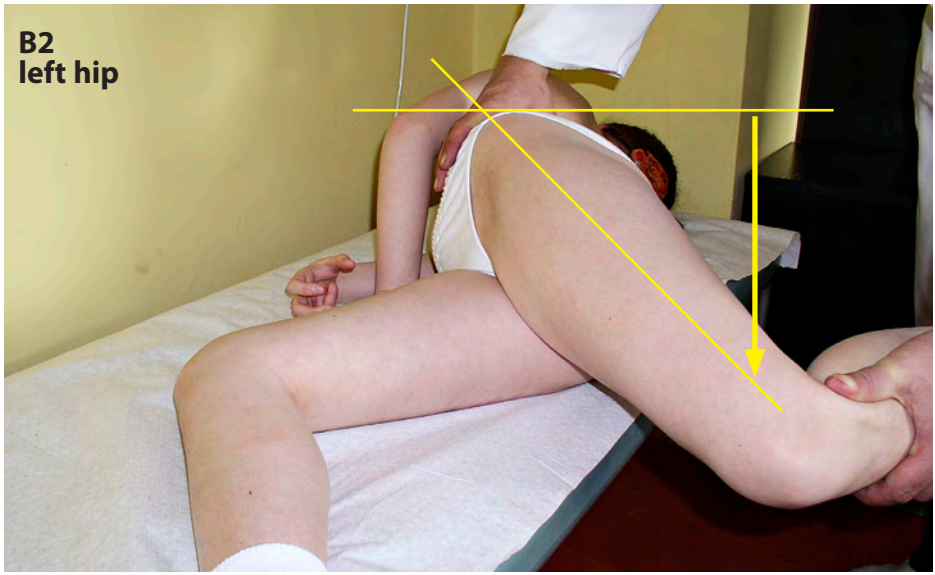



**Figure 1.** A1, A2, B1, B2: Examination of hip adduction

**New classification as important information for physiotherapy [4, 5, 6, 7, 8, 9, 10]**. There are three groups and four types of scoliosis (T. Karski 2001–2004).

To understand the biomechanical pathological influence in development of scoliosis we present also the child from control group without scoliosis to show the "physiological model of movement of hips" protecting before so-called idiopathic scoliosis **(Fig. 2)**.

**1)** "S" I etiopathological (epg) scoliosis **(Fig. 3)**. Double curves. Influenced by the "gait" and the permanent "standing at ease on the right leg". Stiff spine. 3D. Progression.

**2A)** "C" II/A epg scoliosis **(Fig. 4a)**. Influenced by the permanent "standing at ease on the right leg". One curve. Flexible spine. 1D. No or slight progression.

**2B)** "S" II/B epg scoliosis **(Fig. 4b)**. Influenced by the permanent "standing at ease on the right leg", plus – laxity of joints or/and incorrect exercises in previous treatment. Flexible spine. 2D or mix. Moderate progression**.**

**3)** "I" III epg scoliosis **(Fig. 5)**. Influenced by the "gait" only. Stiff spine. No curves or small. No progression. No included till now to scoliosis.

## PHYSIOTHERAPY

All previous extensions, its mean "muscles strengthening exercises" were incorrect / harmful and caused only bigger curves and made the spine more stiff.

Because of this the orthopaedic surgeon used to speak about "Natural History of Scoliosis" to explain the parents wrong result of therapy.

Instead of such therapy – all stretching exercises for spine and hips are proper for treatment and for prophylaxis. These exercises lead to symmetry of movements and symmetry of function and therefore protect before scoliosis.

## CONCLUSIONS

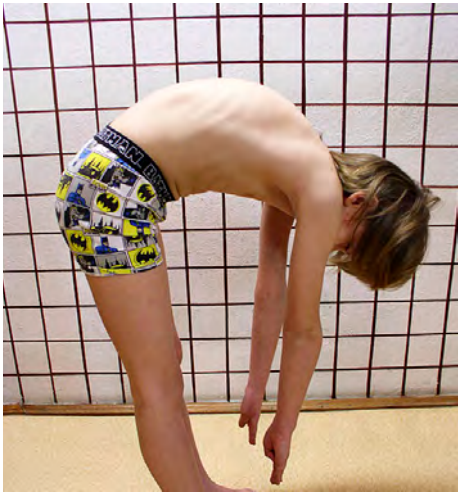
**1)** All scientists and all Institutions engaged with scoliosis should learn about biomechanical reasons in development of so-called idiopathic scoliosis.

**2)** All orthopaedic surgeons, rehabilitations and physiotherapies should introduce the new conception of treatment and the causal prophylaxis in children with so-called idiopathic scoliosis, checking on own material the new point of view to the scoliosis.

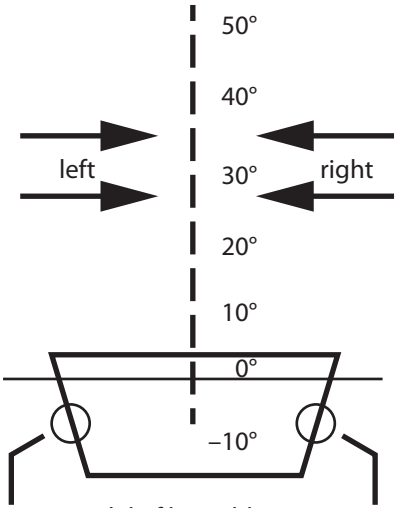
## SUMMARY

The biomechanical aetiology of so-called idiopathic scoliosis is based on material and observations from 1984 (scholarship one month of T. Karski in Invalid Foundation Hospital in Helsinki / Finland – operator of scoliosis Dr Olai Snellman) and on material of Paediatric Orthopaedic and Rehabilitation Department of Medical University in Lublin in the years 1984–2007/2014.

**Healthy child. Physiological model of hips movements. Proper Adams test. Normal axis of spine. The same level of lumbar and thoracic part of spine.**



By proper model of hips movements there is symmetry of loading during gait and symmetry in the time of standing on left / right leg. Never develop the so-called idiopathic scoliosis.

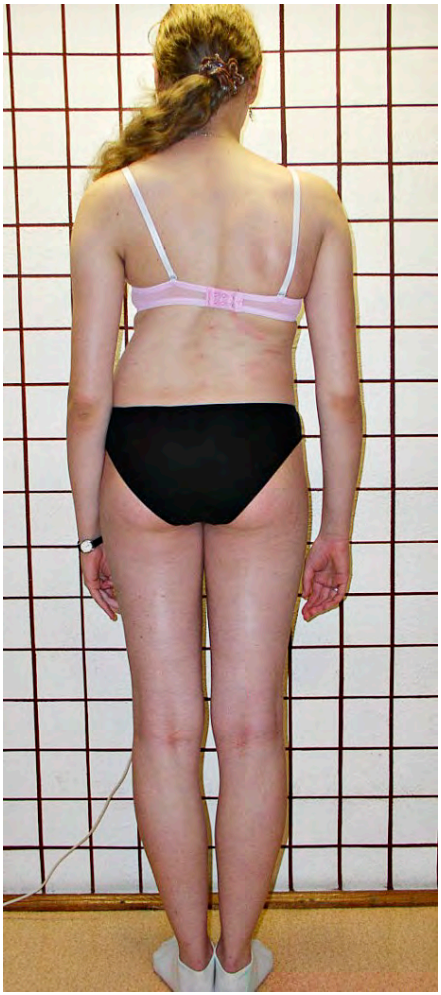


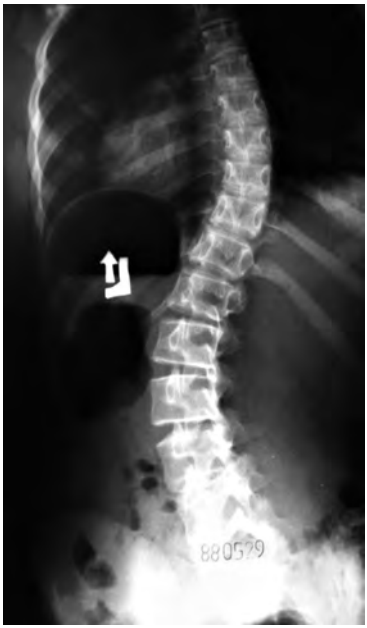

Model of hip adduction
left right

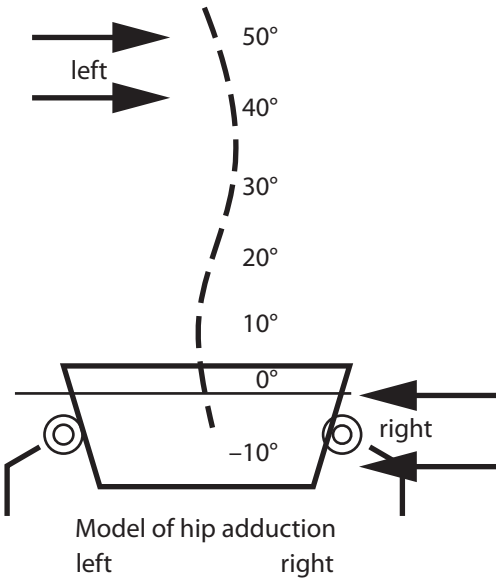
**no scoliosis**

**Figure 2** Physiological model of hips movements – no so-called idiopathic scoliosis.

**New classification: I epg. "S" scoliosis**



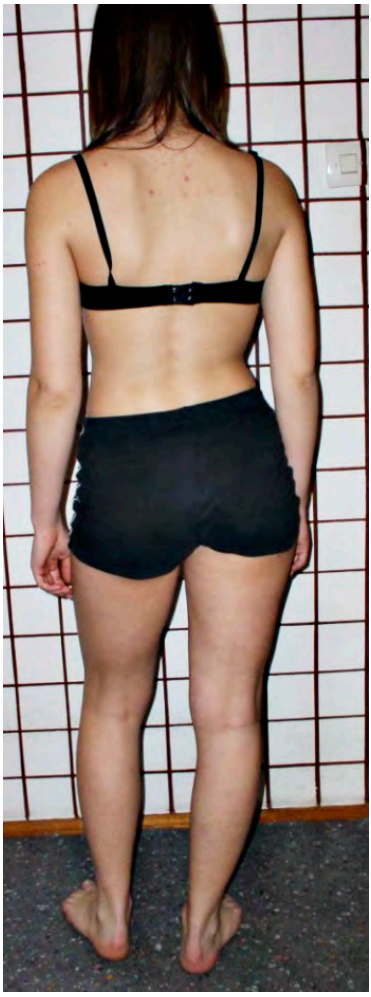


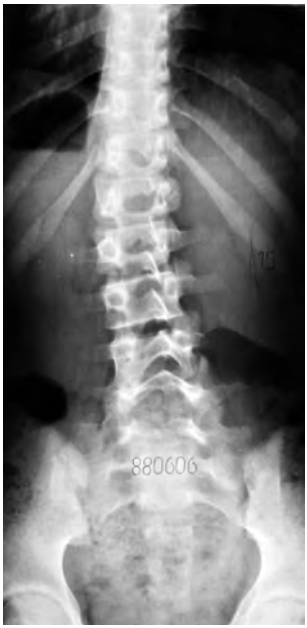


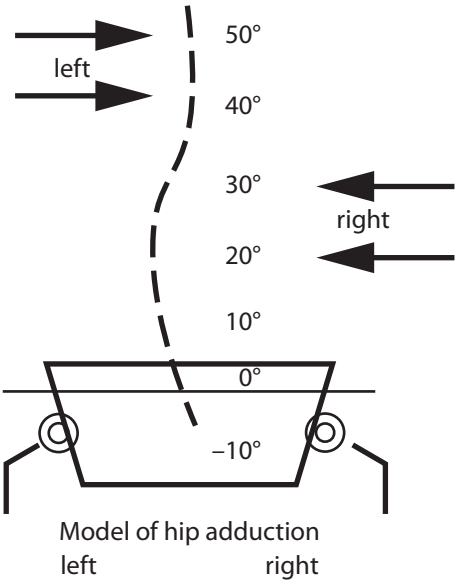

„S" scoliosis in I epg (3D). Primary double curves – connected with gait & standing 'at ease' on right leg. First rotation deformity, next curves. Stiffness of spine.

**Figure 3** I epg deformity - "S" scoliosis connected with specific model of hips movements. Two curves. Stiff spine. 3D. Causal influence: "gait" and "standing 'at ease' on the right leg". Progression.

**New classification: II/A epg.”C” scoliosis**



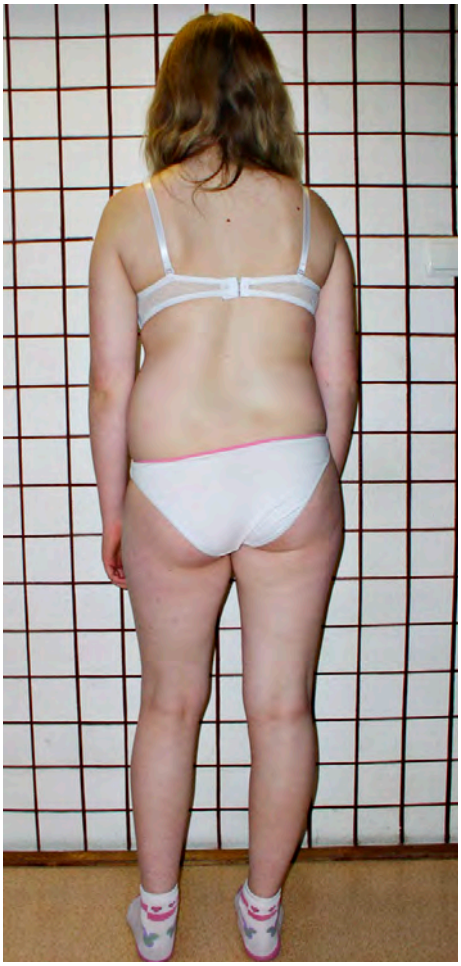


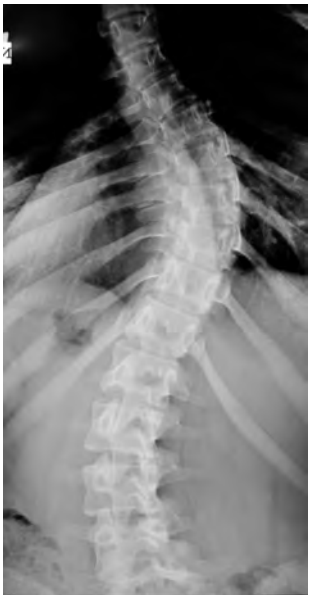



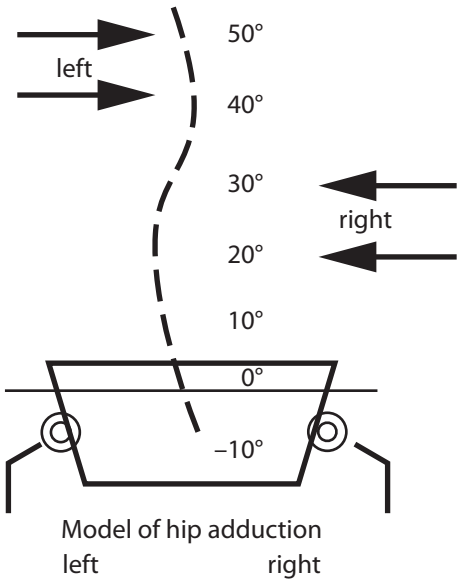

Scoliosis in II/A epg ”C” shaped. 1D. In II/A epg flexible spine. Causative factor: standing ‘at ease’ on the right leg. Beginning of scoliosis 2nd year of life. After 6 or 8 years of such standing – it’s mean in 10th or 12th year of life the curve on x-ray is visible.

**Figure 4a** II/a epg deformity - “C” scoliosis connected with specific model of hips movements. One curve. Flexible spine. 1D. Causal influence: permanent “standing ‘at ease’ on the right leg”. No progression.

## New classification: II/B epg „S" scoliosis








Scoliosis in II/B epg „S" shaped. 2D or mix. In II/B epg flexible spine. Thoracic curve secondary. Causative factor: standing 'at ease' on the right leg and additionally laxity of joints and / or wrong exercises in therapy. In this case wrong therapy 5 years.

**Figure 4b** III/b epg deformity - "S" scoliosis connected with specific model of hips movements. Two curves. – thoracic secondary. 2D or mix. Causal influence: permanent "standing 'at ease' on the right leg" and flaccidity of joints. No progression, or small.

**New classification: III epg."I" scoliosis Stiff spine / no curves or small curves**



In the case (A) wrong exercises were performed in 7 y. To the mother was spoken all the time - the wrong result of the therapy is typical for „natural history of scoliosis".

Scoliosis in III epg „I" shaped, connected with gait only. 2D or mix. Stiffness of spine. Small curves or no curves.
In adulthood – pain.

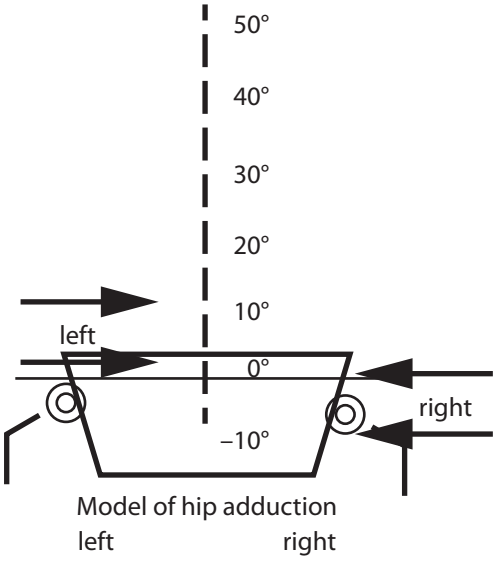



**Figure 5** – III epg deformity – "I" scoliosis connected with specific model of hips movements. No curves or small. Stiff spine. 2D or mix. Causal influence: "gait". No progression. Till now not included to scoliosis.
Explanation: Epg – ethio-patho-genesis

We found three group and four types of scoliosis. With the type of scoliosis is connected the method of treatment and possibility of causal prophylaxis.

All strengthened exercises in therapy should be reject from the program of treatment. Only the stretching exercises are proper. The causal prophylaxis should be introduced to all patients in all countries.

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# NERADIAČNÉ SLEDOVANIE PACIENTOV S ADOLESCENTNOU IDIOPATICKOU SKOLIÓZOU PO OPERAČNEJ LIEČBE AKO ALTERNATÍVA RÖNTGENOVÝCH SNÍMOK

# RADIATION-FREE MEASUREMENT OF PATIENTS WITH ADOLESCENT IDIOPATHIC SCOLIOSIS AFTER SURGICAL TREATMENT AS AN ALTERNATIVE TO X-RAYS.

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## ABSTRACT

### Introduction

Patients with adolescent idiopathic scoliosis have to undergo multiple full-length spinal x-rays. Repeated exposure to ionizing radiation leads to higher incidence of breast cancer, thyroid cancer and leukemia. One of the radiation-free methods that try to replace the x-rays is magnetic measurement of the spine with Ortelius 800. We assessed the accuracy of this method in patients after surgical correction with pedicular screws and rods and possible influence of incision scar and presence of the implant on measurement accuracy.

### Methods

13 patients with adolescent idiopathic scoliosis after surgical correction were measured with Ortelius. Data from Ortelius were compared with standard spinal x-rays taken the same week.

### Results

The average Cobb's angle measured by x-ray was 18.92 degrees. The average absolute difference between Ortelius and x-rays was 4.53 degrees. The difference was not statistically significant (p= 0.0698).

### Conclusion

Ortelius is accurate alternative to X-rays measurement of scoliosis patients after surgical correction. The titanium implant has no influence on measurement accuracy. Hypertrophic scar can occasionally prevent the patient to be examined with Ortelius. Although Ortelius seems to be an acceptable alternative to x-rays in Cobb's angle measurement, it does not provide all the information regarding bone structure that only the x-ray does.

**Key Words:** adolescent idiopathic scoliosis, radiation-free assessment, Ortelius 800, magnetic spine mapping

## ABSTRAKT

### Úvod

Pacienti s adolescentnou idiopatickou skoliózou absolvujú počas liečby väčšie množstvo röntgenových snímok chrbtice. Opakovaná expozícia ionizujúcemu žiareniu má za následok vyššiu incidenciu karcinómu prsníka, štítnej žľazy a leukémií. Jednou z neradiačných alternatív röntgenových snímok je magnetické meranie chrbtice prístrojom Ortelius 800. Hodnotili sme presnosť prístroja u pacientov po operačnej liečbe skoliózy pedikulárnymi skrutkami a tyčami a aj prípadný vplyv hypertrofickej jazvy a prítomnosti implantátu na presnosť merania.

### Metodika

Vyšetrili sme 13 pacientov po operačnej korekcii skoliózy. Údaje z Orteliusa boli porovnané s röntgenovými snímkami zhotovenými v ten istý týždeň.

### Výsledky

Priemerná veľkosť meraného Cobbovho uhla na röntgenových snímkach bola 18,92°. Priemerný absolútny rozdiel medzi Orteliusom a RTG snímkami bol 4,53°. Rozdiel nebol štatisticky signifikantný (p=0,0698).

### Záver

U pacientov po operačnej liečbe je Ortelius dostatočne presnou alternatívou RTG snímok. Titánový implantát nemá vplyv na presnosť merania, ale hypertrofická jazva môže v ojedinelých prípadoch znemožniť dokončenie vyšetrenia. Aj keď sa Ortelius zdá byť akceptabilnou alternatívou RTG snímok pri meraní Cobbovho uhla, neposkytuje všetky údaje o štruktúre kosti a postavení implantátu, ktoré zachytí len RTG snímka.

**Kľúčové slová:** adolescentná idiopatická skolióza, neradiačné meranie chrbtice, Ortelius 800, magnetické merania chrbtice

# ÚVOD

Pacienti s adolescentnou idiopatickou skoliózou predstavujú úzko špecializovanú časť spinálnej chirurgie, ktorá patrí výlučne do starostlivosti ortopéda. Štandardnou metódou diagnostiky a sledovania pacientov so skoliózou počas liečby sú röntgenové snímky chrbtice, zhotovené v dvoch projekciách. Počas jedného roka sú potrebné 3–4 snímky chrbtice v dvoch projekciách, čo počas niekoľkých rokov predstavuje veľkú expozíciu žiareniu dospievajúcich dievčat, a tým zvýšený výskyt rakoviny prsníka a štítnej žľazy u týchto pacientov (**1, 2**).

Preto sa v posledných rokoch hľadá spôsob, ako znížiť radiačnú záťaž pacientov, a tak predísť komplikáciám (**3**). Ako alternatívy röntgenových snímok chrbtice boli navrhnuté metódy mechanické, optické, ultrazvukové a magnetické. Použitím týchto metód sa pacient vyhne ionizujúcemu žiareniu, ale ich presnosť a využiteľnosť pri sledovaní pacientov počas konzervatívnej liečby a po operačnej liečbe je stále kontroverzná.

# NERADIAČNÉ METÓDY MERANIA SKOLIÓZY

Medzi neradiačné metódy merania chrbtice zaraďujeme metódy mechanické, optické a magnetické. Vo všeobecnosti je možné tieto metódy rozdeliť na tie, ktoré merajú chrbticu priamo, a tie, ktoré vytvárajú rekonštrukciu povrchu chrbta nasnímaným svetlom alebo fotografickými technikami. Prvý typ metód poskytuje meranie jednoduchých parametrov, ktoré možno korelovať s veľkosťou Cobbovho uhla. Druhá skupina, ktorá využíva povrchovú topografiu chrbta, zachytáva viac parametrov, a vyzerá byť vhodnejšia na sledovanie progresie kriviek.

## Mechanické metódy

**Skoliometrom** dokážeme zmerať rotáciu trupu pacienta v predklone na základe asymetrie paravertebrálnych valov (rebrového hrbu) (**4**). Je to ale jediný údaj, ktorý nám poskytuje a sám o sebe nestačí na úplné zhodnotenie krivky. Úspešne sa využíva v skríningu skolióz (**5**).

**Spinálna pantografia** zaznamenáva kontúru chrbta pomocou sústavy spojených pák, ktoré vytvárajú jeden alebo niekoľko kosoštvorcov. Používala sa predovšetkým na meranie lordózy a kyfózy. Nissen a kol. použili pantografické meranie kyfózy u dievčat a lordózy u chlapcov na predikciu vzniku skoliózy (**6**).

## Ultrazvuk

Letts a kol. predstavil novú metódu (Computerized ultrasonic digitization), ktorá využíva sondu, ktorá vysiela ultrazvukové vlny nad chrbticou pacienta v predklone. Tieto sú po odrazení zachytené štyrmi senzormi umiestnenými v rohoch obdĺžnika nad pacientom, a následne spracované počítačom. Takto nameraný uhol krivky u pacienta v predklone je menší ako u pacienta v stoji, dobrá korelácia s RTG snímkami je u kriviek nad 30 stupňov (**7**).

### Optické metódy

Princípom optických metód je snímanie asymetrie obrazca premietnutého na chrbát pacienta. Pri **Moiré topografii** je to kontúrová mapa z prekrývajúcich sa interferenčných pruhov z dvoch rôznych zdrojov svetla (**8**). Na pacienta sa pred snímaním umiestnia markery na tŕňové výbežky C7 – S1, spina iliaca posterior superior obojstrane, a horný a dolný uhol lopatky, ktoré sú lokalizované palpáciou. Takto je možné hodnotiť zakrivenie chrbtice vo frontálnej a sagitálnej rovine; rotácia trupu je hodnotená podľa asymetrie paravertebrálnych valov. **Quantec systém** premieta na chrbát pacienta svetelnú mriežka. Tento systém dokáže sledovať skoliotické krivky do veľkosti 30 stupňov, väčšie krivky už nedokáže zachytiť presne (**9**). **ISIS (Integrated Shape Investigation System)** premieta na chrbát sériu horizontálnych svetelných čiar. ISIS dokázal úspešne sledovať progresiu kriviek do 55 stupňov (**10**). V inej štúdii dokonca zachytil progresiu ťažších kriviek určených na operačnú liečbu o rok skôr ako röntgenové snímky (**11**). Pri menších krivkách liečených korzetom ale takú dobrú koreláciu nedosiahol.

### Magnetické metódy

Veľkosť Cobbovho uhla u pacientov so skoliózou je možné stanoviť pomocou magnetickej rezonancie. Pri magnetickej rezonancii vykonávanej v ľahu je veľkosť Cobbovho uhla priemerne o 10° nižšia ako na röntgenových snímkach zhotovených v stoji, má výbornú koreláciu (**12**). Pozičná magnetická rezonancia vykonávaná v stoji dosahuje vynikajúcu koreláciu s röntgenovými snímkami (**13**). Dostupnosť tohto vyšetrenia pri rutinnom sledovaní pacientov je však nízka. Ďalšou magnetickou metódou merania deformít chrbtice, ktorá umožňuje vykonať meranie v priestoroch ortopedickej ambulancie, je prístroj Ortelius 800, ktorého presnosť sme skúmali v tejto práci. Podrobnejšie bude popísaný v časti materiál a metodika. Jedná sa o prístroj, ktorý zaznamená polohu tŕňových výbežkov v priestore pomocou magnetického poľa a rotáciu trupu pacienta a vytvorí obraz chrbtice v troch rovinách, pričom pacient nie je vystavený ionizujúcemu žiareniu. Zamerali sme sa na sledovanie pacientov po operačnej korekcii zo zadného prístupu, s implantátom zo zliatiny titánu.

V odbornej literatúre je len niekoľko článkov skúmajúcich túto metódu u pacientov liečených konzervatívne, výsledky vo väčšine článkov vyzerajú sľubne v jednom však menej optimisticky. Žiadne články sa zatiaľ nezaoberali pooperačným hodnotením pacientov s prístrojom Ortelius. Ak by sa presnosť prístroja potvrdila, mohol by v praxi do značnej miery nahradiť röntgenové snímky chrbtice, znížiť radiačnú záťaž pacienta, a tým znížiť riziko vzniku poradiačných komplikácií.

## CIELE PRÁCE

Cieľom práce bolo vykonať prospektívnu nerandomizovanú štúdiu u pacientov po operačnej korekcii skoliózy, stanoviť presnosť prístroja pri meraní Cobbovho uhla v stupňoch oproti röntegnovým snímkam zhotovených v ten istý týždeň, a tak zistiť prípadné nepresnosti prístroja Ortelius spôsobené prítomnosťou kovového fixátora chrbtice a operačnej jazvy oproti súborom

pacientov meraných pred operačnou liečbou. Inkluzívne a exkluzívne kritéria sú uvedené v **tabuľke č. 1**.

| **Inkluzívne kritériá** |
|---|
| – pacienti s adolescentnou idiopatickou skoliózou po operačnej liečbe |
| – pacienti operovaní zo zadného prístupu polysegmentálnym implantátom – systém pedikulárnych skrutiek a tyčí |
| – pacienti s implantátom z neferomagnetickej zliatiny titánu |
| **Exkluzívne kritériá** |
| – pacienti, ktorým boli pri operácii odstránené tŕňové výbežky stavcov |
| – pacienti po viac ako jednej operácii, prípadne operačnej revízii chrbtice |
| – pacienti, ktorí nie sú schopní dostatočného predklonu na vykonanie vyšetrenia (predklon do takmer 90° ako pri Adamsovom teste) |
| – pacienti s veľkosťou krivky na RTG snímke nad 55 stupňov (limitácia prístroja udávaná výrobcom) |
| – pacienti s implantátom z feromagnetickej zliatiny |
| – pacienti menej ako 6 týždňov po operácii |

**Tabuľka 1.** Inkluzívne a exkluzívne kritériá

# MATERIÁL A METODIKA

## Ortelius – systém magnetického merania

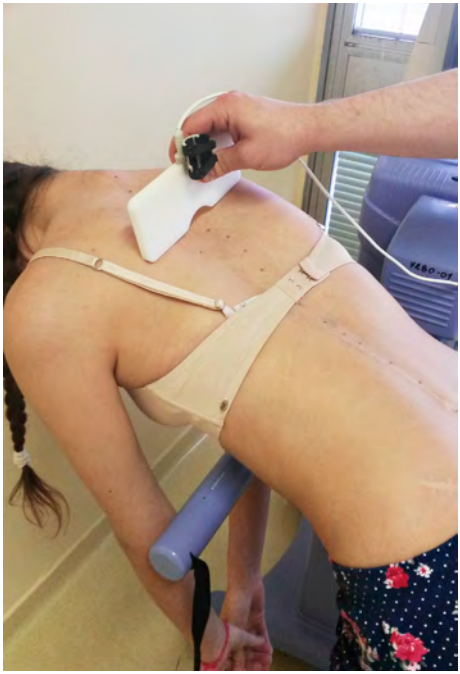
Ortelius 800 (**obr. 1**) je prístroj, ktorý umožňuje hodnotenie deformít chrbtice bez expozície ionizujúcemu žiareniu. Prístroj využíva nízkoenergetické elektromagnetické vlnenie na zaznamenanie polohy tŕňových výbežkov stavcov v priestore, ktoré sa simultánne zobrazujú na displeji prístroja. Po skončení vyšetrenia prístroj ihneď vytvorí obraz chrbtice v troch rovinách, automaticky vypočíta uhol deformity (Cobbov uhol), rozdiel v dĺžke nôh (pravej a ľavej) a ďalšie údaje o rovnováhe pacienta, ktoré sú dôležité pre pred- a pooperačné hodnotenie pacienta. Hoci je potrebná úvodná röntgenová snímka, nasledujúce využitie prístroja v sledovaní skoliózy môže výrazne znížiť radiačnú záťaž pacienta, a teda aj riziko možných komplikácií.

## Postup pri vyšetrení

Najprv sa u pacienta v predklone zmeria rotácia trupu autoskoliometrom (skoliometer napojený na senzor, ktorý zachytáva jeho polohu v priestore). Vyšetrujúci prejde skoliometrom chrbticu od C7 po S1 (**obr. 2**), pričom prístroj priebežne zachytáva rotáciu chrbtice v jednotlivých úsekoch chrbtice, výsledok udáva v stupňoch.

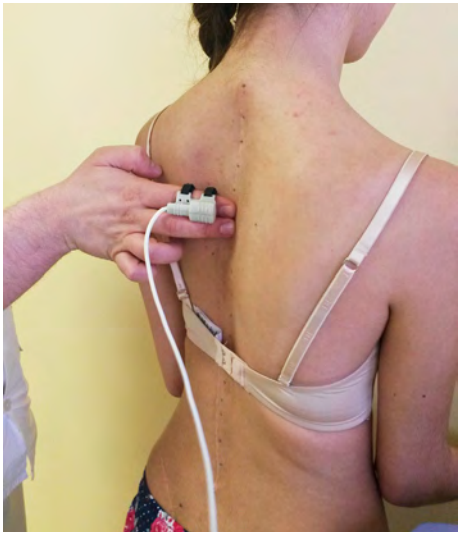
Nasleduje vyšetrenie skoliotickej krivky. Vyšetrujúci má na prste pripevnený senzor, ktorého poloha v priestore vzhľadom na základný stroj sa zaznamená po stlačení spínača nohou. Lekár

**Obr.1** Prístroj Ortelius 800

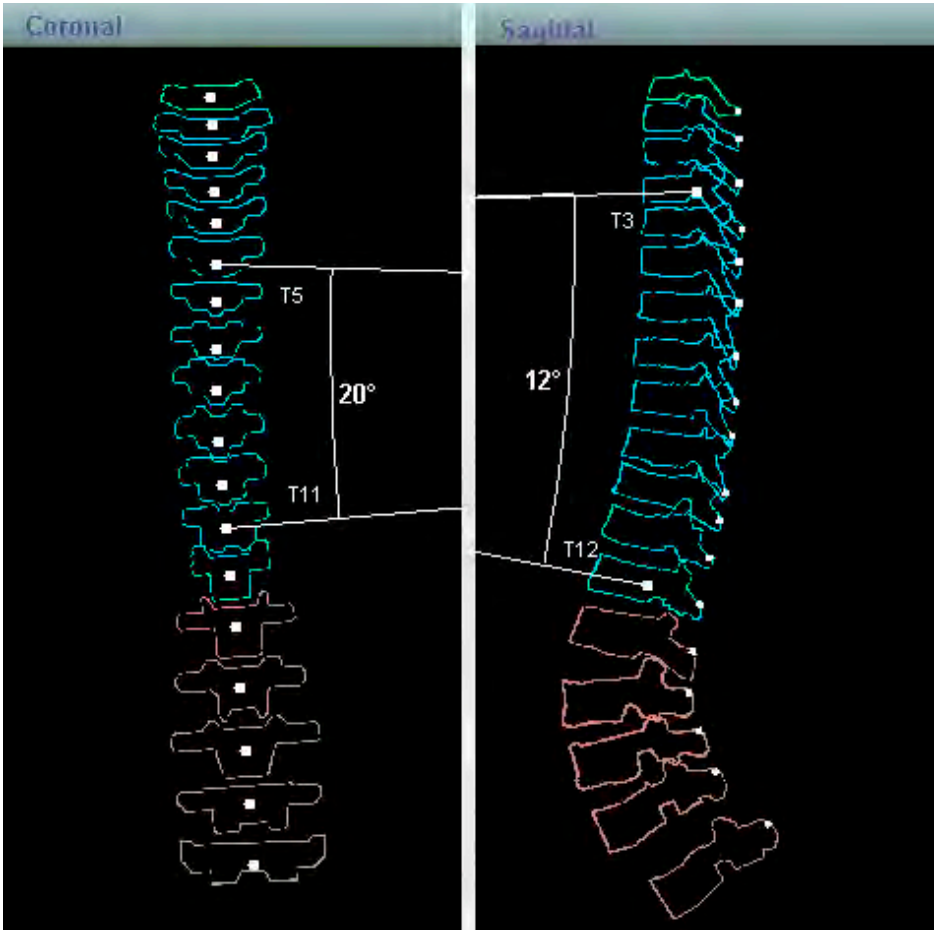


**Obr. 2** Meranie rotácie trupu autoskoliometrom

nahmatá tŕňový výbežok príslušného stavca a zachytí jeho polohu v priestore (**obr. 3**). Takto zaznačí všetky stavce od C7 po S1 a vyšetrenie zopakuje ešte raz – prístroj pri každom vyšetrení vyžaduje zachytiť polohu tŕňových výbežkov dvakrát za sebou, takto sa snaží eliminovať prípadnú intraindividuálnu chybu. Ak sa poloha jednotlivých stavcov medzi dvoma meraniami od seba odlišuje, vyžiada si tretie meranie – pri pretrvávajúcom rozdiele polohy obraz chrbtice nevytvorí a vyšetrenie je nutné zopakovať od začiatku, vrátane nového merania rotácie trupu. Po úspešnom zachytení tŕňových výbežkov prístroj vyhodnotí rozdiel v postavení stavcov v priestore a s pomocou údaju o rotácii trupu vytvorí model chrbtice v troch rovinách (nejedná sa však o 3D model, ktorý by bolo možné napr. ľubovoľne rotovať).



**Obr. 3** Zaznamenávanie tŕňových výbežkov počas merania

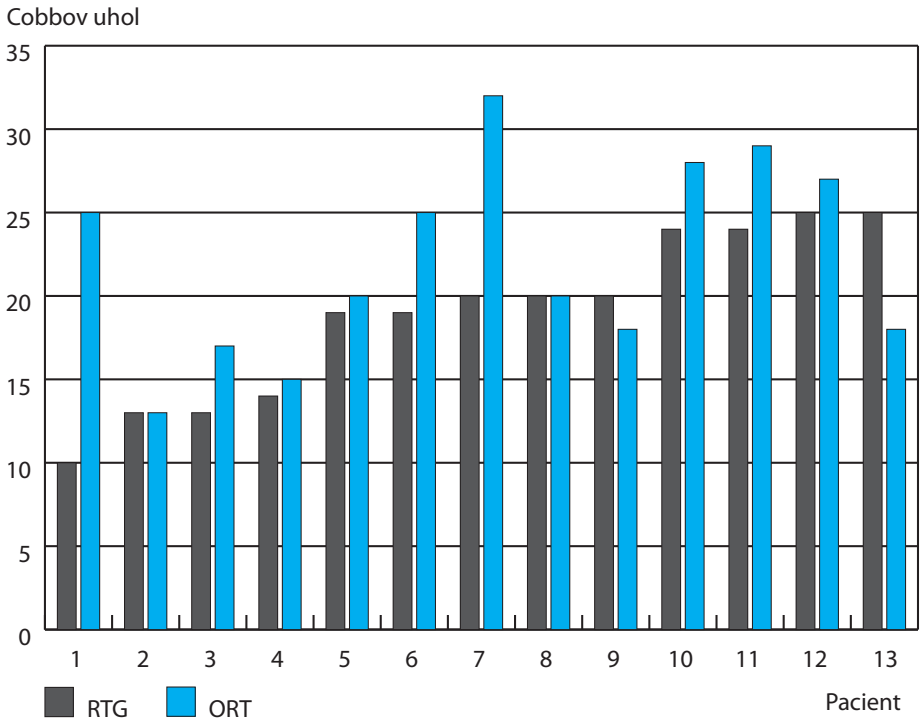



**Obr. 4** Výstup z prístroja Ortelius 800 – PA a bočná projekcia

Vo frontálnej rovine automaticky zmeria Cobbov uhol deformity v stupňoch, pričom sám určí aj koncové stavce každej krivky (**obr. 4**). V sagitálnej rovine určí uhol hrudníkovej kyfózy a bedrovej lordózy, a tak poskytne údaje o sagitálnej rovnováhe pacienta.

Do prístroja sa dajú importovať aj RTG snímky chrbtice pacienta a Cobbove uhly jednotlivých kriviek zmerať digitálne. Uhly namerané na RTG snímkach sa tak dajú hneď porovnať so záznamom získaným pomocou prístroja a určiť prípadnú odchýlku.

Okrem samotného merania chrbtice je možné merať aj rovnováhu tela. Prístroj umožňuje zachytiť aj polohu ramien (akromioklavikulárnych kĺbov), panvy (spina iliaca anterior superior a posterior superior), veľkých trochanterov stehnových kostí a processus mastoidei. Tak sa zistia




**Graf 1:** porovnanie Cobbových uhlov na RTG – Ortelius u pacientov po operačnej korekcii; súbor usporiadaný podľa rastúceho RTG uhla

údaje o asymetrii panvy, rozdielnom postavení ramien, dĺžke končatín a úklone hlavy. Všetky údaje ostávajú uložené v databáze a pri nasledujúcom vyšetrení sa tak môže posúdiť, či sa jedná o progresiu krivky.

Na I. ortopedicko-traumatologickej klinike LFUK a UNB v Bratislave sme prospektívne porovnávali vyšetrenie skoliózy prístrojom Ortelius so štandardnými RTG snímkami. Vyšetrili sme 13 pacientov po operačnej korekcii polysegmentálnym implantátom zo zadného prístupu. Namerané hodnoty boli porovnávané s RTG snímkami spravenými v ten istý týždeň, vyšetrenie Orteliusom aj meranie Cobbovho uhla na RTG vykonával ten istý lekár. Pacienti po operačnej liečbe boli hodnotení najskôr 6 týždňov po operácii, teda po zhojení mäkkých tkanív. Pozícia pacienta pri vyšetrení bola upravená podľa Knotta (pacienti sa opierali rukami o stenu – flexia do 90° v lakťoch, bez väčšieho predpaženia v ramenách - aby sa pri vyšetrení nekývali, ale stáli rovno) pre lepšiu presnosť vyšetrenia. Sagitálny profil chrbtice sa aj pri predpažení horných končatín môže zmeniť (napr. pri štandardných RTG snímkach v bočnej projekcii je poloha horných končatín odlišná na rôznych pracoviskách, čo môže zmeniť veľkosť nameranej lordózy

a kyfózy – najmenšie odchýlky sú pri flexii v ramenách do 45°) (**14**) – v našej štúdii sme však hodnotili len deformitu vo frontálnej rovine.

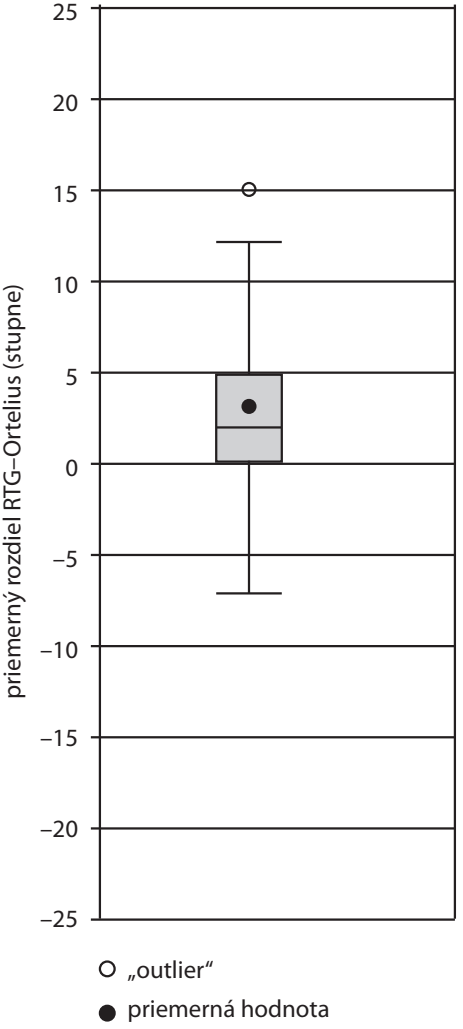
Namerané hodnoty boli štatisticky spracované, aby sa určila presnosť prístroja oproti RTG snímkam pri vyšetrení Cobbovho uhla.

U jedného pacienta sme kvôli prítomnosti keloidnej jazvy zaznamenali sťažené palpovanie tŕňových výbežkov. V niektorých častiach chrbtice nebolo možné tŕňové výbežky nahmatať, preto bol výsledok vyšetrenia nepresný a pacienta sme nezaradili do sledovania.

## VÝSLEDKY

Spolu sme vyšetrili 13 pacientov, z toho všetky ženského pohlavia, s priemerným vekom 15,4 roka (13–19 rokov) s adolescentou idiopatickou skoliózou typu Lenke 1 (jedna hlavná hrudníková krivka), ktoré boli merané 6 týždňov až 3 mesiace po operačnej korekcii. Namerané hodnoty zobrazuje **tabuľka č. 2**.

Priemerná veľkosť Cobbovho uhla na RTG dosahovala 18,92 stupňa (rozpätie 10–25 stupňov), čo zodpovedá dolnej polovici rozsahu udávaného výrobcom (10–55 stupňov) Priemerný rozdiel v nameraných stupňoch medzi RTG a prístrojom Ortelius bol 3,15 stupňa (rozsah –7–15 stupňov). Priemerná absolútna hodnota rozdielu RTG – Ortelius bol 4,53 stupňa (rozpätie 0–15 stupňov). Súhrn štatistického spracovania súboru je v **tabuľke č. 3**.




**Graf 2** – Percentilový graf priemerného rozdielu medzi RTG a Orteliusom

Namerané hodnoty Cobbovho uhla boli štatisticky spracované **párovaným T-testom**. Rozdiel medzi nameranými hodnotami **nebol štatisticky signifikantný** (párovaná (two-tailed) P hodnota bola 0,0698). 95% confidence interval bol v rozmedzí –0,30 – 6,61, štandardná chyba rozdielu 1,585.

Na **grafe č. 1** je zrejmá dobrá korelácia nameraných hodnôt. Na percentilovom grafe (**graf č. 2**) je vidieť, že väčšina hodnôt rozdielu medzi RTG a Orteliusom je v rozmedzí 1–5 stupňov, s ojedinelými výraznejšími odchýlkami.

| Pacient | RTG snímka | Ortelius | rozdiel | Ortelius – rotácia |
|---|---|---|---|---|
| 1 | 10 | 25 | 15 | 16 |
| 2 | 13 | 13 | 0 | 4 |
| 3 | 13 | 17 | 4 | 9 |
| 4 | 14 | 15 | 1 | 6 |
| 5 | 19 | 20 | 1 | 6 |
| 6 | 19 | 25 | 6 | 17 |
| 7 | 20 | 32 | 12 | 21 |
| 8 | 20 | 20 | 0 | 12 |
| 9 | 20 | 18 | -2 | 8 |
| 10 | 24 | 28 | 4 | 17 |
| 11 | 24 | 29 | 5 | 17 |
| 12 | 25 | 27 | 2 | 17 |
| 13 | 25 | 18 | -7 | 7 |

**Tabuľka 2.** Cobbov uhol na RTG a Orteliuse po operačnej korekcii, zoradené vzostupne dľa RTG veľkosti krivky a uhol rotácie zmeraný autoskoliometrom

| počet n=13 | priemerný uhol | rozsah | štandardná odchýlka | medián | 25–75 percentil | párovaný Študentov t-test | 95% confidence interval | štandardná chyba rozdielu |
|---|---|---|---|---|---|---|---|---|
| RTG | 18,92 | 10;25 | 5,02 | 20 | 13;24 | p=0.0698 | -0,30;6,61 | 1,585 |
| Ortelius | 22,07 | 13;32 | 5,93 | 20 | 17;27 | | | |
| priemerný rozdiel | 3,15 | –7;15 | 5,71 | 2 | 0;5 | | | |
| absolútny rozdiel | 4,53 | 0;15 | 4,59 | 4 | 1;6 | | | |

**Tabuľka 3.** Štatistické spracovanie súboru po operačnej liečbe

# INTERPRETÁCIA VÝSLEDKOV

Pri interpretácii výsledkov merania dvoma rôznymi metódami je potrebné vziať do úvahy niekoľko spôsobov hodnotenia. Môžeme štatisticky spracovať presné hodnoty rozdielu nameraných Cobbových uhlov, v takomto prípade bude výsledok ukazovať nepresnosti oboma smermi (kladným a záporným, teda či Orteliusom nameriame vo všeobecnosti väčšie alebo menšie hodnoty ako na RTG), výsledok však môže skresľovať realitu, napr. pri piatich pozitívnych a piatich

negatívnych rozdieloch o veľkosti 5 stupňov nám priemerný rozdiel vyjde nula, teda dokonalá presnosť, čo v skutočnosti nie je pravda.

Druhým spôsobom môžeme štatisticky spracovať tzv. absolútny rozdiel medzi RTG a Orteliusum, bez kladných alebo záporných hodnôt. Takto lepšie vyjadríme presnosť prístroja, avšak nezistíme tendenciu merať väčšie alebo menšie hodnoty. Pri predchádzajúcom príklade piatich pozitívnych a negatívnych päťstupňových rozdielov nám v tomto prípade vyjde priemerný absolútny rozdiel 5, čo zodpovedá realite.

Pomocou spárovaného T-testu posúdime koreláciu medzi oboma metódami štatisticky najpresnejšie, chýba však kvantifikácia rozdielu.

Je potrebné si uvedomiť, že výsledky, ktoré sú štatisticky akceptovateľné, nemusia byť akceptovateľné pri hodnotení pacientov v klinickej praxi.

# DISKUSIA

Výskum magnetického sledovania chrbtice pomocou prístroja Ortelius u pacientov so skoliózou sa doposiaľ zameriaval na predoperačné hodnotenie krivky u pacientov. J. Dubousset et. al (**15**) a P.Parsiny et. al (**16**), posudzovali spoľahlivosť prístroja Ortelius 800 u pacientov so skoliózou pred operačnou liečbou, a zistili, že prístroj má oproti štandardným RTG snímkam len malú odchýlku. Ovadia a kol. kvantifikovali veľkosť odchýlky oproti RTG snímkam 5 stupňov pre Cobbov uhol a 6 stupňov pre uhly lordózy a kyfózy v sagitálnom zobrazení (**17**). Dokázala sa aj presnosť prístroja pri meraní zošikmenia panvy a asymetrie ramien (**18**). P. Knott a kol. (**19**) však poukázal na väčšiu odchýlku a variabilitu pri viacerých meraniach, na základe čoho vyhlásil metódu za nepresnú. V roku 2008 však sám P. Knott navrhol novú pozíciu pacienta pri vyšetrení, ktorá značne zlepšuje presnosť merania; rozdiel od uhlov nameraných na RTG snímkach klesol na 1,5°, čo sú vynikajúce výsledky (**20**). Interindividuálna a intraindividuálna spoľahlivosť bola testovaná vo viacerých štúdiách (**17, 19**), merania boli konzistentné, bez štatisticky významného rozdielu. V našom súbore pacientov hodnotených pred operačnou liečbou (**21**) sme si všimli závislosť presnosti merania od veľkosti meranej krivky, pričom najpresnejšie Ortelius meral krivky v rozmedzí 15–30 stupňov, presnosť merania kriviek s veľkosťou Cobbovho uhla nad 40° nebola akceptovateľná v klinickej praxi.

Z našich výsledkov u pacientov po operačnej korekcii vyplýva, že meranie pomocou Orteliusa u pacientov po operačnej korekcii je možné považovať za presné. Absolútna hodnota rozdielu bola 4,5 stupňa pri priemernej veľkosti meranej krivky 18,9 stupňa. Tieto výsledky sú porovnateľné s ostatnými štúdiami, ktoré sledovali pacienta pred operačnou liečbou. Ovidia udáva priemernú hodnotu rozdielu 4,40 stupňa pri priemernej veľkosti meranej krivky 17,8 stupňa. Namerali sme však aj rozdiel o veľkosti 12 a 15 stupňov, čo je v klinickej praxi neakceptovateľné.

Preto sme znovu detailne preštudovali jednotlivé články. V samotnom komentári k štúdii (**17**) je poznámka, že pokiaľ je rozdiel medzi RTG snímkou a Orteliusom väčší ako 10 stupňov, nedoporučuje sa ďalej pokračovať v sledovaní pacienta Orteliusom. Z toho vyplýva, že aj autori tejto štúdie dosiahli rozdiel v nameranej hodnote nad 10 stupňov. Vo výsledkoch Ovadia a kol. (2007) uvádzajú iba interkvartilný rozsah 2–7 stupňov rozdielu (u nás 1–6), z histogramu v tej

istej publikácii však vyplýva, že u 10 % pacientov bol nameraný rozdiel 10–12 stupňov a vyskytlo sa niekoľko pacientov s rozdielom až 18 stupňov. Knott a kol vo svojej práci (2006) uvádzajú podstatne horšie výsledky, pri krivkách s priemernou veľkosťou 29 stupňov dosiahli priemerný absolútny rozdiel 8 stupňov. Maximálny rozdiel bol dokonca 51 stupňov, a najčastejšie veľké rozdiely boli u kriviek nad 40 stupňov. Ponúka sa teda vysvetlenie, že menšie krivky Ortelius meria presnejšie. Nakoľko pacienti po operačnej korekcii majú reziduálne krivky zvyčajne menšie ako 30 stupňov, je meranie pomerne presné. Domnievame sa, že veľké nepresnosti pri väčších krivkách môžu byť spôsobené rozdielnou líniou tiel stavcov (sledovaných na röntgenovej snímke) a líniou tŕňových výbežkov (sledovaných Orteliusom), navyše tŕňové výbežky bývajú pri skolióze deformované, čo môže ovplyvniť ideálny matematický model pre výpočet veľkosti Cobbovho uhla (línia tŕňových výbežkov + rotácia trupu = línia tiel stavcov).

Na porovnanie jedna z posledných neradiačných topografických metód (rasterstereografia, Formetric 4D) dosahuje pomerne dobrú koreláciu s RTG snímkami, rozdiel oproti Cobbovmu uhlu na RTG je priemerne o 7–9,4 stupňa nižší, tiež s pomerne veľkým rozsahom 0–22 stupňov (**22**). Táto metóda bola úspešne použitá na pooperačné sledovanie pacientov, kde dokáže znížiť počet potrebných snímok (**23**).

# ZÁVER

## Využiteľnosť prístroja Ortelius 800 v praxi

U pacientov po operačnej korekcii skoliózy je možné na sledovanie veľkosti krivky použiť prístroj Ortelius s akceptabilnou odchýlkou oproti RTG snímkam. Táto ale môže v ojedinelých prípadoch dosiahnuť až 15 stupňov. Prítomnosť jazvy a kovového fixátora presnosť neovplyvňuje za predpokladu, že je možné nahmatať všetky tŕňové výbežky stavcov. V prípade, že ich kvôli jazve nie je možné nahmatať, vyšetrenie nemôže byť vykonané štandardným spôsobom a výsledok bude preto skreslený vždy – u takýchto pacientov vyšetrenie Orteliusom nedoporučujeme.

Prístroj môže v pooperačnom období nahradiť RTG snímky pri meraní Cobbovho uhla. Nevýhodou vyšetrenia je, že zobrazuje iba polohu tŕňových výbežkov v priestore, neukazuje teda štruktúru chrbtice a prítomnosť alebo neprítomnosť fúzie, ani postavenie a prípadné uvoľnenie implantátu. V prípade pooperačného sledovania sa štandardne robí RTG snímka krátko po operácii. Ak je to pre operatéra akceptovateľné, môže nahradiť zvyšné vyšetrenia prístrojom Ortelius a kontrolné RTG robiť iba 1x ročne do viditeľnej fúzie. Následne je možné pacienta sledovať len pomocou Orteliusa. V prípade zhoršenia veľkosti krivky oproti predošlému meraniu alebo pri objavení sa nových ťažkostí u pacienta doporučujeme zhotoviť klasickú RTG snímku.

Z uvedeného vyplýva, že Ortelius neposkytuje ortopédovi rovnako detailné informácie ako RTG snímka, je však možné znížiť počet RTG snímok v pooperačnom sledovaní a niektoré z nich nahradiť vyšetrením pomocou Orteliusu.

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# APLIKACE MYOELEKTRICKÝCH PROTÉZ RUKY U DĚTÍ

# APPLICATION OF MYOELECTRIC HAND PROSTHESIS IN CHILDREN

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## SOUHRN

V České republice je nedostatek informací a zkušeností s aplikací myoelektrických protéz u dětí. Dlouhodobě byla aplikace tohoto typu protéz u dětí kontraindikována. S pokračující miniaturizací se celosvětově přistupuje k aplikaci myoelektrických protéz i u velmi malých dětí. Autoři se pokusili zmapovat současný stav týkající se aplikace myoelektrických protéz u dětí ve věku 3–10 let v České republice a Slovenské republice.

V souboru 10 dětí, vybavených myoelektrickou protézou na území České republiky a Slovenské republiky v letech 2009–2013, je hodnocen věk při aplikaci prvovybavení a následného vybavení myoelektrickou protézou. Kromě délky pahýlu předloktí byla hodnocena rovněž průměrná doba používání protézy v průběhu dne.

Závěry autorů jsou v souladu s výsledky dříve publikovaných zahraničních studií, které uvádějí, že tříleté dítě je vývojově připraveno k aplikaci myoelektrické protézy).

Na základě zjištěných skutečností autoři doporučují vytvořit metodiku pro racionální preskripci myoelektrických protéz u dětí od 3 let věku. Autoři doporučují vybavení dítěte druhou pasivní protézou, která umožní dítěti provádět aktivity, které by mohly vést k výraznějšímu opotřebení myoelektrické protézy.

**Klíčová slova:** Myoelektrická protéza, dětské protézy, ergoterapie, amputace horní končetiny, vrozené defekty horní končetiny

## SUMMARY

There is lack of information and experience with the application of myoelectric prostheses in children in the Czech Republic. In the long term, the application of this type of prosthesis was contraindicated in children. With ongoing miniaturization worldwide there is approach to application of myoelectric prostheses for very small children. The authors have attempted to map the current situation with myoelectric prostheses applications in children aged 3-10 years in the Czech Republic and the Slovak Republic.

In a group of 10 children, equipped with myoelectric prosthesis in the Czech and Slovak Republic from 2009 to 2013, is assessed the age at the first fitting and the subsequent equipment myoelectric prosthesis. Aside from the length of the forearm stump the average time of the prosthesis using during the day was also evaluated.

The findings of the authors are consistent with the results of previously published international studies suggesting that three year old child is developmentally ready for application of myoelectric prosthesis.

Based on the findings, the authors recommend creating a methodology for rational prescribing of myoelectric prostheses for children from 3 years of age. The authors recommend outfit these children by the second passive prosthesis, which allows the child to engage activities that could lead to significant wastage of myoelectric prosthesis.



**Key words:** Myoelectric prosthesis, child prosthesis, occupational therapy, upper limb amputation, congenital defects of upper limb


## ÚVOD

Cílem práce autorů je na základě vlastních pozorování a publikovaných zahraničních studií přiblížit problematiku aplikace myoelektrických protéz u velmi malých dětí. Aplikace tohoto typu protéz byla dlouhodobě u dětí kontraindikována, především z důvodu příliš velkých a těžkých stavebních součástí jednotlivých protéz. Příčinou nejasných názorů na tuto problematiku byl rovněž nedostatek zkušeností s aplikací myoelektrických protéz u dětí v časném věku. Z výše uvedených důvodů byla aplikace myoelektrických protéz celosvětově umožněna především dospívajícím a dospělým pacientům, nejčastěji s oboustrannou ztrátou úchopu. S pokračující miniaturizací bylo v průběhu 90. let zejména ve skandinávských zemích přistoupeno k aplikaci myoelektrických protéz u menších dětí (**4, 6, 18**). Výsledky Egermanovy studie publikované v roce 2009 (**6**), vedly autory ke zmapování současné situace v aplikaci myoelektrických protéz u dětí ve věku 3–10 let v České republice a Slovenské republice.

### Funkce ruky v časném dětském věku

Důležitost plné funkce horní končetiny a ruky jako úchopového orgánu je všeobecně známa. Kromě funkce fixační, umožňující úchop, je pro rozvíjející dětský organismus důležitá rovněž opěrná funkce horní končetiny k zajištění postury v poloze na břiše a při lezení dítěte po čtyřech.

S postupným vzpřimováním se opora dítěte o horní končetinu z oblasti paží a předloktí posouvá periferně do oblasti zápěstí. Zajištění bimanuální opory je důležité pro symetrické a vyvážené nastavení těla při postupující vertikalizaci jedince. Absence této opory o horní končetiny může být příčinou strukturálních i funkčních asymetrií pohybové soustavy (**5, 16, 19**).

## Vhodný věk pro první aplikaci protetického vybavení horní končetiny

Pohybový a psychický vývoj dítěte neposuzujeme podle kalendářního věku. Dítě je vždy potřeba vyšetřit a posuzovat přísně individuálně. První aplikaci protetické pomůcky doporučujeme tehdy, pokud tomu odpovídá fyzický a psychický vývoj postiženého dítěte. Základní podmínkou pro rozhodnutí o vybavení myoelektrickou protézou je pak především jeho komunikativnost a schopnost poslouchat a řídit se pokyny cizích lidí (ošetřujícího personálu). Další důležitou podmínkou je motivace dítěte a tendence k oboustrannému používání horních končetin. Nutné je posouzení připravenosti dítěte používat a plně využít protetické vybavení. Při samotné aplikaci protetického vybavení rozlišujeme pomůcky určené k polohování pahýlu a opoře dítěte při lezení. Kontinuální neuromuskulární vývoj dítěte a neuroplasticita mozku je v případě normálního psychomotorického vývoje zárukou velmi rychlé adaptace malého jedince na protetické vybavení. Pozdější aplikace myoelektrické protézy může být obtížná z důvodu vytvoření náhradních pohybových stereotypů, které mohou zhoršit adaptaci pacienta na pomůcku. V pozdějším věku a zvláště v období puberty byla v některých případech i z tohoto výše uvedeného důvodu pozorována odmítavá reakce pacientů nosit jakoukoliv protézu horní končetiny (**6, 16, 18**).

## Specifika aplikace protéz v dětském věku

Při aplikaci protéz u dítěte musíme brát v úvahu dynamické růstové změny skeletu, které si vyžadují častější úpravy pahýlového lůžka i výměnu komponent protézy. Při vybavení protézou horní končetiny musíme předpokládat vysokou aktivitu jedince.

Součástí správné přípravy pacienta k aplikaci protézy je důležité posouzení uživatelského prostoru dítěte a jeho denních aktivit. Musíme pečlivě zhodnotit aktivity dítěte s ohledem na zajištění bezpečného úchopu při hraní a případných sportovních činnostech (**9, 10, 11**).

Funkce protézy horní končetiny se s postupujícím psychomotorickým vývojem mění. Protéza horní končetiny u dětských pacientů (s vrozeným defektem HK) v prvním roce života slouží především k zajištění opory při lezení po čtyřech a při vertikalizaci. Nejdůležitější funkcí v následujícím období je, kromě kompenzace kosmetického vzhledu, zajištění aktivního úchopu a umožnění bimanuálních činností. Dosud opomíjenou funkcí protézy HK při jednostranném defektu (vrozeném nebo získaném) je náhrada chybějící hmotnosti končetiny. Asymetrická hmotnost HK v období růstu vede k vývoji deformity páteře (tzv. statické skoliózy).

## Požadavky na protézy horní končetiny

Při uplatnění principu funkčního protézování horních končetin od protézy vyžadujeme náhradu funkce končetiny spočívající v umožnění úchopu a manipulaci s předměty. Při nácviku ovládání protézy máme za cíl plynulé a nenápadné ovládání pomůcky, které umocní kosmetické

zakrytí defektu. U dětských uživatelů je rovněž důležitý požadavek na mechanickou odolnost protézy a jednoduchost manipulace (**2, 8, 13**).

## Absolutní a relativní kontraindikace k aplikaci myoelektrických protéz (20)

Absolutní kontraindikace:

- Výrazná atrofie svalstva s omezenou svalovou funkcí
- Nedostatečná tonizace a diferenciace antagonistických svalových skupin i přes adekvátní rehabilitační přípravu pacienta
- Opakovaně naměřené nízké hodnoty myoelektrických potenciálů svalů potřebných k ovládání protézy
- Kontraktura v přilehlém kloubu znemožňující aktivní ovládání protézy
- Neschopnost dítěte psychicky příjmout a ovládat myoelektrickou protézu
- Celkově špatný zdravotní stav pacienta
- Nespolupracující dítě a rodina

Relativní kontraindikace:

- Nezhojená operační rána
- Velmi krátký nebo enormně dlouhý amputační pahýl znemožňující technickou aplikaci protézy
- Rozsáhlé plošné adherující jizvy na pahýlu končetiny
- Prominující distální kostěná část pahýlu bez dostatečného svalového krytu
- Neprovedení myoplastické amputace
- Nedodržení nejvhodnější doby pro aplikaci myoelektrické protézy u dětí

## Problematika aplikace myoelektrických protéz HK u dětí v České republice a v zahraničí

Legislativa a metodika zdravotních pojišťoven v České republice umožňuje aplikaci myoelektrických protéz pouze u pacientů po oboustranné amputaci horních končetin nebo u jednostranné amputace horní končetiny a současným výrazným funkčním postižením úchopu druhé horní končetiny. Současná česká legislativa (**21**) neřeší vybavení myoelektrickou protézou u dětských pacientů s jednostranným vrozeným defektem horní končetiny. Z výše uvedených důvodů, které znemožňují aplikaci myoprotéz u dětských pacientů, neexistují v současné době ani relevantní studie hodnotící aplikaci myoelektrických protéz. Ucelený koncept regulující aplikaci myoelektrických protéz u dětí v ČR neexistuje.

Metodika aplikace myoelektrických protéz na Slovensku (**20**) je oproti České republice (**21**) rozdílná a umožňuje aplikaci myoelektických protéz u vrozených defektů HK nebo získaných amputací bez ohledu na funkční stav zachované horní končetiny. Slovenská metodika zároveň řeší i časový faktor aplikace myoelektrické protézy u dětí. Podle tohoto předpisu má být aplikována myoelektrická protéza u dítěte do 15 let nejpozději do 2 let od provedené amputace. U dítěte nad 15 let by měla být aplikována myoelektrická protéza do jednoho roku od amputace. U dětí s vrozenou amputací se aplikuje myoprotéza ve věku od 2,5 do 4 let. Do té doby je indikována pasivní protéza.

Zkušenosti s aplikací myoelektrických protéz u velmi malých dětí v západní Evropě shrnuje Egermannova studie (**6**), která retrospektivně popisuje protetické vybavení horní končetiny 41 dětí ve věku 2–5 let. Soubor Egermannovy studie tvořilo 22 děvčat a 19 chlapců. Etiologie ztráty končetiny zahrnovala 36 vrozených defektů a 5 traumatických amputací horní končetiny. Ve 35 případech se jednalo o ztrátu horní končetiny v úrovni předloktí, u 6 dětí bylo postižení v úrovni nad loketním kloubem. U 14 dětí bylo postižení lokalizováno na pravé horní končetině u zbývajících dětí pak na levostranné horní končetině. Autoři se zabývali hodnocením využití myoelektrické protézy v průběhu dne při jídle, rehabilitaci, pobytu ve školce, v exteriéru a při jízdě na kole. Využití myoelektrické protézy se pohybovalo v rozmezí od 60–85 % (příjem jídla, hraní si s dětmi ve školce a venku, jízda na kole). Průměrná doba denního využití protéz ve sledované skupině byla 5,8 ± 4,1 hodiny za den. Časový rozsah využití pomůcky se pohyboval od 0 do 14 hodin za den.

Základní doporučení pro indikaci a aplikaci myoelektrických protéz u dětí ve věku 2–5 let, která vyplývají se závěrů Egermannovy studie:

- podmínkou indikace je komunikativnost a schopnost řídit se pokyny cizích lidí
- motivace dítěte k používání protézy
- tendence k oboustrannému používání horních končetin
- podpora rodičů k zajištění následného edukačního programu i mimo rehabilitační zařízení
- zajištění úhrady pomůcky s perspektivou kontinuálního vybavení dítěte
- zajištění profesionálního mezioborového týmu (rehabilitace, protetika)
- technická podpora s poskytnutím velmi rychlé a efektivní údržby nebo opravy
- malé děti mohou používat myoelektrickou protézu v jakékoliv situaci vyjma některých aktivit, uvedených v následujícím bodě
- konstrukce dílů myoelektrické protézy neumožňuje některé fyzické aktivity (lezení po stromech, úchop myoelektrickou protézou při zavěšení dítěte na průlezkách apod.)
- protože může dojít k relativně rychlému opotřebení a nutnosti četnějších oprav, je vhodné vybavení dítěte druhou – pasivní (pracovní) protézou, která umožní provádět aktivity, které by mohly vést k výraznějšímu opotřebení myoelektrické protézy (možnost znečištění, nošení těžších břemen a poškození kosmetického krytu pomůcky)

## PACIENTI A METODIKA

Soubor 10 dětí (6 chlapců, 4 dívky) vybavených myoelektrickou protézou na území České republiky (3 chlapci) a Slovenské republiky (4 dívky, 3 chlapci) v letech 2009–2013, byl retrospektivně hodnocen 2 lékaři – specialisty v ortopedicko-protetickém oboru, kteří se podíleli na jejich protetickém vybavení. Informace, které byly podrobeny hodnocení, jsou čerpány ze zdravotní dokumentace vedené na protetických pracovištích autorů. Popis defektů HK se řídí nomenklaturou ISO/ISPO (**12, 17**). Jeden pacient je po oboustranné traumatické amputaci v úrovni zápěstí, ke které došlo v 10 letech. Dalších 9 dětí má vrozený defekt v úrovni předloktí a distálněji. Ve 2 případech se jednalo o izolovaný transverzální defekt na pravé horní končetině (HK). U těchto dětí mělo jedno dítě transverzální defekt v úrovni zápěstí a druhé v úrovni proximální třetiny

předloktí. U 5 dětí se jednalo o transverzální defekt levé HK. Z této skupiny byl defekt u 2 dětí v úrovni zápěstí a u 3 pacientů v úrovni střední třetiny předloktí. Ve dvou případech se jednalo o pacienty s postižením obou HK (transverzální defekt v úrovni zápěstí) a obou dolních končetin (transverzální defekt distální třetiny bérců). U jednoho pacienta byl diagnostikován Hanhartův syndrom, ve druhém případě syndrom amniotických pruhů.

V uvedeném souboru pacientů bylo hodnoceno: 1. první vyšetření lékařem ortopedickým protetikem, 2. věk pacienta při aplikaci protetického prvovybavení, 3. věk pacienta při první aplikaci myoelektrické protézy, 4. využití myoelektrické protézy v průběhu dne, 5. vybavení druhou pasívní protézou ruky.

# VÝSLEDKY

Charakteristika souboru pacientů a výsledky pozorování jsou shrnuty v **tabulce 1**.

Aplikace myoelektrických protéz u dětí v období 2009–2013 v ČR a SR

| Charakteristika souboru | | | Prezentace výsledků | | | | |
|---|---|---|---|---|---|---|---|
| Pacient / pohlaví | defekt HK | Rok narození | 1. vyšetření ortopedem protetikem | prvovybavení protézou | 1. aplikace myoelektrické protézy | Další typ protézy | Využití protézy |
| | | | (věk v měs.) | (věk v měs.) | (věk v měs.) | | |
| 1/♂ | TDCU l. dx | 2006 | 6 | 7 | 38 | ne | denní aktivity, hraní, sport |
| 2/♂ | TDCU l. sin | 2008 | 41 | 42 | 61 | pasivní | denní aktivity, hraní |
| 3/♀ | TD HKK+DKK | 2007 | 2 | 10 | 65 | pasivní | pouze manipulace s předměty, denně |
| 4/♀ | TDA l. sin | 2008 | 6 | 9 | 56 | ne | denní aktivity, hraní, kreslení |
| 5/♀ | TDA l. sin | 2005 | 60 | 62 | 102 | pasivní | denní aktivity, hraní, kolo |
| 6/♀ | TDA l. dx | 2002 | 44 | 45 | 108 | pasivní | denní aktivity, hraní, kreslení |
| 7/♂ | TD HKK+DKK | 2006 | 2 | 14 | 41 | pracovní nasádce | pouze manipulace s předměty, denně |
| 8/♂ | TDA l. sin | 2006 | 6 | 6 | 36 | pasivní | denní aktivity, golf, kolo |
| 9/♂ | TDCU l. sin | 2008 | 8 | 10 | 34 | pasivní | denní aktivity, kolo, badminton |
| 10/♂ | TC amp. l. utr | 2003 | 5. den po úrazu | 2 | 2 | ne | denní aktivity, sport, kolo |

**Tabulka 1.** Charakteristika souboru 10 dětí a prezentace výsledků pozorování
Vysvětlivky zkratek v tabulce: HK – horní končetina, HKK – horní končetiny, DK – dolní končetina, DKK – dolní končetiny, ♀–dívka, ♂–chlapec, TDCU – transverzální defekt karpu úplný, TD HKK + DKK – transverzální defekt obou horních i dolních končetin (upřesnění v textu), TDA – transverzální defekt předloktí, TC amp. – transkarpální amputace (traumatická), měs – měsíc, měsíce

## První vyšetření lékařem ortopedickým protetikem

U všech pacientů před samotnou indikací protéz bylo provedeno cílené psychologické, rehabilitační a ortopedicko-protetické vyšetření s posouzením psychomotorického vývoje, schopnosti spolupráce dítěte i posouzení morfologických změn s vyloučením možných kontraindikací aplikace myoelektrické protézy. Při posuzování dokumentace byla zjištěna terminologická nejednotnost v názvosloví defektů horních končetin. Při následném sjednocení terminologie jsme vycházeli z platné nomenklatury vrozených končetinových vad (VKV) dle Mezinárodního standardu ISO 8548/1 (**12, 17**). U vyšetřovaných dětí byla hodnocena pouze úroveň (výška) amputace případně délka pahýlu v centimetrech. Při vyšetření dětí byla zjištěna u jedinců s jednostranným vrozeným defektem HK svalová asymetrie trupu a pletenců ramenních s rozvíjející se statickou deformitou trupu. V dokumentaci nebyly záznamy o zjišťování rozdílu hmotnosti končetin.

V psychologických posudcích byla cíleně hodnocena schopnost spolupráce a pochopení provedení požadovaných úkonů dítětem vždy se závěrem, že je dítě schopno aplikace a nácviku ovládání myoelektrické protézy. Závažným zjištěním byly informace týkající se prvního vyšetření specialistou ortopedickým protetikem. Ve 2 případech u dětí s postižením horních i dolních končetin bylo provedeno vyšetření v prvních 2 měsících od porodu. U třech pacientů bylo první vyšetření provedeno do půl roku od narození se včasným zahájením protetické péče. V jednom případě bylo první vyšetření ortopedem provedeno v 8. měsíci s nedoporučením včasného protetického vybavení ( druhé vyšetření s odstupem 1. měsíce jiným lékařem s indikací pasívní protézy). Ve 3 případech bylo dítě poprvé vyšetřeno lékařem ortopedickým protetikem až po uplynutí 41 měsíců od narození. Důvodem byly informace jiných ortopedů o tom, že se protéza HK aplikuje až v pozdějším věku kolem 6 let.

## Věk pacienta při aplikaci protetického prvovybavení

První protéza (prvovybavení) byla aplikována v rozmezí 2-3 měsíců od prvního vyšetření lékařem ortopedickým protetikem v 7 případech. U 2 dětí s kongenitálním postižením obou horních i dolních končetin byla aplikace prvovybavení na HK provedena v jednom případě do 8 měsíců od vyšetření (10. měsíc věku), ve druhém případě pak 12 měsíců od prvního vyšetření (14. měsíc věku). Vzhledem k pozdnímu odeslání dítěte na specializované ortopedicko protetické vyšetření byla aplikace prvovybavení ve 3 případech uskutečněna až po uplynutí 40 měsíců od narození. 10letý pacient s traumatickou amputací v úrovni zápěstí byl po 2 měsících od úrazu vybaven přímo myoelektrickými protézami (pasívní protézy nebyly aplikovány)**.**

## Věk pacienta při první aplikaci myoelektrické protézy

Nejmladšímu dítěti s VKV při aplikaci myoelektrické protézy bylo 34 měsíců (2 roky 10 měsíců) nejstaršímu pacientovi pak 9 let.

### Využití myoelektrické protézy v průběhu dne

Pacienti s kongenitální jednostrannou amputací HK a chlapec s traumatickou amputací obou HK využívali protézu v průběhu celého dne. Průměrná doba využití protézy u těchto dětí byla 8–12 hodin. Důležité bylo rovněž zjištění, že sledované děti byly schopny používat myoelektrickou protézu v jakékoliv situaci při hraní, překonávání překážek, jízdě na kole, koloběžce apod. Protézu odkládali pouze na spaní nebo při činnostech, které mohly způsobit poškození protézy (koupání, nebezpečí znečištění protézy).

U dvou pacientů bylo časové využití protéz kratší (přibližně 4 hodiny). V obou případech se jednalo o jedince s vrozeným postižením obou horních i dolních končetin (transverzální defekt zápěstí + transverzální defekt distální třetiny bérců). Tito pacienti byli vybavení myoelektrickou protézou pouze na pravou horní končetinu (na druhé HK pasívní protéza, na dolních končetinách aplikovány transtibiální protézy), kterou využívají v průběhu dne. U těchto dětí je patrná preference používání i samotných pahýlů horních končetin bez protézy či využívaní pracovních adaptérů a objímek na pahýly, které používali dříve v rámci ergoterapie.

### Vybavení druhou pasivní protézou ruky

Sedm dětí bylo vybaveno druhou pasívní protézou, kterou používají při aktivitách, kdy může dojít k poškození myoelektrické protézy nebo v době, kdy je potřeba myoelektrickou protézu opravit.

## KAZUISTIKY

Postup při vybavení pacientů myoelektrickou protézou dokumentují následující 3 kazuistiky.

### Kazuistika č. 1

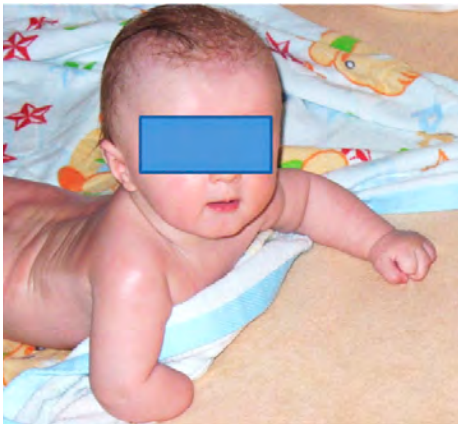
Chlapec F. A. se narodil v prosinci 2006 s transverzálním defektem v úrovni proximální třetiny předloktí pravé HK. Psychomotorický vývoj probíhal v 1. roce normálně.

Psychologické vyšetření vyhodnotilo dítě jako jedince s nadprůměrnou intelektovou kapacitou a množstvím zálib, plně začleněné ve společenském i pedagogickém procesu, bez anxiózních rysů. Okolím bylo vnímáno jako zdravé dítě.

Ortopedicko–protetické vyšetření vyloučilo případné kontraindikace použití myoelektrické protézy. Pohyblivost v loketním i ramenním kloubu pravé HK byla volná, bez omezení. Opakovaně byly vyšetřeny myoelektrické potenciály, jejich hodnota byla vyhovující (40–60 μV) pro aplikaci myoelektrické protézy. Pacient od 7 měsíců věku byl opakovaně vybavován pasivní protézou ruky. Vzhledem k předpokladu zlepšení motorického vývoje bylo rozhodnuto o indikaci předloketní myoelektrické protézy.

Po splnění podmínek – zhodnocení myoelektrických potenciálů, vyjádření psychologa, vyjádření pediatra o celkovém stavu a přidružených chorobách byl zkompletován odborný ortopedicko-protetický lékařský nález s poukazem na myoelektrickou pomůcku. Po schválení zdravotní pojišťovnou bylo přistoupeno ke zhotovení individuální myoelektrické protézy.

| Postup protetického vybavení | Věk pacienta (měsíce) |
|---|---|
| První vyšetření protetikem | 1 |
| Prvovybavení pasivní protézou | 7 |
| Vyšetření psychologem | 25 |
| První vyšetření myoelektrických potenciálů | 26 |
| 2. vyšetření myoelektrických potenciálů | 33 |
| Aplikace předloketní myoelektrické protézy | 38 |

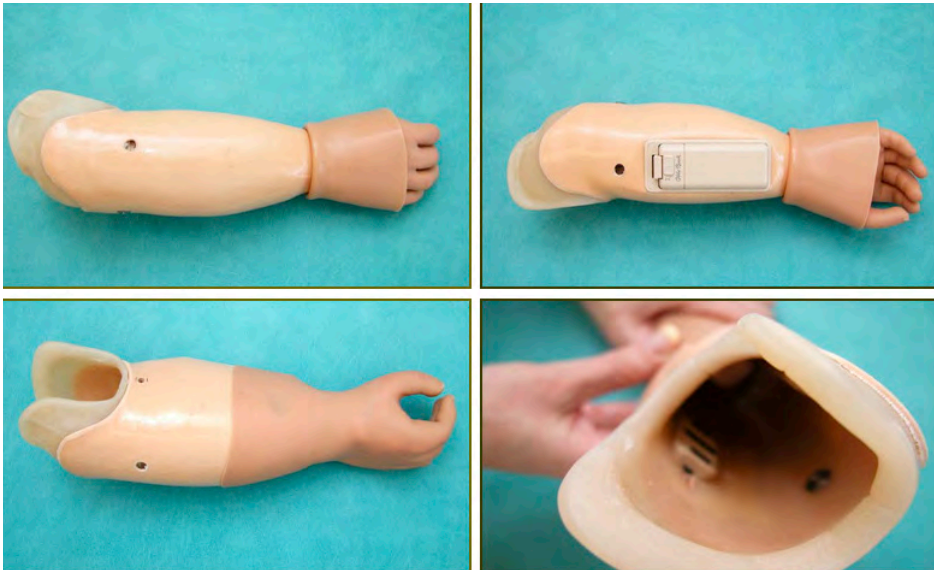


**Obr. 1a.** Dítě – kojenec s transverzálním defektem pravého předloktí v proximální třetině, 5. měsíc života.

**Obr. 1b.** Dítě po aplikaci pasivní předloketní protézy PHK ve věku 7 měsíců.

**Obr. 1c, d.** Dítě s využitím pasívní protézy PHK ve 2 letech.

**Obr. 1e, f.** Chlapec ve věku 3 let a 2 měsíců při používání myoelektrické protézy PHK



**Obr. 1g** Myoelektrická protéza.

## Kazuistika č. 2

J.K. se narodil v lednu 2003.

Chlapec v 10 letech utrpěl úraz, při kterém byly amputovány obě horní končetiny v úrovni zápěstí. S ohledem na oboustranné postižení a výborné intelektové schopnosti chlapce bylo přistoupeno k časnému vybavení myoelektrickými protézami. Po zhojení operační rány bylo přistoupeno k intenzivní rehabilitační péči směřující k utužení měkkých tkání pahýlu a výcviku ovládání antagonistických svalových skupin, důležitých k ovládání myoelektrických protéz. Pro nácvik byl použit speciální myotrenažér se softwarem k vizualizaci snímaných myoelektrických potenciálů z pahýlu přeloktí Jako prvovybavení byly aplikovány myoelektrické protézy na obě horní končetiny již 2 měsíce od úrazu. U pacienta došlo k velmi dobré adaptaci na protézy, které využívá v průběhu celého dne (12 hodin). Pomůcky odkládá pouze při koupání a činnostech, kdy může dojít k mechanickému poškození protéz.

| Postup protetického vybavení | Doba od amputace (dny) |
|---|---|
| Příprava pacienta (bandážování, otužování pahýlu) | 1–60 |
| První vyšetření lékařem ortopedickým-protetikem | 5 |
| Vyšetření myoelektrických potenciálů | 20 |
| Aplikace předloketních myoelektrických protéz (prvovybavení) | 60 |

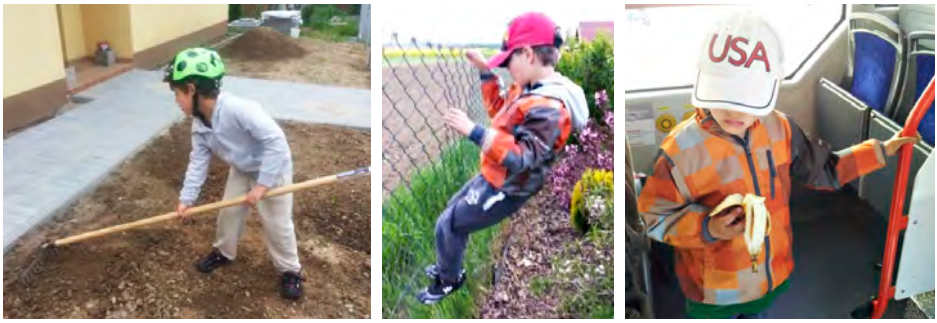
**Obr. 2a, b, c** Ukázka vybavení a využívání myoelektrických protéz při práci u 10letého pacienta s oboustrannou transverzální traumatickou amputací v zápěstí.

## Kazuistika č. 3

F.S. byl narozen v listopadu 2008, porod ve 37. týdnu těhotenství.

Po narození byl diagnostikován transverzální terminální defekt v úrovni zápěstí LHK. Dítě bylo prvních 7dní po narození v inkubátoru. Zahájení rehabilitační léčby bylo ve 2 měsících Nejdříve bylo prováděna stimulace a masáž pahýlu předloktí. Od 3. do 33. měsíce věku byla prováděna Vojtova reflexní terapie. První ortoped, který dítě vyšetřil ve věku 8 měsíců nedoporučil aplikaci protézy s odkazem na vybavení dítěte protézou až v pozdějším věku při vertikalizaci. V tomtéž měsíci rodiče vyhledali ortopéda na jiném pracovišti, který pomůcku indikoval. V10. měsíci věku byl chlapec vybaven kosmetickou protézou předloktí, která byla aplikována vzhledem k růstu dítěte opakovaně. Po vyhodnocení motorických a psychologických hledisek byla pacientovi indikována a na zdravotní pojišťovně schválena myoelektrická protéza levého předloktí. Chlapec se na myoelektrickou protézu výborně adaptoval. Používá ji v průběhu celého dne prakticky při všech denních aktivitách – používání příboru při jídle, používání nůžek, jízda na kole, držení knihy při čtení. Pomůcku využívá ke hře jak v domácím prostředí, tak v exteriéru. Krátkodobé výpadky v používání myoelektrické protézy z důvodu nutné úpravy nebo opravy pomůcky vnímá nepříznivě.

| Postup protetického vybavení | Věk pacienta (měsíce) |
|---|---|
| Zahájení rehabilitační péče (masáž pahýlu, polohování) | 2 |
| První vyšetření ortopedem | 8 |
| Druhé vyšetření jiným ortopedem | 8 |
| První aplikace kosmetické pasivní protézy | 10 |
| 2 následné vybavení kosmetickou pasívní protézou | 18 |
| Psychologické a rehabilitační vyšetření k indikaci myoelektrické protézy | 25 |
| Předpis myoelektrické protézy | 32 |
| První aplikace myoelektrické protézy a nácvik ovládání v RÚ | 34 |




**Obr. 3a, b, c** Denní aktivity 5letého dítěte s transverzálním terminálním defektem zápěstí LHK, které je vybaveno myoelektrickou protézou.

# DISKUSE

## Postup při indikaci myoelektrické protézy

Rozhodnutí o indikaci myoelektrické protézy zahrnuje provedení včasného komplexního ortopedicko-protetického, rehabilitačního a psychologického vyšetření s posouzením morfologických změn pohybového aparátu a přidružených postižení, dále pak zhodnocení psychomotorického vývoje a schopnosti spolupráce dítěte s vyloučením možných kontraindikací aplikace myoelektrické protézy. Při popisu vrozených končetinových vad je nutné terminologicky správné zařazení (**17**).

Při vyšetření dětí s vrozenými končetinovými vadami je potřebné zaměřit se nejen na možné přidružené systémové vady (zvláště močopohlavního ústrojí a vrozené srdeční vady), ale také na výskyt statických deformit páteře podmíněných asymetrickou hmotností HK, které mají v růstovém spurtu tendenci se zhoršovat. S ohledem na rozdílnou hmotnost končetin při protetickém vybavení je rovněž nutné optimalizovat hmotnost protézy a využívat antropometrického či denzitometrického vyšetření k určení hmotnosti amputované části končetin (**3**, **14, 15**).

Základním předpokladem pro indikaci myoelektrické protézy u dítěte ve věku 3 let je především jeho komunikativnost a schopnost poslouchat a řídit se pokyny cizích lidí (ošetřujícího personálu). Další důležitou podmínkou je motivace dítěte a tendence k oboustrannému používání horních končetin. Nejdůležitější je však podpora rodičů, kteří jsou schopni dítě povzbuzovat a zajistit následný edukační program i mimo rehabilitační zařízení. Při indikaci protéz preferujeme co nejjednodušší ovládání pomůcky. Na základě zhodnocení používání první myoelektrické protézy dítětem, můžeme při aplikaci další protézy využít k ovládání pomůcky více signálů, které umožní například současné ovládání úchopu a rotace zápěstí.

Před samotnou indikací a aplikací protézy je potřeba zvážit rovněž ekonomickou dostupnost a úhradu pomůcky buď z prostředků zdravotního pojištění nebo jiných zdrojů. Je důležité si uvědomit, že pokud je jednou u dítěte zahájena aplikace myoelektrické protézy, pak je z důvodu psychické adaptace dítěte potřebné v používání myoelektrické protézy pokračovat (**1, 6, 7**).

Při studiu souboru byly zjištěny zásadní rozdíly v přístupu zdravotních pojišťoven v ČR a na Slovensku, kdy ve Slovenské republice je systém úhrady myoelektrických protéz u dětí s kongenitálními vadami horních končetin precizněji propracován jak z hlediska timingu aplikace, tak posuzování indikačních kriterií u jednostranných amputací horních končetin.

## Časové hledisko první aplikace protetického vybavení (prvovybavení)

U dětí s kongenitální amputací je velmi důležité zahájit aplikaci protetického vybavení v podobě pahýlové objímky k zajištění opory při lezení, jakmile se začne dítě obracet na břicho. Při počátku vertikalizace do stoje aplikujeme první pasivní protézu určenou k symetrické opoře o horní končetiny při chůzi kolem nábytku apod. Protézy ovládané zevní silou tahové a myoelektrické indikujeme při splnění podmínek normálního psychomotorického vývoje a spolupráce dítěte. Základní podmínkou pro zahájení protézování horní končetiny u dětí je včasnost aplikace. S postupujícím věkem se zhoršuje adaptace na prvovybavení protézou (**4, 18**).

V případě traumatické ztráty obou horních končetin doporučujeme u dětí při splnění podmínek normálního psychomotorického vývoje a po vyloučení případných kontraindikací včasnou aplikaci myoelektrických protéz, to znamená do půl roku od úrazu po stabilizaci objemů pahýlu končetin.

## Věk pacienta a aplikace myoelektrické protézy

Zjištění autorů je v souladu s výsledky dříve publikovaných zahraničních studií (**4, 6**), které uvádějí, že 3leté dítě je vývojově připraveno k aplikaci myoelektrické protézy. Základní podmínkou pro aplikaci myoelektrické protézy je schopnost motorického učení pacienta. Pro ovládání myoelektrické protézy je důležité izolované ovládání antagonistických svalových skupin zachované části horní končetiny. Pro úspěšnou aplikaci protézy je nutné zajistit z tohoto důvodu rehabilitační přípravu, spočívající v použití myotrenažéru napodobujícího formou hry funkci protézy. Po vybavení protézou je potřebná následná rehabilitační komplexní péče zahrnující cílenou ergoterapii zaměřenou na ovládání myelektrické protézy při manipulaci s předměty různé velikosti i hmotnosti a na zvládání denních činnosti. Přínos aplikace myoelektrické protézy spočívá především v sociální integraci dítěte, zajištění a zlepšení sebeobsluhy, využití volného času při hraní a učení směřující k rozvoji osobnosti.

Podmínkou pro úspěšnou výrobu, aplikaci a využití pomůcky dítětem je zajištění profesionálního mezioborového týmu, který je schopen velmi rychle reagovat na potřeby dítěte. Mezioborový tým zahrnuje lékaře specializovaného v ortopedické protetice, ergoterapeuta, fyzioterapeuta, ortotika–protetika a samozřejmě i malého pacienta s rodiči.

Pro minimalizaci případných problémů při aplikaci myoelektrických protéz je důležité zajištění protetického pracoviště s dostatečnými zkušenostmi a technickým zázemím, umožňujícím rychlé řešení případných úprav a oprav protetického vybavení.

## Využití myoelektrické protézy v průběhu dne

Závažným zjištěním je skutečnost, že velmi malé děti jsou schopny používat myoelektrickou protézu v jakékoliv situaci, přičemž konstrukce dílů myoelektrické protézy některé fyzické aktivity neumožňuje. Při studiu souboru pacientů jsme zjistili měnící se nároky na protézu v průběhu růstu dítěte i s ohledem na převládající aktivity malých uživatelů. I z tohoto důvodu může dojít k relativně rychlému opotřebení protézy a nutnosti četnějších oprav, což zvyšuje finanční náročnost protetického vybavení. Tato pozorování jsou v souladu s publikovanými výsledky jiných autorů.(**6, 18**)

## Vybavení druhou pasivní protézou ruky

Někteří autoři (**16, 18**) doporučují vybavení dítěte druhou pasivní protézou, která umožní dítěti provádět aktivity, které by mohly vést k výraznějšímu opotřebení myoelektrické protézy. Pasívní protéza zároveň slouží k překlenutí doby, kdy je potřebná oprava nebo úprava myoelektrické protézy.

Při sportovních a jiných společenských aktivitách u starších dětí přistupujeme k použití adaptérů modifikujících úchop u pasivních protéz (úchop řídítek na kole, adaptér na trsátko ke kytaře apod.).

## ZÁVĚR

S ohledem na zjištěné zkušenosti autoři konstatují, že u dětí s vrozenými vývojovými vadami HK po důkladném zhodnocení psychosomatických schopností je možná úspěšná aplikace myoelektrické protézy již ve věku dítěte od 3 let. U dětí se získanou amputací HK se rovněž potvrdil oprávněný požadavek včasného protézování. Zásadní podmínkou pro úspěšnou aplikaci myoelektrické protézy je velmi úzká spolupráce s rodinou.

Byly zjištěny významné rozdíly v metodickém přístupu zdravotních pojišťoven v ČR a na Slovensku, jak z hlediska timingu aplikace myoelektrických protéz, tak posuzování indikačních kritérií u jednostranných amputací HK.

Na základě zjištěných skutečností autoři doporučují jednání se zdravotními pojišťovnami a Ministerstvem zdravotnictví ČR, směřující k vytvoření metodiky pro racionální preskripci myoelektrických protéz u dětí.

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## Poděkování

Autoři děkují za spolupráci dětským pacientům a jejich rodičům při pořizování fotodokumentace. Poděkování patří rovněž lékařům, psychologům, fyzioterapeutům, ergoterapeutům a protetickým technikům, kteří se podíleli na rehabilitační a protetické péči o pacienty prezentované v našem souboru.

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# STANOVENÍ AXIÁLNÍ ROTACE PÁNVE PŮVODNÍ RADIOGRAFICKOU METODOU – PROSPEKTIVNÍ STUDIE

# THE PELVIS ROTATION ASSESSMENT ACCORDING TO THE NEW ORIGINAL RADIOGRAPHIC METHOD – A PROSPECTIVE STUDY

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## ABSTRAKT

Úkolem prospektivní studie je stanovit rotaci pánve novou originální radiografickou metodou, která vychází z určení definovaných bodů na předozadním RTG snímku pánve.

Protože doposud neexistuje jednoduchá metoda pro stanovení rotace pánve, tedy i sakra, dostáváme měřením axiální rotace segmentů páteřního sloupce hodnoty zkreslené, protože se neprovádí korekce o rotaci pánve, která by měla být součástí vyhodnocení předozadních RTG snímků dlouhého formátu zhotovených ve stoje. Až po získání hodnot axiální rotace páteřního sloupce vzhledem k pánvi (sakru) získáme hodnoty skutečné, které lze porovnávat u téhož jedince za zkoumané období a získat tak informace o změně zdravotního stavu.

Předkládaná radiografická metoda umožňuje získat číselnou hodnotu axiální rotace pánve pouze zkonstruováním čtyř přímek a změřením hledaného úhlu úhloměrem. Není zapotřebí žádných speciálních pomůcek a lze uvedeným způsobem vyhodnocovat axiální rotaci pánve na jakémkoliv zdroji, tedy jak na konvenčním snímku, tak na jeho digitální podobě. Předkládanou metodu lze jednoduše implementovat do počítačových programů. V takovém případě se pouze zkonstruují příslušné čtyři přímky a úhel je pak vypočítán automaticky.

Metoda může sloužit k hodnocení rotace pánve z mnoha dalších důvodů v různých oborech (např. antropologie, biomechanika, rentgenologie, dětská ortopedie, ortopedická protetika, spondylochirurgie aj.).

**Klíčová slova:** rotace, úhel, obratel, pánev, deformita páteře, skolióza, RTG snímek

## ABSTRACT

The aim of this prospective study is to evaluate the pelvis rotation according to the new original radiographic method, which is based on defined details on an antero-posterior (AP) X-ray picture.

Since no simple method for the evaluation of the axial pelvis rotation (and of the sacrum rotation too) has been found until now, all types of methods for the measurement of the vertebral rotation from AP X-ray pictures give inaccuracy and biased value. A correction of the pelvis rotation should be practised in each interpretation of AP X-ray pictures of long format. Only when the values of the axial vertebral rotation are evaluated and corrected in relation to the pelvis rotation, it will be possible to acquire real values, which will be comparable the values of the same individual examined in a certain period. These values will thus inform about any changes of the spine.

The presented radiographic method enables getting a numeric value of the angle of the axial pelvis rotation by drawing only four lines and measuring the searched angle using a protractor. It is not necessary to use any special devices as it is possible to evaluate the axial pelvis rotation using any source, either a conventional X-ray picture or a digital picture on a PC monitor. The proposed method can be simply installed into computer programs. In that case, only four correspondent lines are drawn and the angle of the axial pelvis rotation is then automatically calculated.

The method may serve to evaluate the axial pelvis rotation for other reasons in various scientific fields (e.g. anthropology, biomechanics, radiology, child orthopaedics, orthotics-prosthetics etc.).



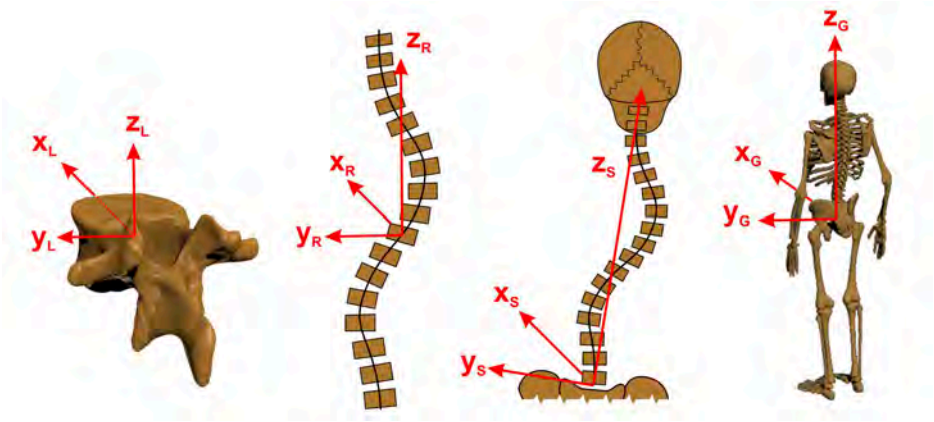
**Key words:** rotation, angle, vertebrae, pelvis, spine deformity, scoliosis, X-ray picture.


## ÚVOD

Úkolem prospektivní studie je stanovit rotaci pánve novou originální radiografickou metodou, která vychází z určení definovaných bodů na předozadním RTG snímku pánve.

Metrologie lidského skeletu se neustále vyvíjí s cílem získat jednak co nejobjektivnější údaje a jednak další možnosti k porovnávání skeletálních změn v průběhu růstu či onemocnění. Pro hodnocení deformit páteře z konvenčních RTG snímků se nejvíce používají metody ke stanovení úhlu zakřivení páteře dle Cobba [**2**] či Fergusona [**10**], kterými hodnotíme deformitu nejen v rovině frontální a sagitální. Tato měření jsou prováděna podle jednotné terminologie především na regionální, spinální nebo globální úrovni, **obr. 1** [**11**].

Jsou to metody relativně velmi rozšířené a pro praxi dostatečně přesné. V naší zemi se prakticky výhradně používá metoda dle Cobba [**9**]. Vedle primárního měření deformit páteře v rovině frontální se hodnotí deformity i v rovině sagitální, kde se hodnotí odchylky od fyziologického zakřivení a stanovují se další kritéria. Jde především o hodnocení sagitálního tiltu (sklonění), a to tiltu C7 a T9 [**1, 7, 9**]. Jsou hodnoceny i hlavní sagitální parametry pánve, což je především sakrální sklon (SS), pánevní tilt (PT) a pánevní incidence (PI) [**1, 6, 7**].




a **Lokální** (obratel)

b **Regionální** (křivka)

c **Spinální** (páteř)

d **Globální** (skelet – tělo)

**Obr. 1.** Znázornění hierarchie čtyř souřadnicových systémů definujících páteřní geometrii podle Stokese [**11**]. a – lokální souřadnicový systém obratle. b – regionální souřadnicový systém na deformovaném úseku páteře. c – spinální souřadnicový systém je definovaný osou, procházející C1 a L5. d – globální souřadnicový systém, kde osa těžiště prochází sakrem (S1).

Pro stanovení axiální rotace obratů existuje řada metod. Nejméně přesná, ale vzhledem k její jednoduchosti nejvíc používaná, je metoda podle Nash-Moe [**8**], která určuje pouze 5 stupňů v rozsahu 0 až 90°. Pro přesnější stanovení rotace obratlů se z praktického a objektivního pohledu ukazuje jako nejvhodnější použít Perdriolle torsion-meter nebo Raimondi šablonu [**5**]. Nová radiografická metoda pro stanovení axiální rotace obratlů [**3**] dává, bez nutnosti jakýchkoliv speciálních pomůcek, podobně přesné hodnoty jako obě zmíněné. S výhodou ji lze aplikovat i u digitálních snímků přímo na PC monitoru například díky volně dostupnému programu AngleSpine [**III**]. Velmi důležité je měření nejen samotné rotace skoliotického páteřního sloupce u dětí v období růstu a kostního zrání, ale především změny rotace sledovaných obratlů za období [**3**].

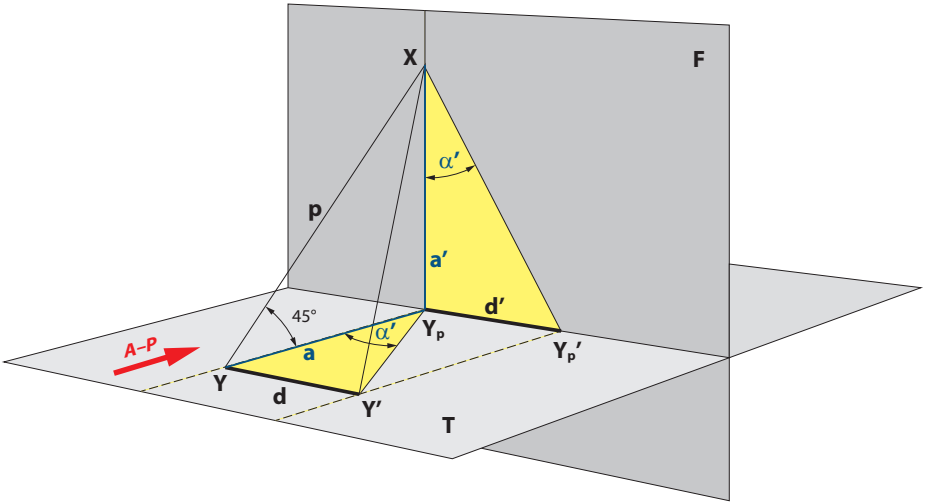
Protože doposud neexistuje jednoduchá metoda pro stanovení rotace pánve, tedy i sakra, je v praxi hodnocena axiální rotace obratlů pouze z AP RTG snímků na úrovni spinální [**11**], **obr. 1c**, přestože AP RTG snímky, poskytují obraz skeletu na úrovni globální [**11**], **obr. 1d**. Dostáváme tak hodnoty zkreslené, protože se již neprovádí korekce o rotaci pánve, která by měla být součástí čtení snímků na úrovni globální. Vzhledem k nepreciznímu a nejednotnému provádění konvenčních AP RTG snímků tak zjevně dochází k nepřesnostem a chybám v rovnoběžnosti v úrovni spin (SIAS) s kazetou přístroje, způsobených individuálním nahodilým axiálním postavením pánve při snímkování. Pro získání hodnot rotace jednotlivých obratlů vzhledem k páteřní základně – kosti křížové (os sacrum), je potřebné opravit jejich axiální rotaci získanou z RTG

snímku v AP projekci o rotaci pánve (resp. ossis sacri), čímž dostaneme hodnoty relevantní a dlouhodobě porovnatelné. Předkládaná metoda dokáže bez jakýchkoliv speciálních pomůcek axiální rotaci pánve změřit při použití tužky, pravítka a úhloměru. Velmi snadno lze princip metody implementovat do počítačových programů pro čtení digitálních RTG snímků.

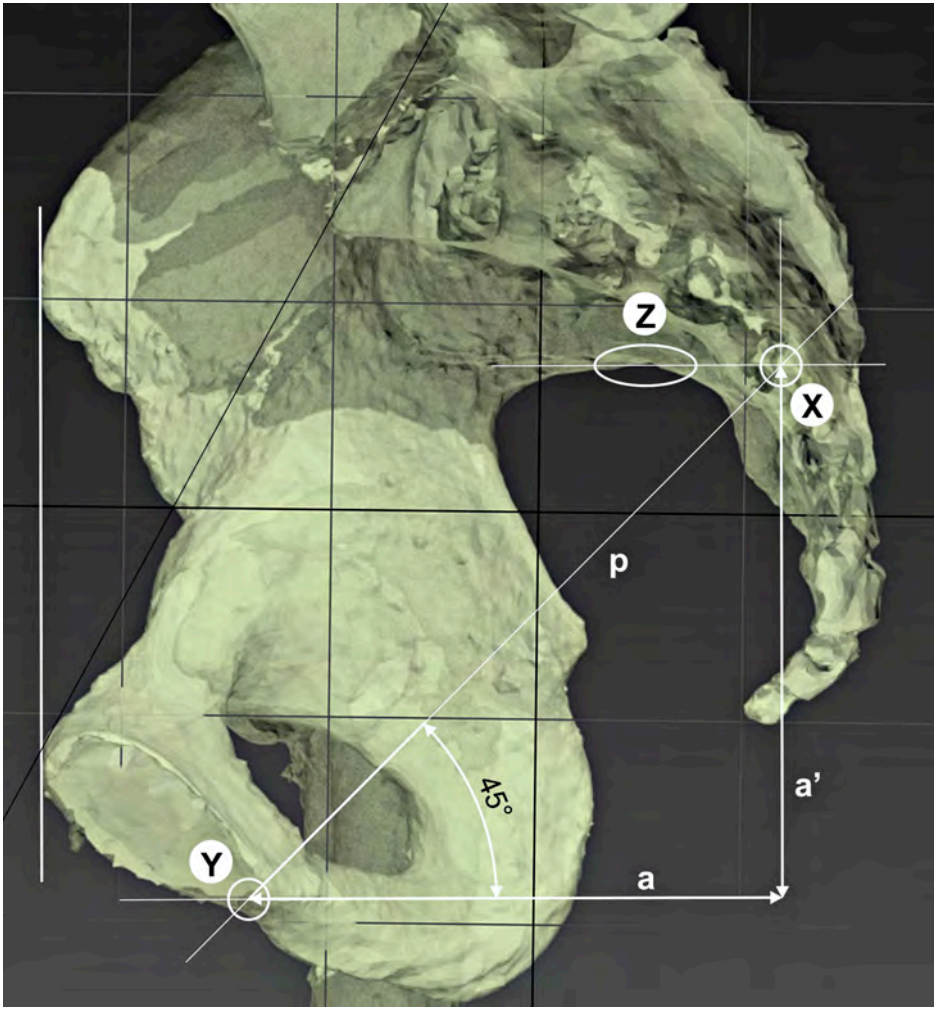
## METODA

K tomu, abychom mohli objektivně odečítat rotaci pánve z konvenčního předozadního RTG snímku (F = frontální rovina na obr. 2), je potřeba nalézt takové body pánevního průmětu, které jsou na snímku čitelné a projevují se jednoznačně. Abychom tedy byli schopni číst úhel rotace $\alpha$ v transversální rovině (T na obr. 2) a odpovídající úhel $\alpha'$ v zobrazené frontální rovině (F na obr. 2) je potřebné, aby body X a Y, které se axiální rotací pánve vzájemně posouvají, ležely v sagitální rovině na přímce p svírající úhel 45° k oběma zobrazovaným rovinám, nebo úhel této hodnotě velmi blízký, **obr. 2**.

Z obrázku je patrné, že bod **Y** reálně rotuje s úhlem $\alpha$ do polohy **Y'** po oblouku, který se ovšem v AP projekci zobrazí jako strana **d**. V takovém případě se strana **d** vyznačeného trojúhelníku v transversální rovině promítne ve stejné délce i do roviny frontální v podobě strany **d'**. Protože rovněž délky stran trojúhelníků **a** i **a'**(což jsou průměty přímky **p** do roviny transversální a frontální), jsou při sklonu 45° přímky **p** stejně dlouhé, musí mít také úhly $\alpha$ i $\alpha'$ stejnou velikost díky podobnosti trojúhelníků.




**Obr. 2.** Znázornění průmětu přímky **p** do frontální (F) a transverzální (T) roviny (sklon 45° k oběma rovinám) v podobě úseček o stejné délce **a**, **a'**. Při reálném axiálním pootočení úsečky **a** se středem otáčení v **Yp**, se strana vzniklého trojúhelníku **d** promítne ve stejné velikosti do frontální roviny v podobě úsečky **d'**. Vzniknou tak stejné pravoúhlé trojúhelníky a proto je jasné, že se úhel axiální rotace $\alpha$ zobrazí nezkreslený v rovině frontální v podobě úhlu $\alpha'$.




**Obr. 3.** Mediální řez 3D modelu pánve. Na obrázku jsou nalezeny body **X** (střed křížové kosti v úrovni pánevního vchodu **Z**) a **Y** (spodní bod symfýzy) na přímce **p**, která svírá k transversální i frontální rovině úhel 45° při obvyklém anatomickém postavení pánve [**4**]. Na obrázku jsou naznačeny stejně dlouhé úsečky **a**, **a'**.

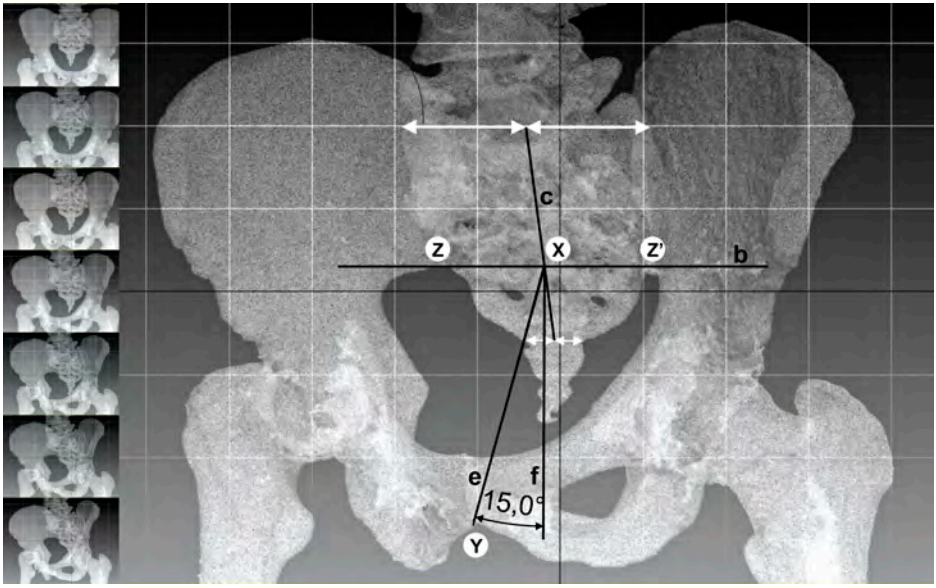
Zkoumáním 3D modelu [**I**] i vlastních konvenčních RTG snímků pánve se ukázalo jako nejvhodnější sledovat střed křížové kosti (os sacrum) **X** v úrovni horních stínů pánevního vchodu (pelvis inlet) **Z** a spodní okraj symfýzy **Y**, **obr. 3**.

Horní okraj symfýzy a přední horní hrana S1 obvykle svírají v sagitální rovině úhel 60° [**4**], spiny SIAS a přední okraj symfýzy tak přibližně leží v jedné rovině.

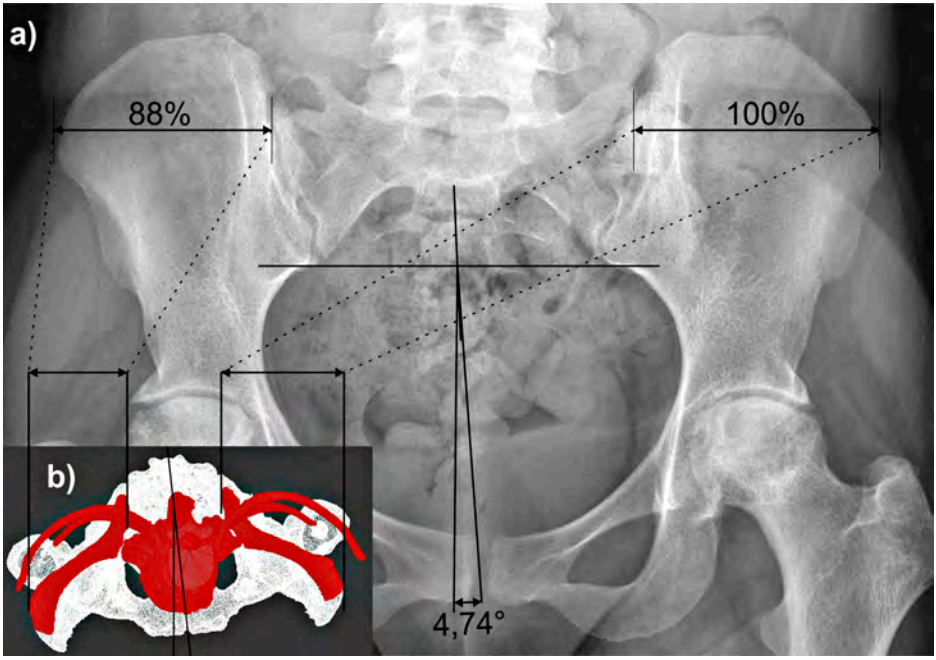
Z konvenčního RTG snímku je patrné, že v AP RTG projekci nelze zjišťovat polohu bodu **X** v křížové kosti v sagitálním zobrazení. U modelové situace byl proto fiktivní bod **X** umístěn zhruba doprostřed hloubky sakra, což vyhovuje podmínce 45° sklonu přímky **p**.

V dalším kroku bylo potřebné navržený postup ověřit na 3D modelu s definovanou rotací. U 3D modelu pánve dospělé ženy byla v komerčním programu „Autodesk – 3ds Max" [**II**] standardním postupem vhodně snížena transparentnost tak, aby se dosáhlo zobrazení, které je blízké opravdovému RTG snímku a byla provedena simulace rotace 0 až 30° v krocích po 5°, **obr. 4** – vlevo. Protože je potřeba bod **X** v sakrální oblasti nalézt, byla nakreslena přímka linie pánevního vchodu **b**, čímž jsme získali aspoň jeden z vrcholů stínů **Z** nebo **Z'** (dle jejich viditelnosti) a přímka **c** procházející středem stínu sakra. Průnikem obou přímek je hledaný bod **X**. Dále je z bodu **X** vedena přímka **e** spodním bodem symfýzy **Y** a svislá přímka **f**, ke které je hledaný úhel vztažen. Změřením úhlu dostáváme úhel $\alpha$, který odpovídá definovanému axiálnímu pootočení, **obr. 4.**

Na **obr. 5a** je znázorněno stanovení rotace pánve na skutečném RTG snímku [**IV**]. Jde o příklad, jak by procedura reálně vypadala, protože jde o běžný snímek, který není zhotoven s definovanou rotací. Patrnou, avšak nedefinovanou rotaci pánve jednoznačně prokazuje vzájemný poměr šířek stínů pánevních lopat (alae ossis ilei) na základě jejich anatomického postavení v transversální rovině, viz **obr. 5b**.




**Obr. 4.** Příklad měření 3D modelu pánve s definovanou rotací 15°. Je zřejmé, že změřená rotace velmi přesně odpovídá definované. Vlevo jsou v miniaturách zobrazeny jednotlivé sekvence rotované pánve s definovanou hodnotou rotace.




**Obr. 5a.** Příklad čtení běžného AP RTG snímku pánve [IV.], na němž je ze vzájemného poměru šířek stínů pánevních lopat (alae ossis ilei) zřejmé, že je pánev mírně rotovaná. Obr. 5b znázorňuje transverzální řez v úrovni pánevních lopat, kde je patrná jejich změna šířky průmětů v AP projekci.

# VÝSLEDKY

Navržená metoda byla ověřena opakovaným měřením axiálního pootočení jednotlivých 3D obrázků pánve s definovanou axiální rotací. Autoři provedli pět opakovaných měření celé série modelovaných snímků. Výsledky získaných průměrných úhlů rotace jsou uvedeny v **tab. 1**, kde $\mathbf{x_r}$ je definovaná rotace a $\mathbf{x_p}$ jsou průměrné hodnoty jednotlivých čtení.

| $x_r$ [°] | n = 1 | n = 2 | n = 3 | n = 4 | n = 5 | $x_p$ |
|---|---|---|---|---|---|---|
| 0 | 0,5 | 0,1 | 0,3 | 0,3 | 0,3 | 0,3 |
| 5 | 4,9 | 5,0 | 5,4 | 6,3 | 5,5 | 5,4 |
| 10 | 10,0 | 10,6 | 10,3 | 10,8 | 11,0 | 10,5 |
| 15 | 15,5 | 14,8 | 15,2 | 15,5 | 15,9 | 15,4 |
| 20 | 18,8 | 19,6 | 21,2 | 20,7 | 20,1 | 20,1 |
| 25 | 25,9 | 25,7 | 25,8 | 26,0 | 26,5 | 26,0 |
| 30 | 28,3 | 28,7 | 26,7 | 27,8 | 27,7 | 27,6 |

**Tabulka 1.** Hodnoty pěti opakovaných měření (**n**) axiální rotace 3D modelů pánve s definovanou rotací (xr). V prvním sloupci jsou uvedeny průměrné hodnoty pěti měření pro každý 3D model s definovanou rotací.

| | **rozptyl** ($\sigma^2$) | **SD** ($\sigma$) |
|---|---|---|
| 0° až 30° | 1,03 | 1,02 |
| 0° až 25° | 0,28 | 0,53 |

**Tabulka 2.** stanovený rozptyl a směrodatné odchylky pro měření v rozsahu 0 až 25° a 0 až 30°.

Z **tabulky 1** je patrné, že při definovaném úhlu 30° dochází k větší chybě čtení než u rotace v rozmezí 0° až 25°. To lze pravděpodobně vysvětlit tím, že osou sakra prokládáme kompromisní přímku, která při vyšších hodnotách rotace pánve již neodpovídá ideálnímu modelu. Tento jev bude potřeba ověřit na reálných RTG snímcích s definovanou rotací pánve.

Pokud výsledky ohodnotíme směrodatnou odchylkou, viz **tab. 2**, pak je zajímavé, že v rozmezí 0° až 25° vychází SD velmi příznivě. Při započtení měření 30° rotace dostáváme hodnotu směrodatné odchylky přibližně dvojnásobnou.

Dále lze konstatovat, že nezáleží na sekvenci jednotlivých kroků postupu. Je potřebné metodicky správně zkonstruovat pouze 4 přímky a na závěr provést jedno úhlové změření úhloměrem. V případě implementování metody do PC programu je výsledný úhel jednoduše vypočítán.

# DISKUZE

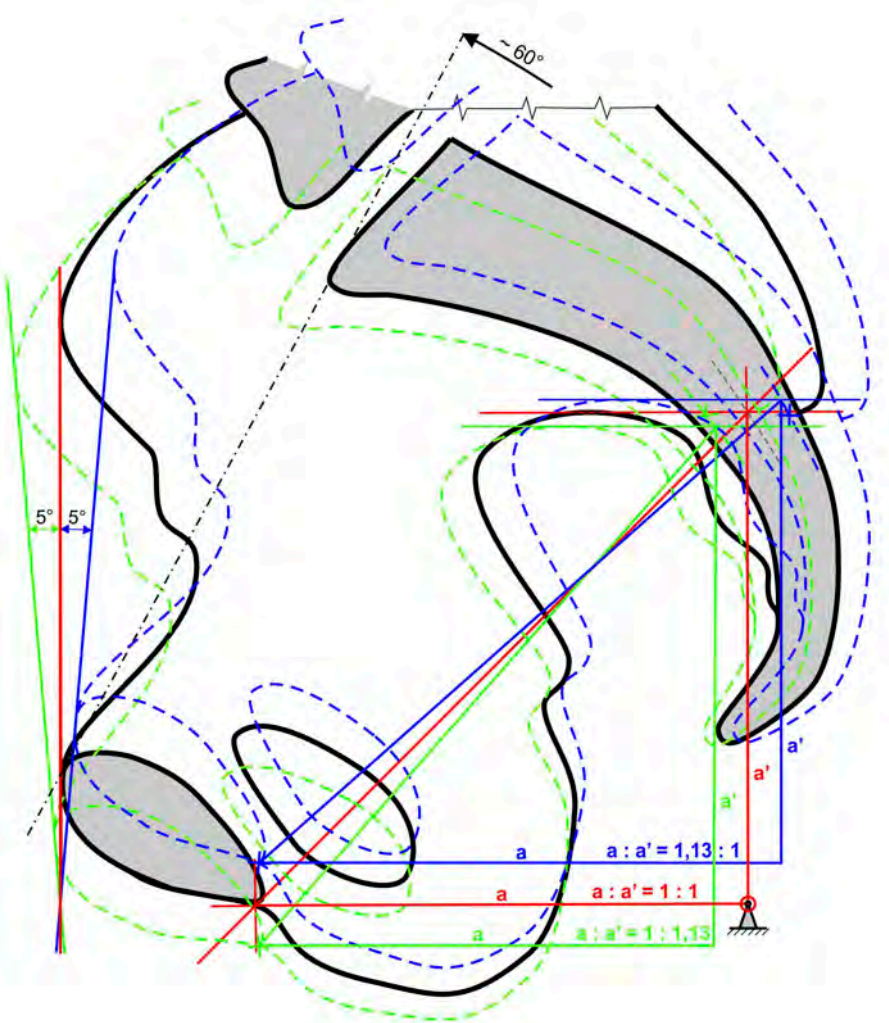
Proložení středové linie kosti křížové přímkou **b**, **obr. 4**, lze provádět odhadem. Je výhodné ji vést středem stínu kosti křížové (os sacrum) v úrovni S1 a středem viditelných proximálních segmentů kostrče (os coccygis). V takovém případě se poloha linie **Z**, **obr. 4**, na úrovni stínů pánevního vchodu nachází přibližně uprostřed, proto se odhadované nepřesnosti se do výsledku promítnou jen minimálně.

Rovněž sagitální inklinace pánve se ve výsledku projevuje minimálně. Změna vzdáleností **a** oproti **a'**, viz **obr. 2**, se mění při sagitální inklinaci s funkcí kosinus, což přináší při malých úhlových změnách minimální změnu délky stran **a, a'** obou trojúhelníků. Například sagitální inklinace (tilt) +/- 5°, jež je vyznačena obrysy v podobě modré a zelené přerušované čáry, **obr. 6**, způsobí odchylku poměru stran **1 : 1.13**, tudíž i chybu navrhované metody ve výsledném odečtení rotace přibližně 10%.

Protože se v praxi bude pravděpodobně jednat o rotaci pánve do 20°, pak zmíněná chyba do cca 2°, způsobená sagitální inklinací 5°, se jeví pro praxi přijatelná.

# ZÁVĚR

Ze studie vyplývá, že bude zapotřebí provést sérii RTG snímků pánve v AP projekci s definovanou rotací. Bude potřebné samostatně prozkoumat a ověřit metodu nejen na RTG snímcích dospělých jedinců, ale i u dětí (období akcelerace růstu). Rotaci pánve a L páteře zjištěnou radiografickou metodou bude nezbytné ověřit komparací s CT či MRI vyšetřením. Po statistickém ověření metody a stanovení základní přesnosti by měla metoda sloužit především k určování úhlové odchylky od ideálního postavení při zhotovování RTG snímků v AP projekci.




**Obr. 6.** Vliv sagitální inklinace +5°/-5° na poměr stran a, a' vnáší chybu přibližně 10% změřené hodnoty axiální rotace pánve předkládanou radiografickou metodou.

Předpokládáme, že při vývoji a progresi deformit páteře u dětí v období akcelerace růstu se současně bude vyvíjet rotace pánve. Tato metoda přináší možnost zpřesnit na RTG snímcích v AP projekci velikost změny rotace za sledované období především bederního úseku páteře, který je podstatně ovlivněn axiálním postavením pánve. V takových případech se pak budou méně projevovat individuální anatomické odlišnosti, protože je čtena rotace pánve téhož jedince.

Novou originální radiografickou metodu pro určení rotace pánve lze velmi snadno implementovat do počítačových programů, které již nyní umožňují sledovat individuální odlišnosti rozpoznatelné a měřitelné na RTG snímcích v AP projekci, jako je výška kyčelních kloubů, obecně obrysy průmětu pánve, rotaci bederních obratlů [**3**] aj. Metoda může sloužit k hodnocení rotace pánve z mnoha dalších důvodů v různých oborech (např. antropologie, biomechanika, rentgenologie, dětská ortopedie, ortopedická protetika, spondylochirurgie aj.).

Lze přepokládat, že zainteresovaní specialisté se shodnou na žádoucím hodnocení deformit páteře z digitálních RTG snímků zhotovených ve stoje v AP a bočné projekci, z kterých bude možné pomocí počítačových programů snadno hodnotit a průběžně monitorovat 3D vývoj deformit páteře, tj. Cobbův úhel na snímcích v AP a bočné projekci, axiální rotaci hrudní a bederní páteře, rotaci a inklinaci pánve ze snímků v AP projekci. Předpokladem je jednotné standardní provádění snímků páteře se zobrazením obou ramenních kloubů, hrudní a bederní páteře, pánve a obou kyčelních kloubů.

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## Další zdroje


I. 3D model pánve, http://www.thingiverse.com/thing:147700/#files, published as free by: Hyla, published-Sep 7, 2013.
II. Program "Autodesk-3dsMax", http://www.autodesk.com.
III. Program "AngleSpine", http://www.anglespine.com, (free).

IV. RTG snímek mírně rotované pánve, http://radiopaedia.org/images/879055, (free).
V. 3D model bederních obratlů, http://www.thingiverse.com/thing:250116/#files, (free, pro zhotovení obrázku 1).
VI. 3D model lidského skeletu, http://tf3dm.com/download-page.php?url=skeleton-58536, (free, pro zhotovení obrázku 1).

## Poděkování

Děkujeme panu Prof. Tomaszi Karskému, MD, PhD za iniciování řešení problému hodnocení deformit páteře z RTG snímku zhotoveného v AP projekci ve stoje na úrovni globální. Nedostatky ve zhotovování a interpretaci RTG snímků páteře u pacientů se skoliózou byly diskutovány na fóru mezinárodního sympózia „The 16th Prague-Lublin- Sydney-St. Petersburg Symposium", které se konalo ve dnech 21. až 24. 9. 2014 v polském Lublinu.

## Seznam symbolů a zkratek

| | |
|---|---|
| a | … úhel axiální rotace |
| p | … přímka se sklonem 45° |
| b, c, e, f | … přímky |
| a, a', d, d' | … úsečky, strany podobných trojúhelníků |
| F, T | … rovina frontální, transversální (jen obr. 2) |
| X, X', Y, Y', Z | … body, definující detaily pánve |
| xr, xp | … definované a průměrné hodnoty rotací (jen **tab. 1**) |
| SD | … směrodatná odchylka (jen tab. 2) |

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# TREATMENT OF KNOCK KNEES IN AN OBESE GIRL WITH A MILD FORM OF RICKETS AND HYPERMOBILITY

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## ABSTRACT

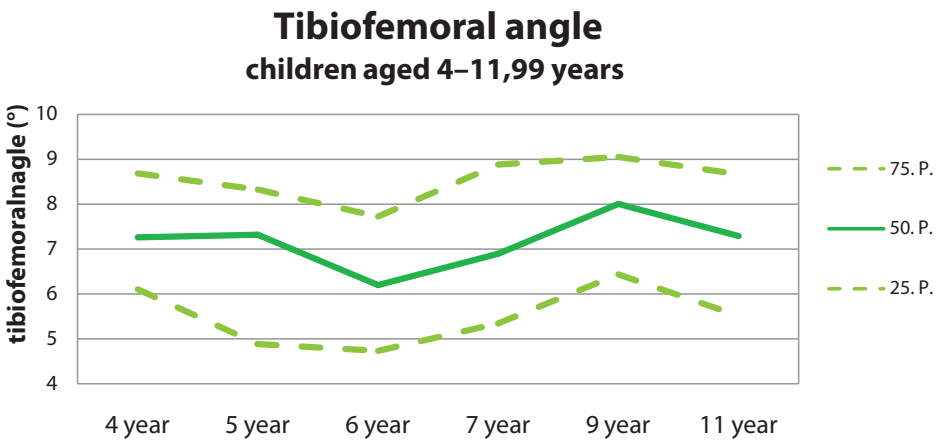
The case report documents the course of orthotic and orthopaedic surgical treatment of a girl with knee valgus deformity. The case shows the frequent treatment procedures used for the knock knee deformities in children at the Ambulant Centre for Defects of Locomotor Apparatus in Prague. Necessary part for indication of orthotic treatment (orhoses with bending prestressing) and mini-invasive surgery (hemi-epiphysiodesis) is the specific early anthropological examination and monitoring of tibio-femoral angle by both anthropometric and photographic methods.

**Key words:** knee valgus deformity, knock knees, tibio-femoral angle, hemi-epiphysiodesis, orthotic treatment

## INTRODUCTION

The Ambulant Centre for Defects of Locomotor Apparatus in Prague has achieved encouraging results with permanent epiphysiodesis that was carried out both in cases of unequal leg length and at deformities around the knee joint (**8, 11**).

Genu valgum (valgosity, knock knee) is relatively frequent in children around three years of age. At this age a genu valgum is physiological finding in majority healthy children (**2, 10**). Majority of the knock knee corrects spontaneously by the age of 6 to 7 years. According to our study (**10**) the mean T-F angle of this age children is 7.01°. Half of children has T-F angle in the range between 5.3–8.9°. Around 25% children have T-F angle above 9° (**Graph 1**).




**Graph 1.** Percentile charts of T-F angle development in Czech children (10).

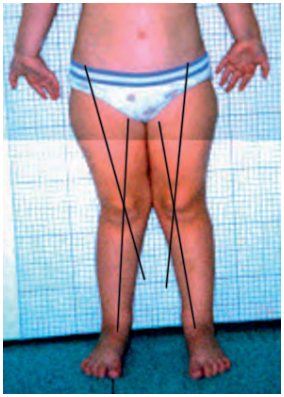


**Fig. 1.** Legs of a girl 2.5 years old – assisted posture, hypermobility of hands and knee joints. Tibiofemoral angle in standing was 18° on right side and 15° on left side. Inter-malleolus distance in standing was 9 cm, in lying position 8.5 cm.

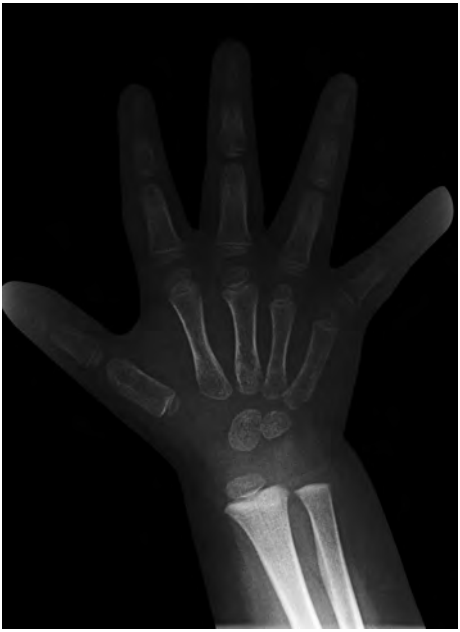


**Fig. 2.** X-ray of right hand, 2.5 years: some retardation of carpal bones ossification (TW20 method) and wider zones of provisional calcification.

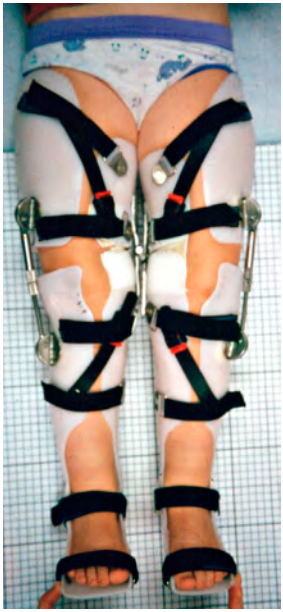


**Fig. 3A, B.** Special orthoses with bending pre-stressing (**6**).

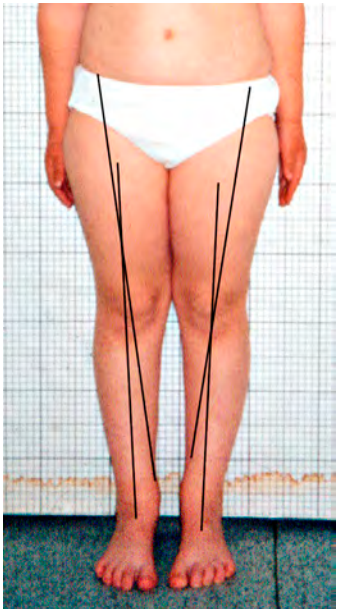


**Fig. 4.** Knock knees were corrected to physiological symmetric T-F angles: 5° bilaterally was measured by both anthropometric method and from assisted photos.

Genu valgum is often associated with overweight and/or obesity and with joint hypermobility, too. In these cases higher T-F angle remains and we talk about so-called idiopathic deformities. After 10 years of age the spontaneous correction does not come up. On the contrary a progress of knee valgosity arises during growth spurt (**13**). Knock knees are connected with coxa valga and pedes plani, too.

Both idiopathic deformities and especially serious three dimensional (3D) knee deformities are not only an aesthetic problem. The latter may be a sign of metabolic (**7, 8**) and/or genetic disoders of the skeleton (formely called skeletal dysplasias) **(9).** These deformities of legs are in high risk of premature osteoarthritis of the knee joints.

Progressive genu valgum or genu varum can be corrected by osteotomy at supracondylar or upper tibial level of the knee. Corrective osteotomy of distal femur and/or proximal tibia is indicated at skeletally matured patients. In preschool age a treatment method of choice may be intermittent application of leg orthoses with bending pre-stressing in night regime. Ten (and more) hours per day orthotic bending influence on the knee joint was empirically proved for orthotic treatment efficiency (**6, 8**). Later in the end of growth period the precise correction of leg axis can be achieved by partial medial or lateral epiphysiodesis (called hemi-epiphysio-

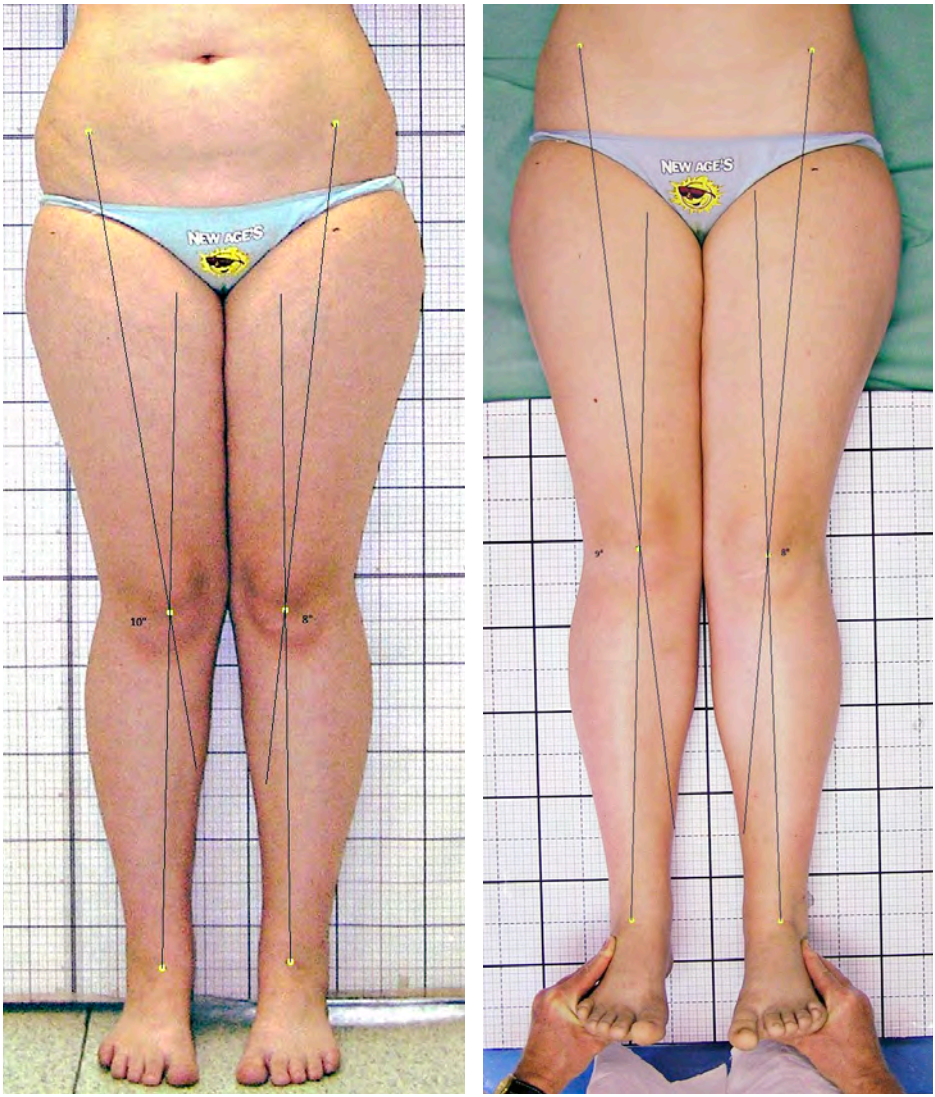



**Fig. 5 A, B.** Legs of the girl in 12 years and 2 months, T-F angle measured at assisted photography was in standing 10° on right side and 8°on left side(**A**), and in lying position 9° on right side and 8°on left side (**B**).

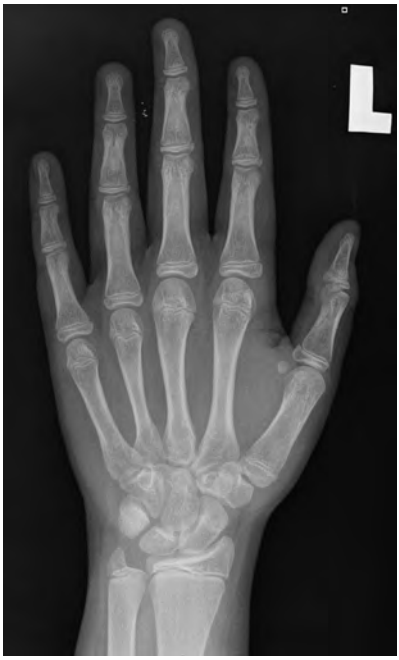



**Fig. 6.** Bone age (TW3 method, RUS (**14**)) of the girl in 12 years and 2 months was 12.9 and 13.0 by Greulich et al. (**4**).

desis) of the tibia or femur carried out by modified Macnicol´s method using drilling of growth physis (**5**). There is necessary precise auxological prediction for the timing of this procedure (**1, 4, 12, 14**).

The goal of the communication is to present on a case of a girl with knock knees our more than ten years experience with anthropometric measurement of tibio-femoral angle (**3, 10, 15**), indication for orthotic fitting, timing of the mini-invasive surgery, and long-term results of both orthotic treatment and permanent hemi-epiphysiodesis.

## THE CASE

We present both development of knock knees in a girl documented by anthropometric measurement of tibiofemoral (T-F) angle and the results of orthotic treatment in preschool age and medial hemi-epiphysiodesis carried out in the knee region during growth spurt.

The patient comes from the second gravidity of healthy parents who are not relatives. Her delivery was uneventful at term, with a weight 3950 g and a length 53 cm. Development of hip joints was normal, psychomotor development was in accordance to her age. She began to walk in 13 months. Family history concerning leg deformities and metabolic disorders was negative.

She was referred to the Ambulant Centre for Defects of Locomotor Apparatus in Prague with diagnosis severe knee valgus deformities and suspect rickets. Orthopaedic and anthropometric examination at the age of 2.5 years revealed obesity and hypermobility (hyperlaxity) of joints. Body weight was above 97$^{th}$ percentile, ratio of body weight to height also above 97$^{th}$ percentile, skin folds were above 97$^{th}$ percentile. Body height was above 97$^{th}$ percentile with normal proportionality of trunk and extremity. Tibiofemoral angle in standing was 18° on the right side and 15° on the left side. Inter-malleolus distance in standing was 9 cm, in lying position 8.5 cm (**Fig. 1**).

Biochemical examination proved a higher bone turnover and higher level of bone alkaline phosphatase. X-rays of knee joints and right hand proved some retardation of ossification (TW20 method) and signs of a mild rickets (wider zones of provisional calcification) (**Fig. 2**). Comprehensive treatment was introduced. It contained as supplementation of vitamin D and calcium as intermittent application of orthoses with bending pre-stressing in night regime. The girl tolerated orthoses very well. Corretion was step by step changed in the same bending prestressing. During 1 year and 3 months of orthotic treatment three pairs of the special ortho-

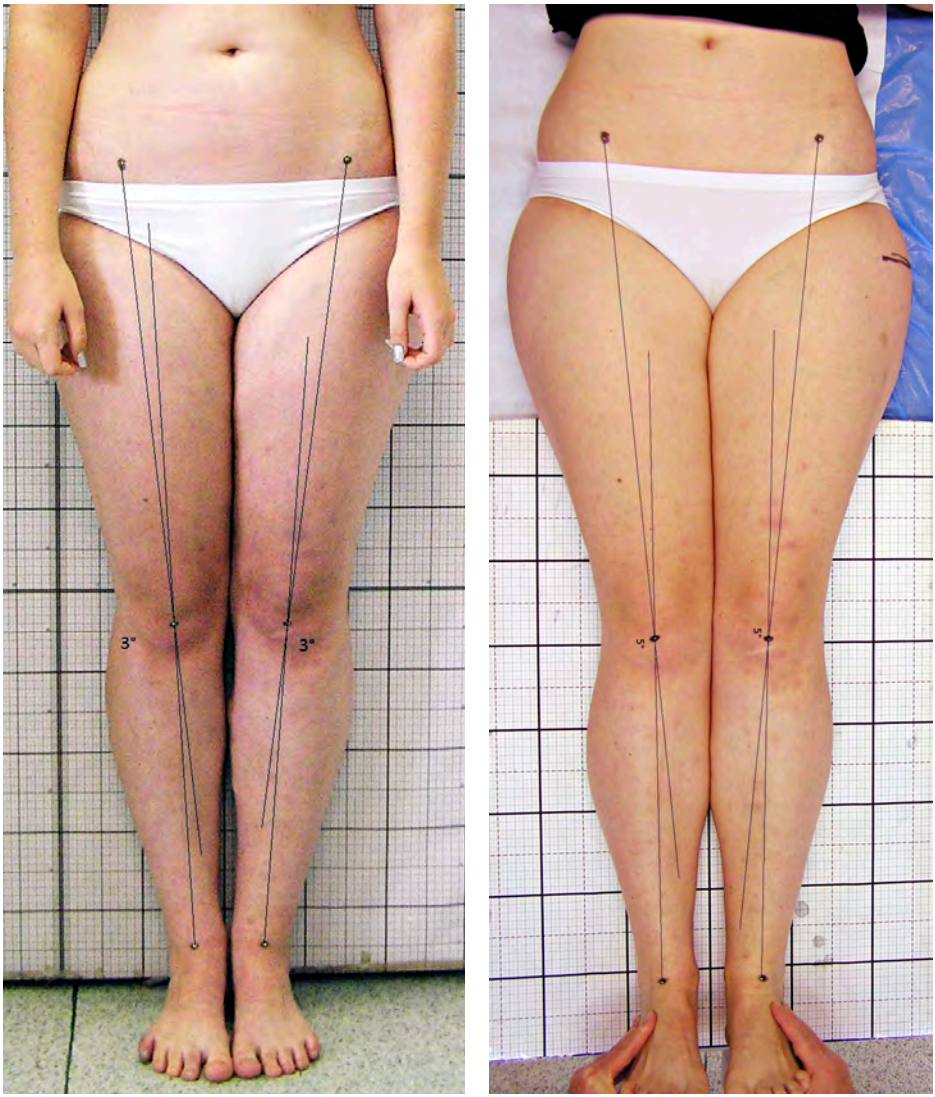



**Fig. 7 A, B.** Result of hemi-epiphysiodesis in 16.5 years: T-F angle measured at assisted photography was 3° in standing (**A**), and 5° in lying position on both sides (**Fig. 6 B**).

ses were applied (**Fig. 3A, B**). Knock knees were corrected to physiological symmetric T-F angles (5° bilaterally was measured by anthropometric method and from assisted photos) (**Fig. 4**).

The girl was again examined at the age of 12 years and 2 months because of recurrence of the knee valgus deformity that spring up during growth spurt. She was obese (height 173.5 cm, weight 83.9 kg), the joint mobility was still higher. Intermalleolar distance was in lying position 8 cm, in standing 6.7 cm, T-F angle measured by anthropometric method was 12.7°, from assisted photography in standing 10° on right side and 8°on left side (**Fig. 5A**), and in lying position: 9° on right side and 8°on left side (**Fig. 5B**). Bone age (TW3 method, RUS) was 12.9 and 13 by Greulich et al. (**4**) (**Fig. 6**). According to X-rays of knee joints (AP projection) a growth 12 mm from distal femoral physis were needed for correction of T-F angle on 6–8°. According to Anderson, Green and Messner (**1**) the remaining growth 12 mm is tabularized at bone age 12.5–13 years. That is why bilateral medial drilling hemi-epiphysiodesis was indicated and carried out in 12 years and 3 months to correct recurrent knock knees.

The result of this mini-invasive surgery was verified in 16.5 years of age by orthopaedic and anthropometric examination. The young lady was robust, the joint mobility was at upper limit of norm. Her final height was 183.6 cm (2.6 SD), weight 80.9 kg, BMI 26.4 (upper limit of norm). Medial hemi-epiphysiodesis of both distal femoral physes caused correction of the knee valgus deformities. Intermalleolar distance was in lying position 3 cm, in standing 0 cm. T-F angle measured from assisted photography was 3° in standing (**Fig. 7A**) and 5° in lying position on both sides (**Fig. 7B**). Walking stereotype was improved.

## CONCLUSION

A mild form of rickets is usually not diagnosed (biochemical examination of calcio-phosphate metabolism and X-rays are not performed) and it may be probably (together with joint laxity and overweight/obesity) a cause of symmetric varosity in toddlers and/or knock knees of older children. For these deformities generally the term idiopathic deformities of legs is used (**7**).

According to our many years ongoing experience in preschool age the treatment method of choice is intermittent application (night regime) of orthoses with bending pre-stressing (**6**). In older children the method of surgical treatment is hemi-epiphysiodesis. In the right time indicated drilling HE results to excellent correction of T-F angle. The correction of the biomechanical axis of legs by HE is a mini-invasive surgical procedure that is indicated on the basis of anthropological examination and monitoring. Appropriate timing of hemi-epiphysiodesis is crucial (**15, 11**). Right correction of leg axis improves the posture, joint function, walking stereotype and visual aspect and it prevents formation of premature osteoarthritis.

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# RECONSTRUCTIVE SURGERY OF RARE UPPER LIMB CONGENITAL DEFECTS: 2 CASE REPORTS

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## SUMMARY

The main objective is to present two case reports of rare congenital differences of the upper extremity that belong to Category II of the modified classification of congenital hand deformities by Ogino et al. (1986). This classification was adopted by the Japanese Society for Surgery of the Hand in 1996. Category II includes incomplete formation of the joint, contracture and deformities due to failure of differentiation of parts and tumor-like conditions including hamartomas. Incomplete formation of the joint may result in synostosis, congenital dislocation and ankylosis of digital joints.

We present an individual comprehensive treatment of two children, Proximal radioulnar synostosis and ulnar hypoplasia in one and Partial ulnar aplasia associated with dislocation of radial head and humeroulnar synchrondrosis in the other.

**Key words:** proximal radioulnar synostosis, ulnar ray deficiency, dislocation of radial head, humeroulnar synchrondrosis

## INTRODUCTION

### Proximal radioulnar synostosis and ulnar hypoplasia

Congenital radioulnar synostosis occurs rarely. Aproximately 350 cases were reported in the literature. The rarity of this condition often leads to a delayed clinical diagnosis. Radioulnar (R-U)

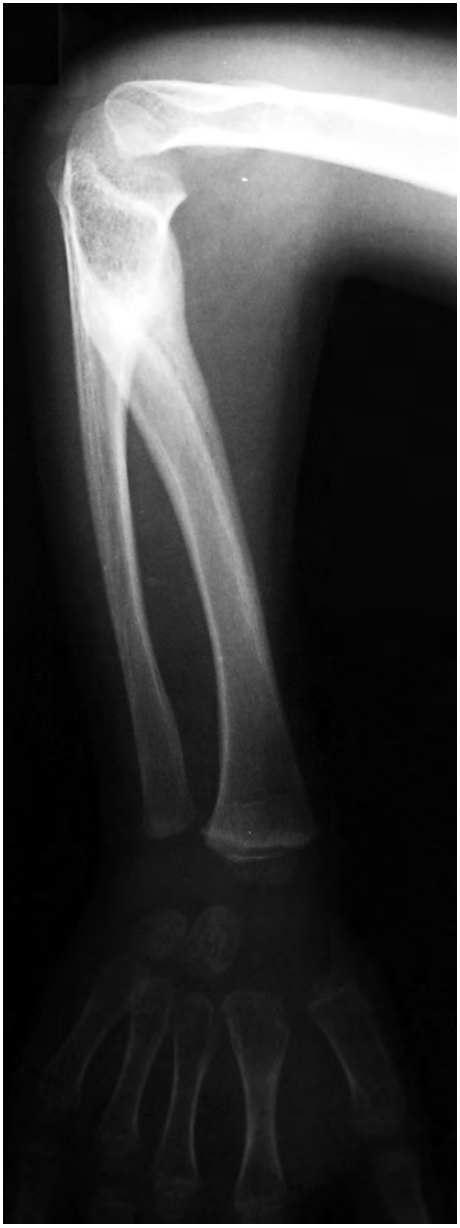


**Fig. 1 A.** Fusion of proximal end of radius and ulna in middle position 3 months after separation of R-U synostosis in 6 years.

synostosis can take 2 forms: congenital and post-traumatic. The congenital form presents only in the proximal forearm, and the post--traumatic form may present anywhere along the radius and ulna (**17**). Congenital form occurs by itself (in isolation) or in association with certain skeletal abnormalities (such as hip dislocation, knee anomalies, clubfoot, polydactyly, syndactyly, Madelung deformity, ligamentous laxity, thumb hypoplasia, carpal coalition) and/or with problems of the heart, kidneys, nervous or GIT system and in association with genetic syndromes – about 1/3 cases (e.g. Holt-Oram syndrome, Poland syndrome, Cornelia de Lange syndrome, fetal alcohol syndrome, chromosomal anomalies, tec.). It affects both arms about in 60%. Boys and girls are equally affected.

## Embryological pathogenesis

R-U synostosis occurs due to a defect in longitudinal segmentation at the 7$^{th}$ week of development. The elbow is first identifiable at 35 days (after conception), at which stage the cartilaginous anlagen of the humerus, radius and ulna are connected. The humerus, radius and ulna become visible on 37$^{th}$ day. For a short time, before segmentation, the radius and ulna share a common perichondrium. Abnormal events at this time can lead to a failure of segmentation (**2**). Ogino et al. (**10**) tried to induce radial and ulnar deficiency in rats fetuses by maternal administration of busulfan. They observed that the critical period of ulnar deficiency in rats is about one day earlier than that of radial deficiency and that both deficiencies are induced by the insult to the embryo before the limb bud is formed (**10, 13, 14**).

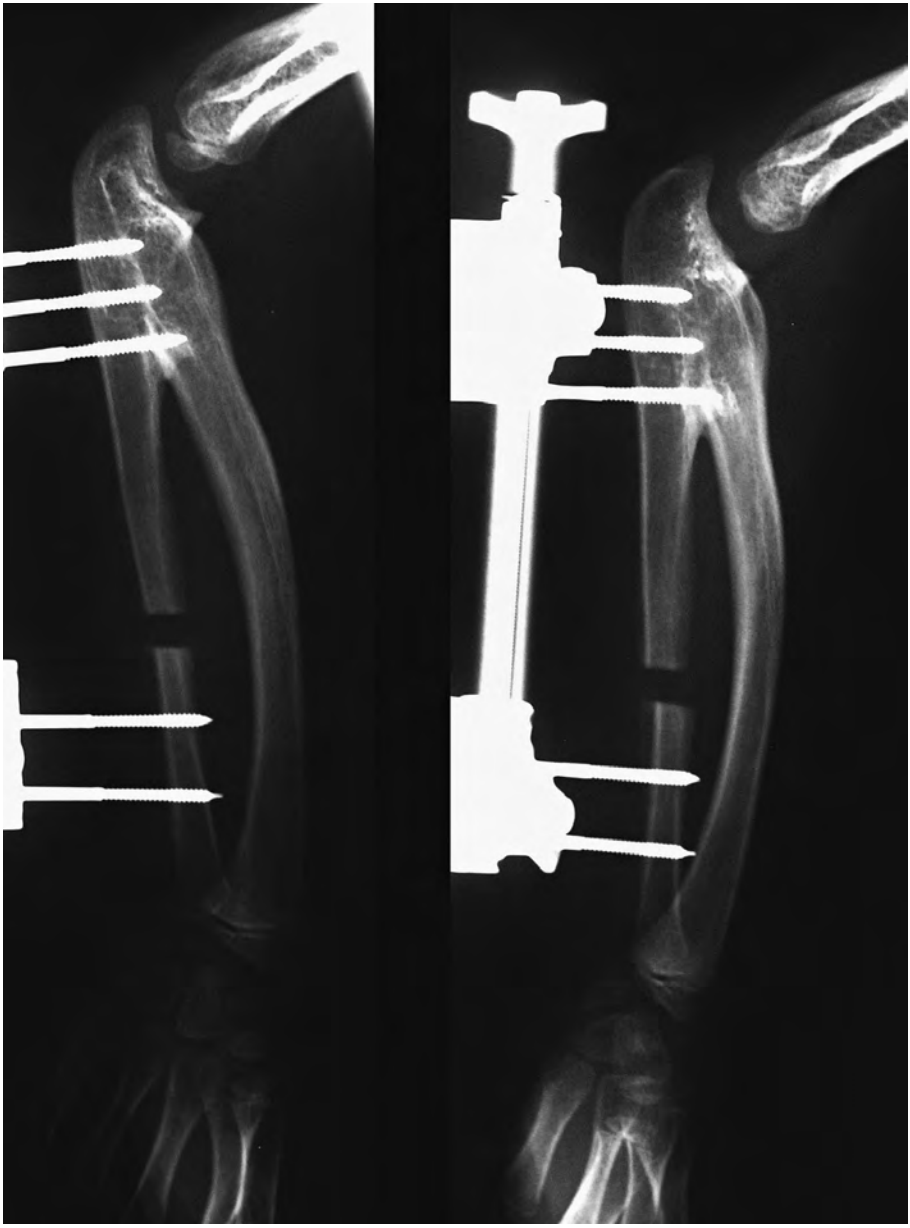


**Fig. 1 B.** Lengthening of ulna about 17 mm in 10.3 years

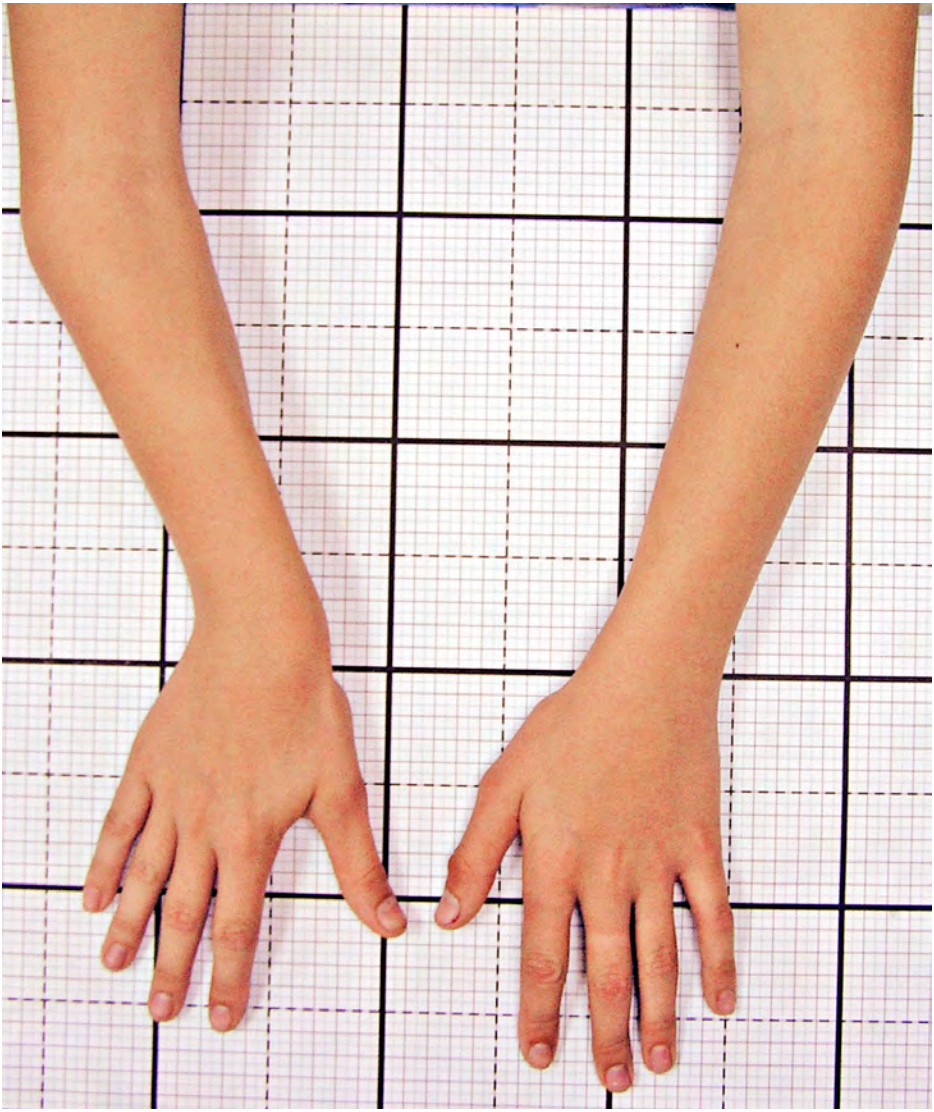
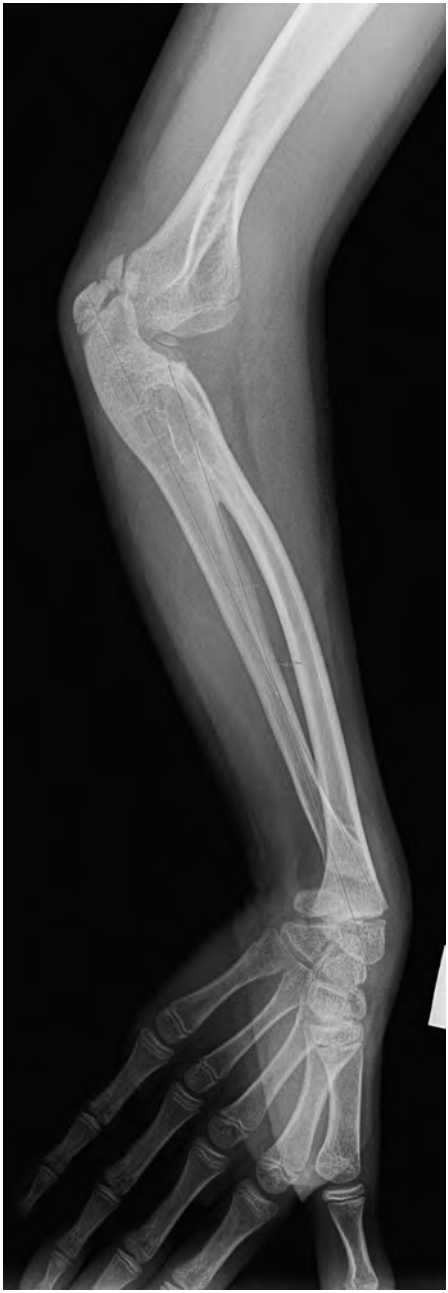


**Fig. 1 C, D.** A radial bowing of radius, shortening of ulna 3 cm, ulnar deaxation of hand 40° – so-called Madelung´s deformity.



### Developmental biology

Oberg et al. (**2010**) explained anomalies of the hand and upper extremity on basis of a contemporary understanding of the developmental process. A morphogen, sonic hedgehog (SHH) plays a pivotal role during limb development, linking the proximal-distal, anteroposterior (radial-ulnar), and dorsal-ventral axes during outgrowth. Loss of SHH function leads to loss of ulnar-associated structures. Operative treatment of congenital radio-ulnar synostosis is rarely indicated (**Cleary JE, Omer GE Jr, 1985**).

## THE CASE 1

A presented boy comes from the 3rd pregnancy of healthy mother. He was born at term, weight 3050 g, length 50 cm. Perinatal period was uneventful, psychomotorical development was normal in the 1st year of life. At the age of 2 years of life a plastic surgery due to hypospadia was carried out.

In 6 months of life was observed an abnormal position of the right hand – fixed pronation of forearm and diagnosis a congenital proximal R-U synostosis was confirmed on X-ray. Joint systemic abnormalities were excluded. Pedigree examination was negative (two older brothers and father are healthy).

### Surgery and results

In 6 years separation of R-U synostosis and correction of forearm into middle position was carried out. Three months later a complete fusion of proximal end of radius with ulna was verified at X-rays (**Fig. 1A**). In 10.3 years the lengthening of ulna about 17 mm was done

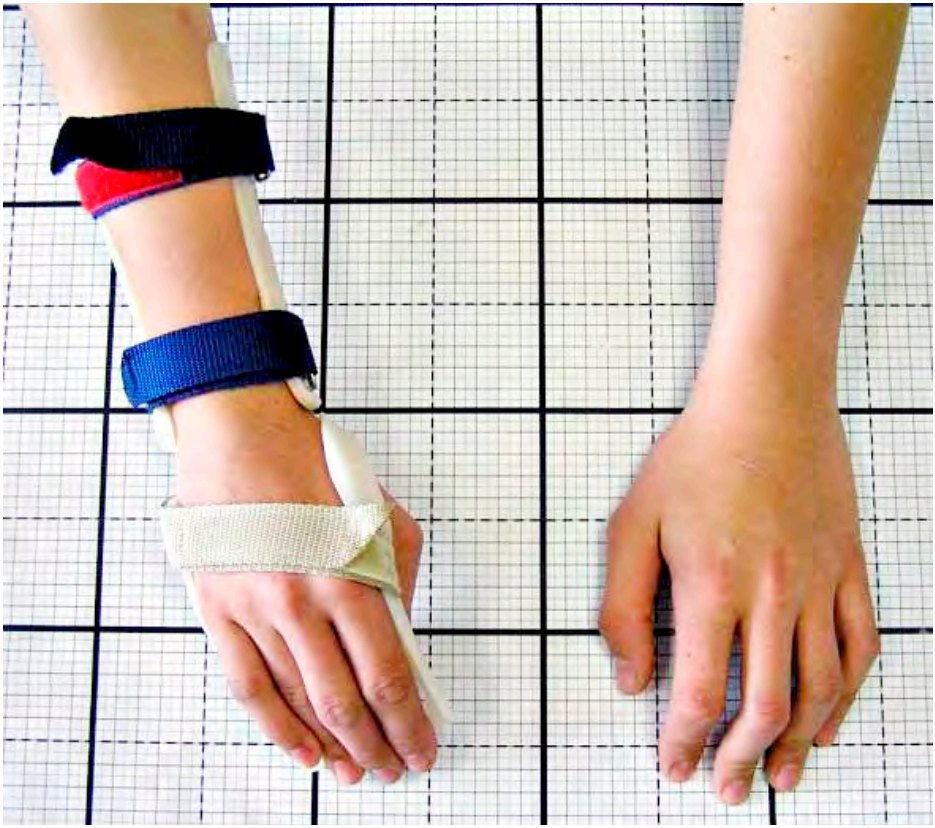


**Fig. 1 E.** Orthotic treatment of Madelung´s deformity.

with the aim to correct Madelung´s deformity that arose due to progressive shortening of distal ulna (**Fig. 1B**).

**Anthropological examination** at the age of 11.5 years confirmed lengthening of the ulna about 17–19 mm and some straightening of the radius. Shortening the right upper extremity was 3 cm. A retardation of bone age was proved by Tanner – Whitehouse method 3. Auxological summary: In consideration of the parents height growth between 50$^{th}$ to 75$^{th}$ percentiles with final height around 181 +/– 8 cm would be expected. The patient was growing in accordance with this growth potential. His height was in middle zone.

During growth acceleration progressed a radial bowing of radius, shortening of ulna was 3 cm, ulnar deaxation of hand 40° and so-called Madelung´s deformity developed (**Fig. 1C, D**) in spite of orthotic treatment (**Fig. 1E**). The boy suffered from pains of his right wrist after stress. In 14 years and 3 months both partial radial epiphysiodesis (drilling method) and step by step lengthening of ulna about 20 mm were made (**Fig. 1F**). At the age of 15 years and

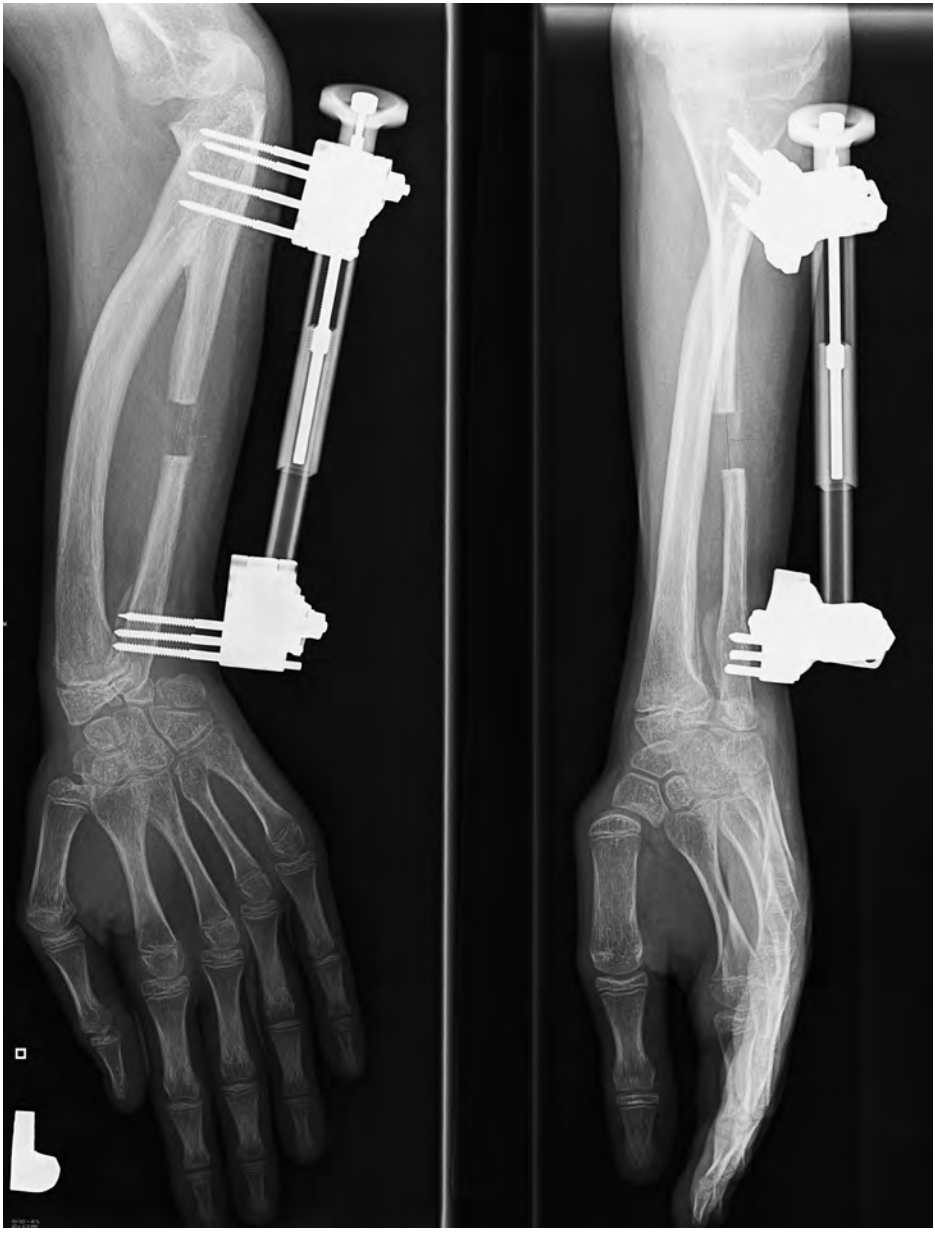


**Fig. 1 F.** Partial radial epiphysiodesis (drilling method) and step by step lengthening of ulna about 20 mm in 14 years and 3 months.

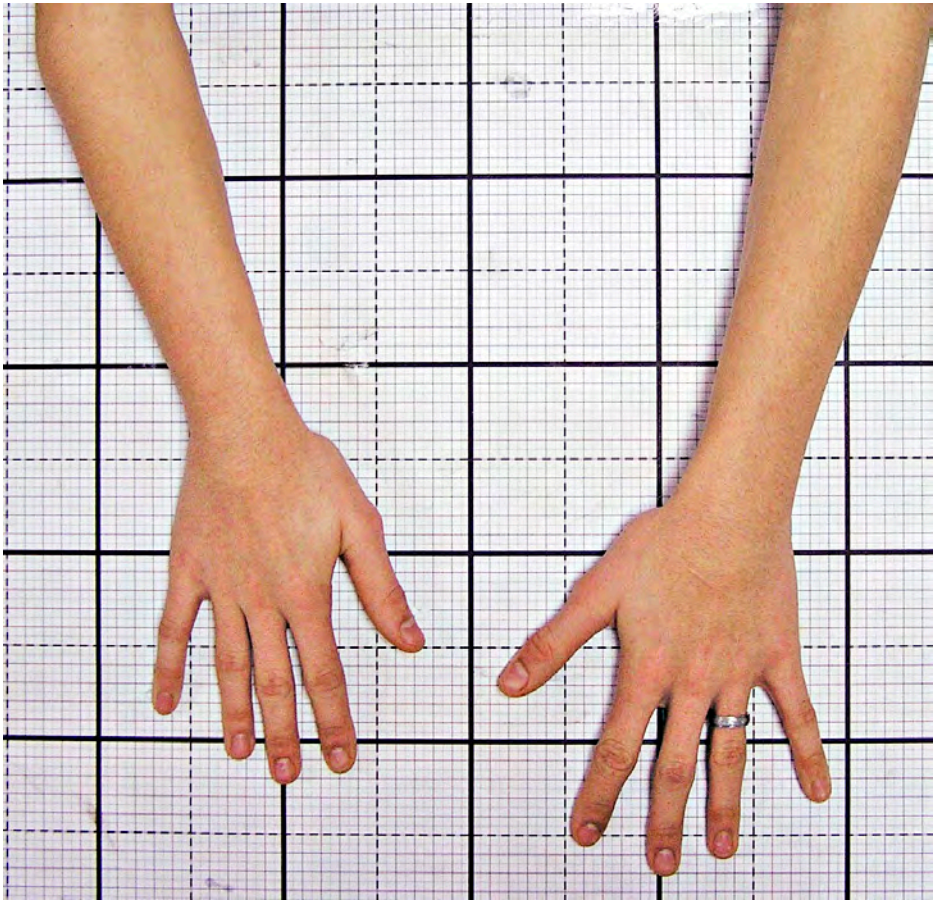


**Fig. 1 G.** Correction of Madelung´s deformity at the age of 15 years and 9 months (18 months later)

9 months (18 months later) correction of Madelung´s deformity was observed (**Fig. 1G**). At next figures correction of forearm into middle position (**Fig. 1H**) and contracture of elbow joint 20° (**Fig. 1Ch**) is documented. Height of the boy was 177 cm, shortening of right upper extremity 4.4 cm. He did not complain of pains after stress.

## Conclusions

Authors have personal experience with comprehensive treatment of next 6 patients with proximal R-U synostosis and fixed pronation of forearm. Only in one of them the affection was double-sided. All our patients underwent single stage derotative osteotomy at the region of R-U synostosis. Forearm was manually corrected in the neutral position or in 10–20 degrees of

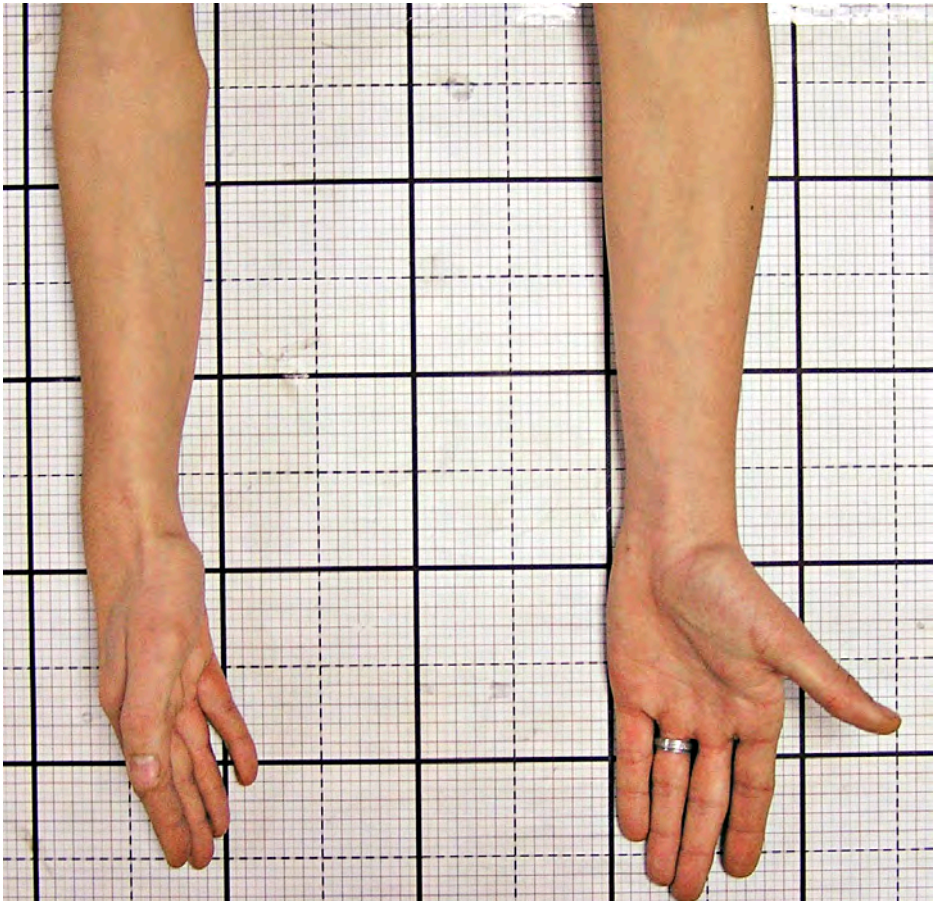


**Fig. 1 H.** Correction of forearm into middle position

pronation and fixed by external fixator Wagner – see **Fig. 2A–D**. Surgery was indicated mostly in preschool age. Osteotomy was usually healed after 2–3 months. Later in growth spurt we carried out lengthening of distal ulna (4 cases) or partial radial epiphyseodesis (2 cases) to prevent Madelung´s deformity. When growth is finished corrective OT of distal radius can be made. Separation of R-U synostosis (as was done in the Case 1) is not a method of choice. There were described other methods to correct hyperpronation of the forearm (e.g. **11, 6, 15, 16**).

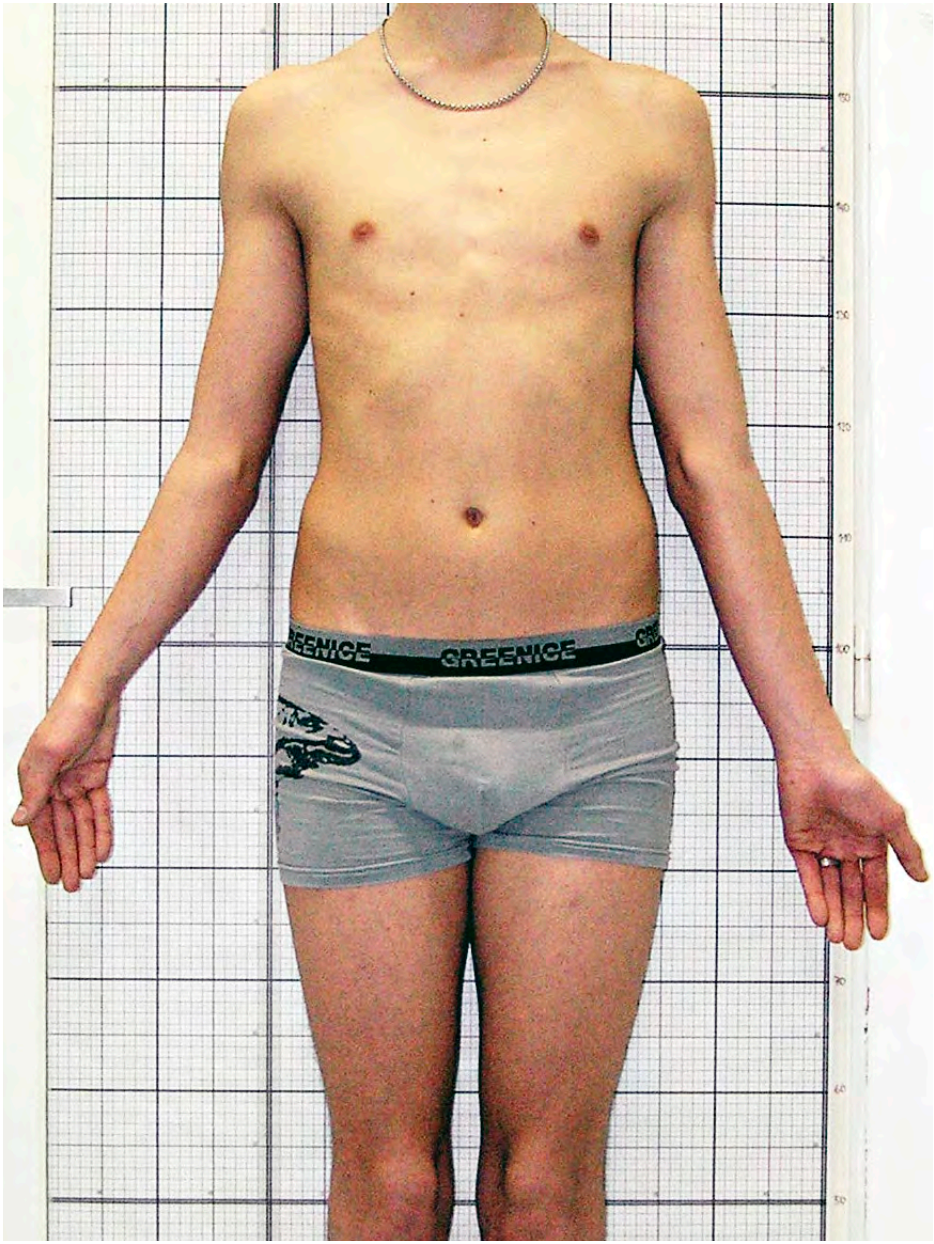



**Fig. 1 Ch.** Contracture of elbow joint 20°.

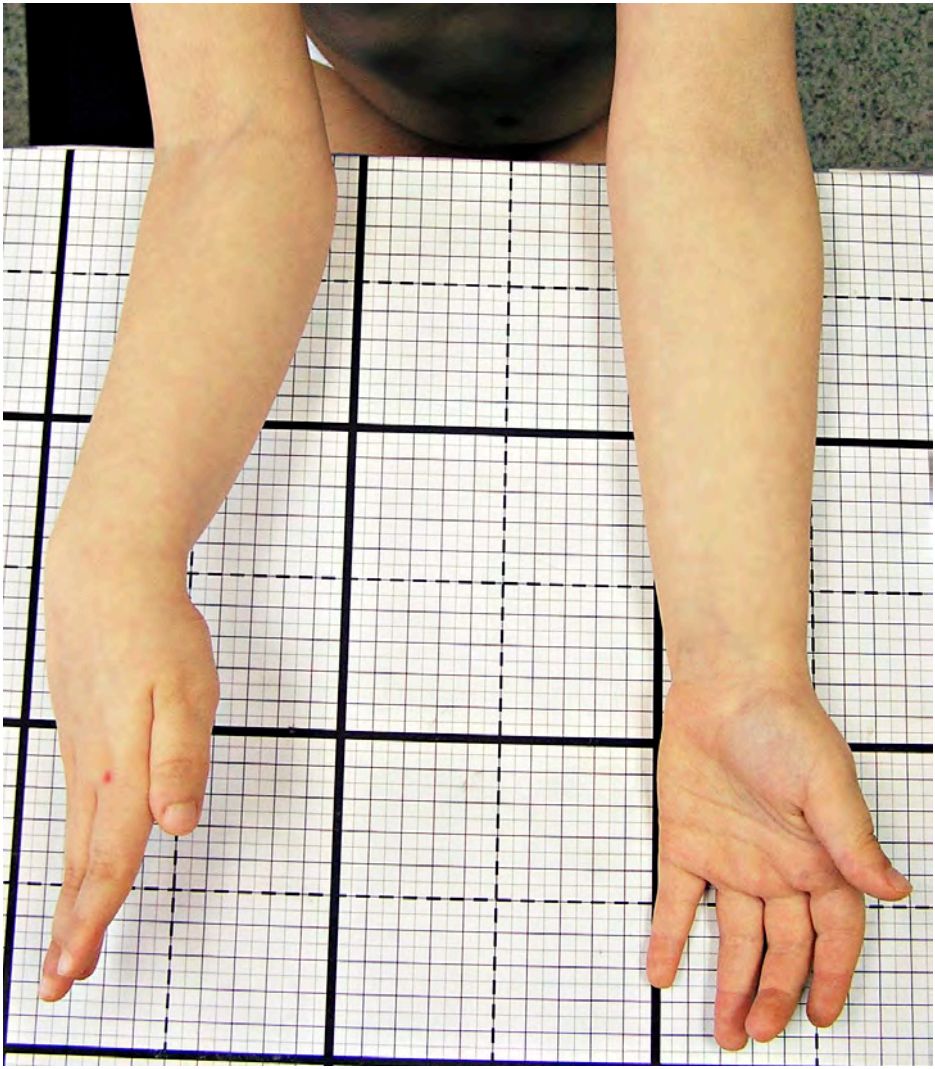


**Fig. 2 A–D.** Typical clinical finding (**A**) and X-ray (**B**) of isolated congenital proximal R-U synostosis with fixed pronation of forearm. **C**. Derotative osteotomy at the region of R-U synostosis, correction in the neutral position (or in 10–20 degrees of pronation), fixation by external fixator Wagner. **D**. Complete consolidation of osteotomy after 3 months.

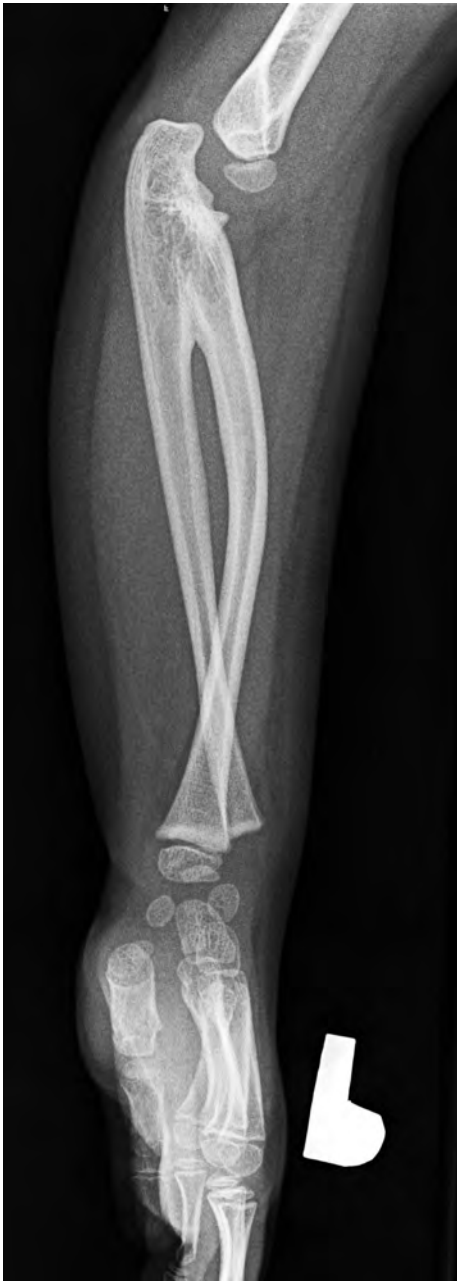


**Fig. 2 B**

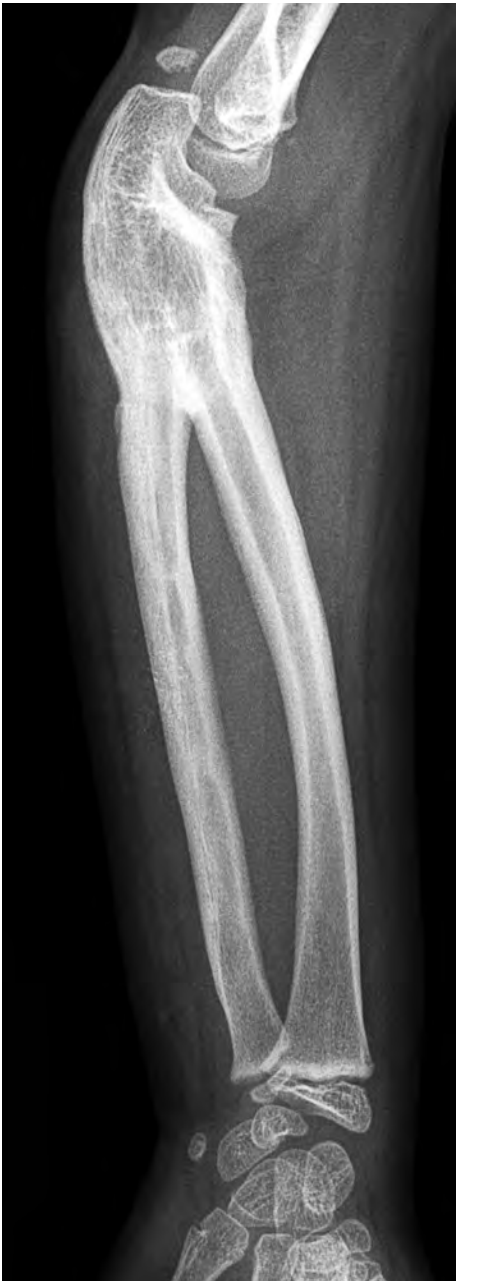


**Fig. 2 D**

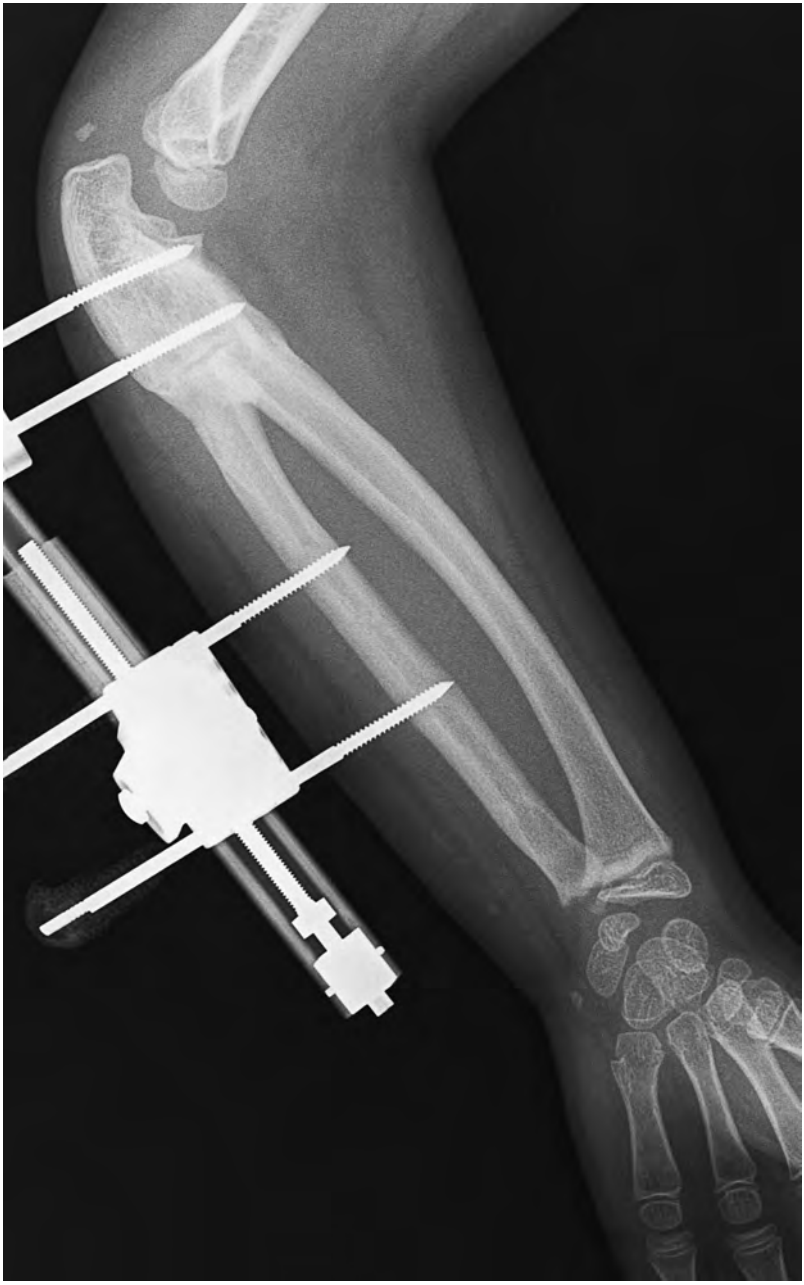


**Fig. 2 C**

# PARTIAL ULNAR DEFICIENCY ASSOCIATED WITH DISLOCATION OF RADIAL HEAD AND HUMERO-ULNAR SYNCHRONDROSIS

Ulnar ray deficiency is rare and has a variable presentation. The reported incidence is 1:100,000 live births. In several studies, over half the patients had radio-ulnar synostosis. A third of the patients were bilateral, and there was a significant incidence of other limb involvement, both upper and lower. Eighty-nine percent (89%) of the patients has loss of at least one digit while 14% had a monodigital hand (**4**).

Longitudinal ulnar deficiency is usually accompanied by shoulder, wrist, and hand abnormalities. The elbow may be in acute flexion, extension, or even present with a radio-humeral fusion. The shoulder is frequently unstable with scapular deficits. Three types of ulnar deformity were observed: (1) hypoplasia, (2) partial aplasia (ossification of the proximal part of the ulna present at birth); and (3) total aplasia (ossification not development). Ulnar deficiencies demonstrated in clinical cases are at **Fig. 3** (reprint from **13**). There are many different classification systems for this anomaly. Most classifications describe 4 types of ulnar longitudinal deficiency (ISO/ISPO classification). Classification is further complicated by the additional abnormalities including other ray deficiencies like proximal femoral focal deficiencies, fibula-femur-ulna syndrome, Cornelia de Lange syndrome, etc. (**4**).

**Developmental biology** of the anomaly is still not fully understood. By T. Ogino (**12**) the degree of ulnar arrest was closely related to the severity of deficiency of the fingers and also to abnormalities of the elbow joint. When the dysplasia of the ulna is severe, ulnar deficiency is often associated with elbow deformities including radio-humeral synostosis, radial head dislocation and severe flexion contracture of the elbow. The critical period of ulnar deficiency was

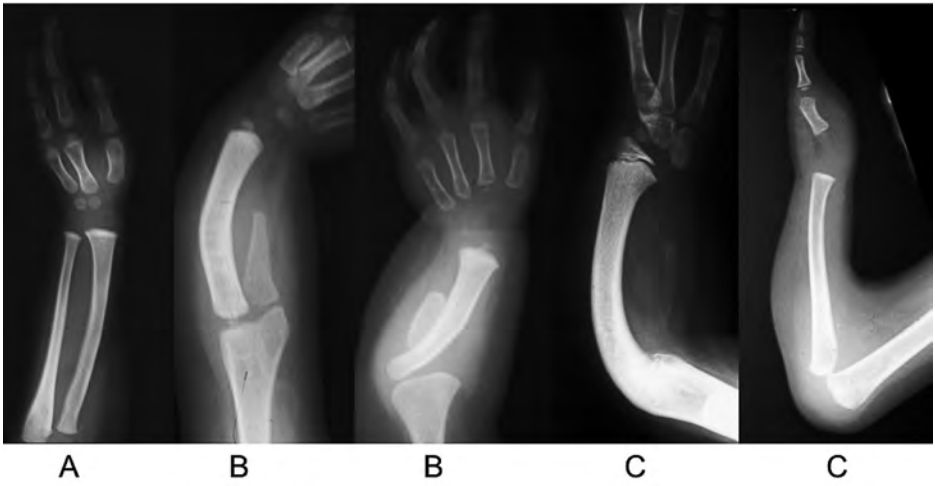



**Fig. 3** Clinical cases of ulnar deficiencies (reprint from **Ogino 2011**).

earlier than that of other anomalies and it corresponds to the period of a high mortality rate of fetuses and therefore ulnar deficiency is unique.

According to Oberg et al. (**7**) limb development and differentiation along the anteroposterior (radial-ulnar) axis is controlled by the zone of polarizing activity (ZPA) in the posterior (ulnar) limb mesoderm. The ZPA expands limb width and posteriorizes (ulnarizes) the developing limb through a secreted morphogen, sonic hedgehog (SHH). The SHH induces ulna formation in the forelimb and 4 ulnar-sided digits in the hand. In addition, SHH is responsible for posterior (ulnar--sided) limb growth and expansion. Progressive loss of SHH expression or targeted temporal interruption of SHH signaling during limb development reduces limb outgrowth, volume, and width (**18**). The phenotypes generated with SHH loss mimic those demonstrated in clinical cases of ulnar longitudinal deficiencies (**Fig. 3**).

The radiographically "absent" segment of the ulna may be a large fibrocartilaginous anlage attached distally to the distal radial epiphysis or the ulnar side of the carpus, or both. The tethering effect of this band may cause ulnar deviation of the wrist (and hand) and proximal dislocation of the radial head in utero as well as progression of these deformities after birth (**8**).

Most **treatment** has been aimed at improvement of function and there is general agreement that the standard hand and plastic surgical techniques, such as syndactyly release, webbed space deepening, and rotational osteotomies of the phalanges or metacarpals, when applied to this condition provide excellent functional improvement. Frantz and O'Rahilly (**3**) suggested prosthetic fitting with even possible elbow disarticulation in some cases).

Some authors have recommended resection of the ulnar-distal radial cartilaginous anlage in an attempt to prevent shortening, bowing, and possible malrotation of the radius (**8**). More recent studies have shown that this procedure is rarely necessary and its use remains controversial. Another frequently advocated procedure is the creation of a one-bone forearm. This technique is applicable only when the proximal ulna is present and involves a radio-ulnar synostosis (**4**).

We present step by step reconstructive surgical treatment of this very rare deficiency and long-term result.

## THE CASE 2

The boy was referred by geneticist to the orthopaedic department of the University Hospital Motol, Prague in 3 months of life due to congenital malformation of right upper extremity. The congenital limb deficiency was specified as a partial ulnar aplasia, dislocation of radial head, aplasia of 5$^{th}$ ray and flexion cotracture of 2$^{nd}$ to 4$^{th}$ digit. He was born at term, weight 4300 g, length 55 cm, Apgar scores were 9-10-10. The 1$^{st}$ pregnancy of mother was uncomplicated. Parents were healthy. No relatives were known to suffer from congenital limb defects or other congenital developmental disorders. Mother during pregnancy worked as a laboratory technician in a glassworks (air with chemicals) and that is why teratological etiology or AD mutation de novo was considered.

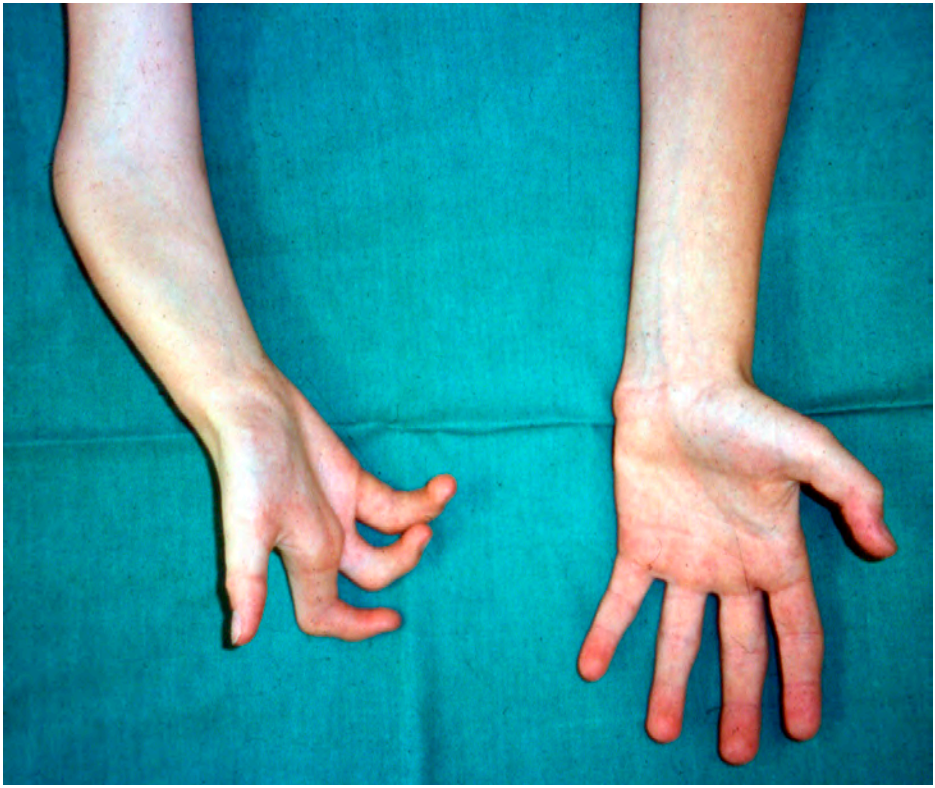


**Fig. 4 A** Local findings of the forearms of a boy aged 7 years.

## Surgical treatment

At 7 years he was examined in Ambulant Centre for Defects of Locomotor Apparatus (ACDLA) in Prague. Local finding is at **Fig. 4 A**. Elbow movement restriction 40-60-60°. Intermitent splinting of 2nd to 4th digits of right hand was carried out.

In 9 years planned surgery was done: resection of dislocated radial head, resection of ulnar anlage distally and cut-off m. extensor carpi ulnaris tendon and lengthening of m. flexor carpi ulnaris tendon (**Fig. 4 B, C**). Later orthotic treatment of Madelung´s deformity was carried out.

In 13.5 years was made 2nd resection of ulnar anlage and pulling of radius distally by external fixator Wagner (**Fig. 4 D**) to level of humeroulnar synchondrosis. 6 months later extraction of external device and fusion of proximal part (rudiment) of ulna to proximal end of radius was carried out (**Fig. 4 E**).

In 15 years and 4 months extraction of a screw in elbow level, aplication of external fixator on radius and osteotomy, then gradual lengthening on 6.5 cm (**Fig. 4 F**).

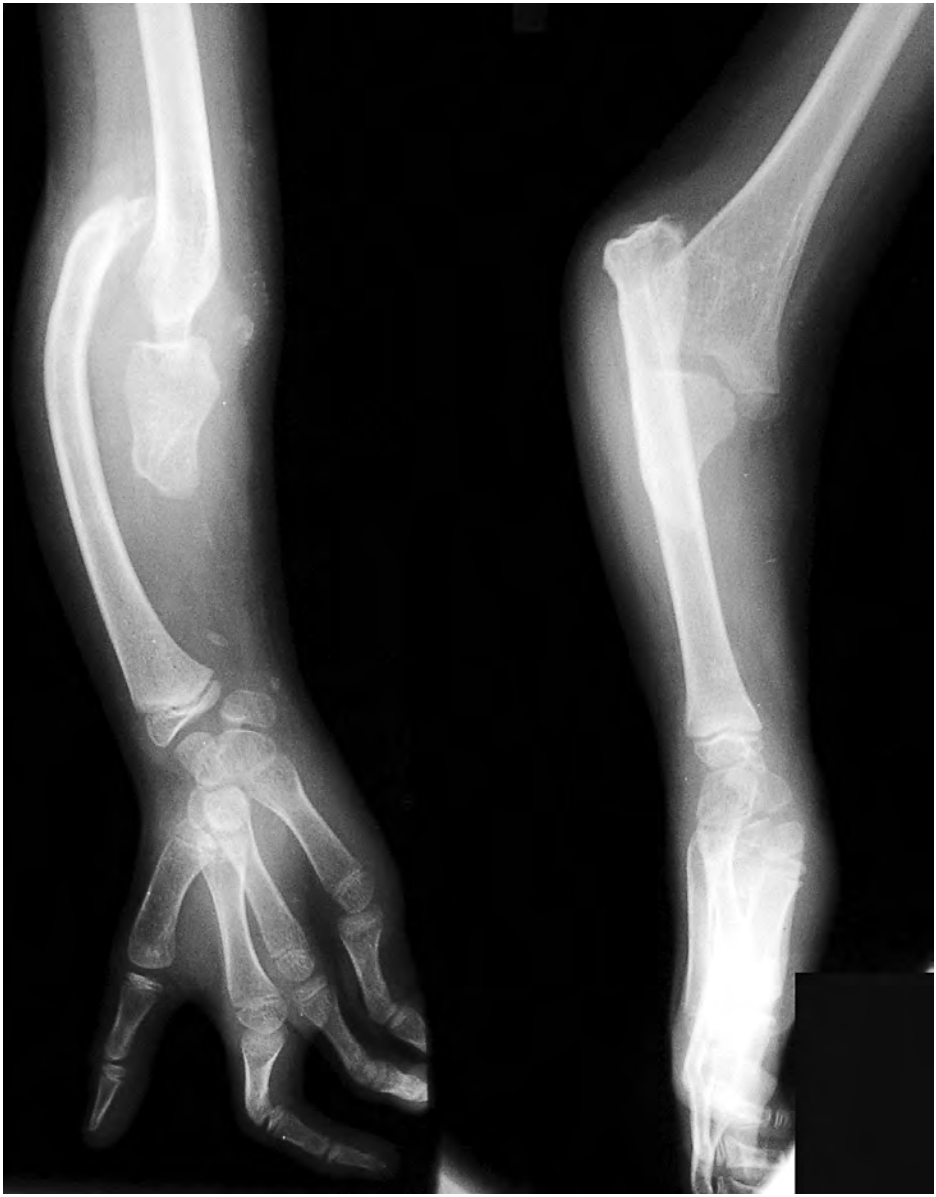


**Fig. 4 B, C** Resection of dislocated radial head, resection of ulnar anlage distally and cut-off m. extensor carpi ulnaris tendon and lengthening of m. flexor carpi ulnaris tendon were carried out in 9 years. Restriction of elbow movement was 40-60-60° in sagittal plane.

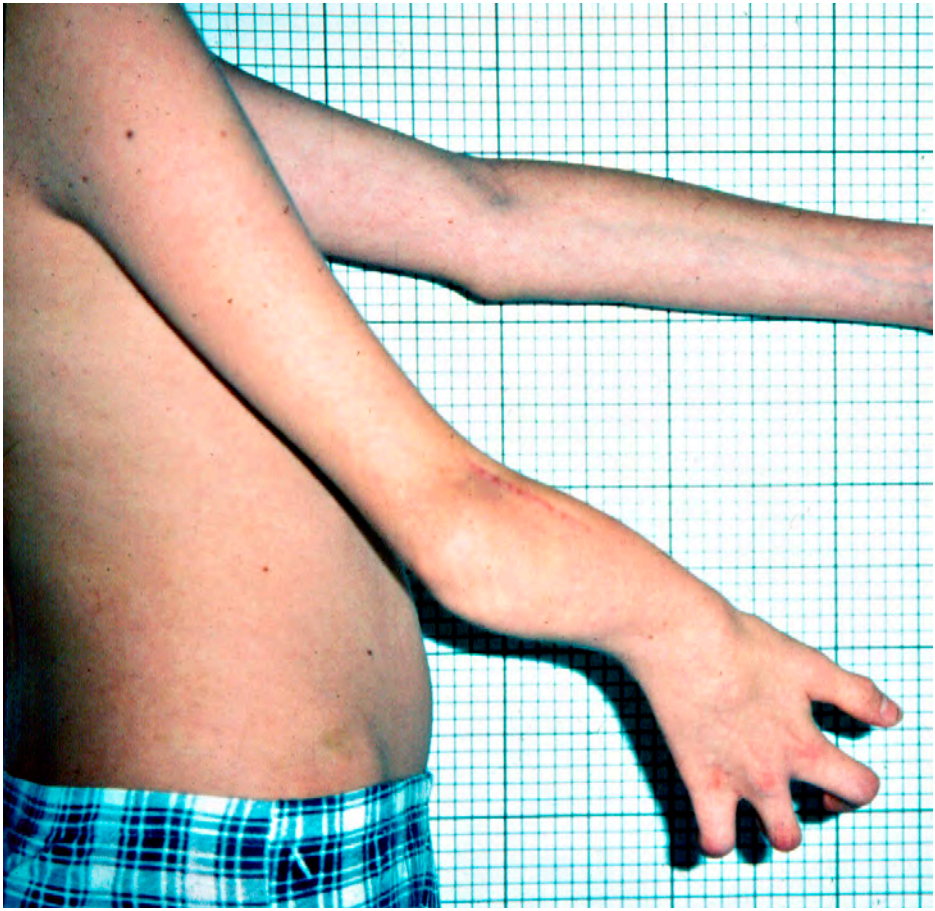


**Fig. 4 C**

8 months later extraction of device was done. Due to bowing of bone regenerate manual reposition and Scotch plaster fixation was made (**Fig. 4 G**). After consolidation of infraction he used orthosis next 2 months.

In 10 years anthropological prediction of right extremity shortening was 20 cm. Prediction of adult height was 180 cm.

In 17 years proband´s height was 181 cm, weight 60 kg, shortening of right forearm about 9 cm, humerus about 3 cm, elbow joint range of motion from 40 do 60°, supination of forearm from 0 do 30°, volar flexion of wrist from 0 to 20° (**Fig. 4 H**).

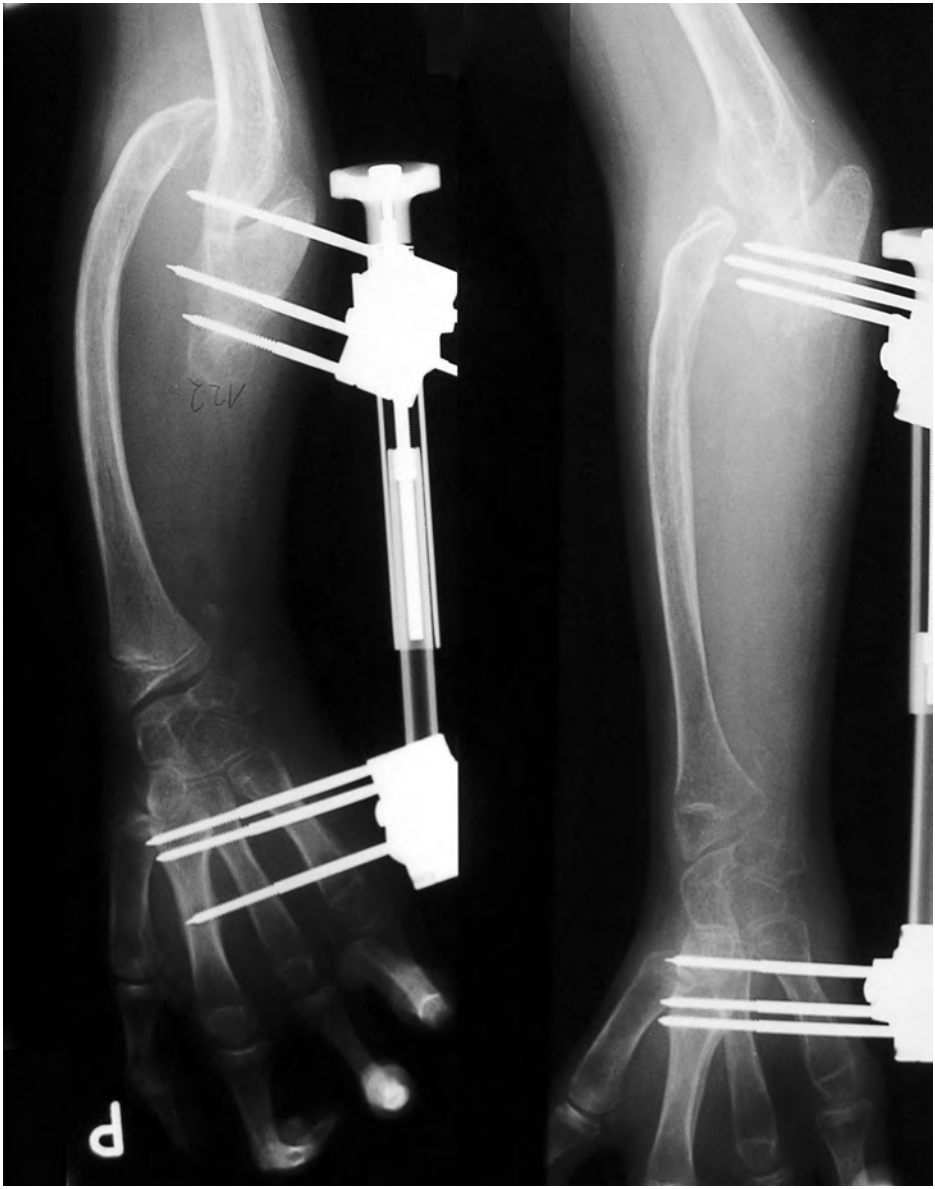


**Fig. 4 D** 2nd resection of ulnar anlage and pulling of radius distally by external fixator Wagner to level of humeroulnar synchondrosis was done in 13.5 years.

In 17 years 9 months was carried out surgical fusion of PIP joint of 3rd digit due to contracture 90° (**Fig. 4 Ch, I**). Splinting of the 2nd and 4th digit was intermitently done to 20 years. Original contractures of PIP joints were 90°. Result was 40° contracture of 2nd digit and 20° one of 4th digit.

### Conclusions

The authors present a boy with partial ulnar aplasia connected with dislocation of radial head, humero-ulnar synchondrosis, aplasia of 5th ray and flexion cotracture of 2nd to 4th digit. Resection of the distal end of the ulnar fibrocartilaginous anlage during the first to second year of life is recommended, since the results of this procedure suggest that it reduces the radial bowing, Madelung´s deformity of hand and prevent proximal radial head dislocation (**8**). Similar approach is recommended in cases of fibular hemimelia to prevent equinovalgosity of foot and tibial angulation (**5**). One-bone-forearm operation should be deferred until a later age when growth is finished (e.g. corrective osteotomy of radius or its lengthening). The elbow disarticulation and prosthetic fitting has been condemned. Individual comprehensive treatment (physiotherapy, orthotic treatment, surgery) is recommended during growth period. Other than the usual hand surgery techniques, children with partial ulnar aplasia are best treated by careful observation, the provision of adaptive aids, and emphasis on occupational therapy (**4**).

## CONCLUSION

Individual comprehensive treatment of rare upper limb congenital defects needs close cooperation of paediatric orthopaedic and plastic surgeons with anthropologist and physiotherapist.

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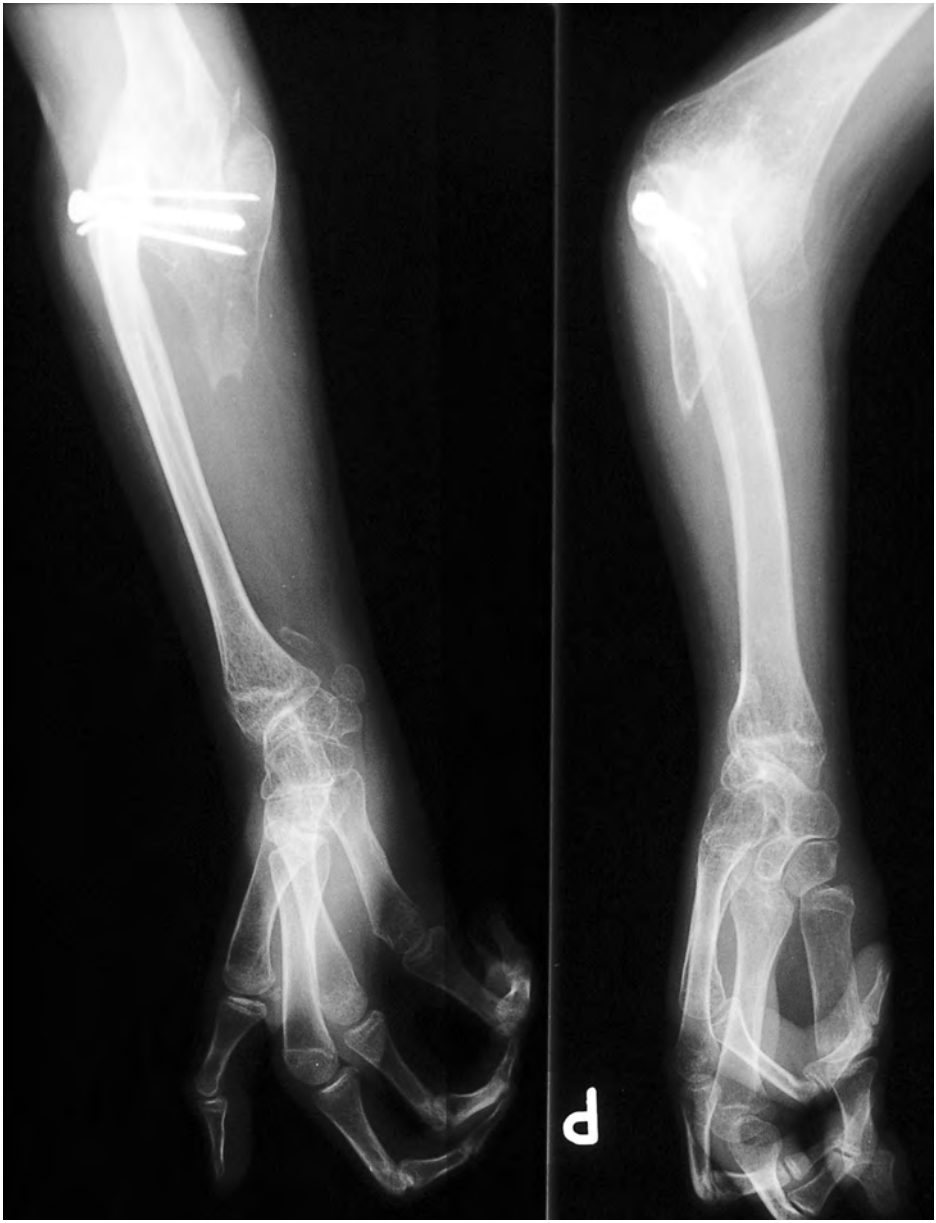

**Fig. 4 E** 6 months later extraction of external device and fusion of proximal part (rudiment) of ulna to proximal end of radius was carried out.

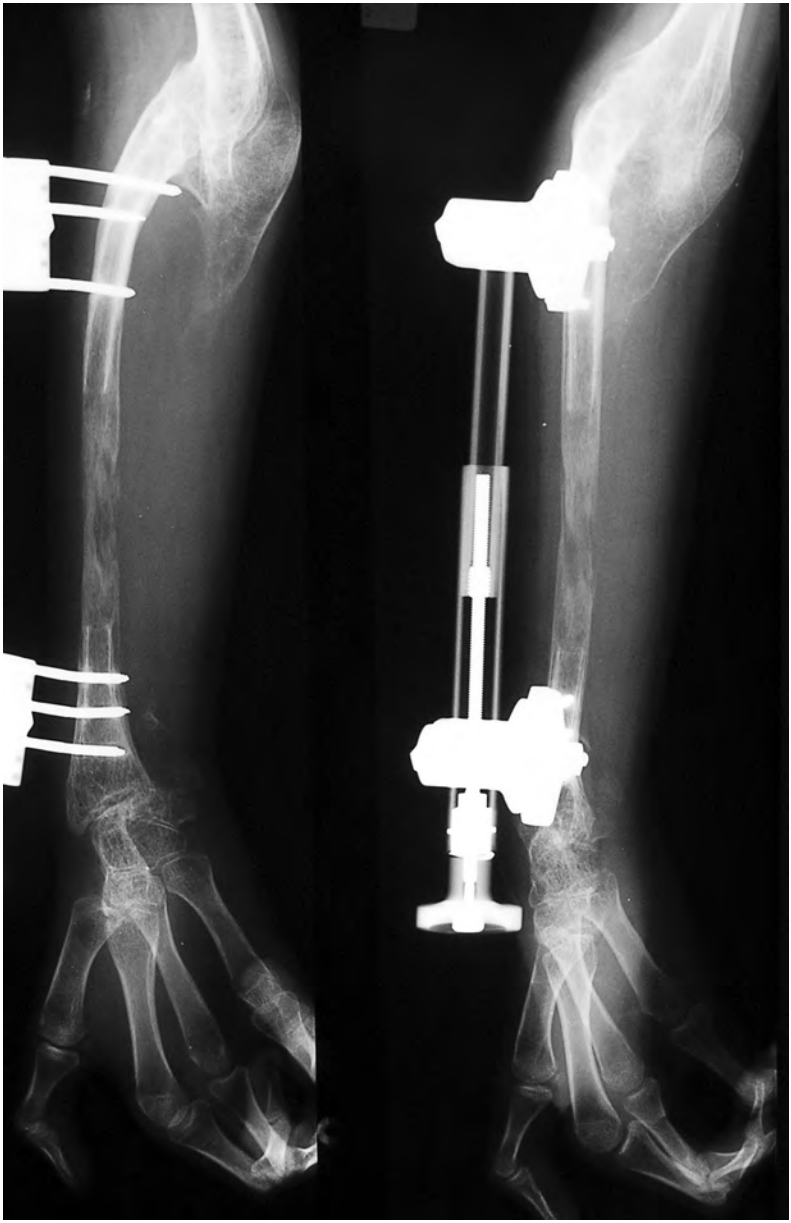

**Fig. 4 F** Extraction of a screw in elbow level, aplication of external fixator on radius and osteotomy, then gradual lengthening on 6.5 cm in 15 years and 4 months.

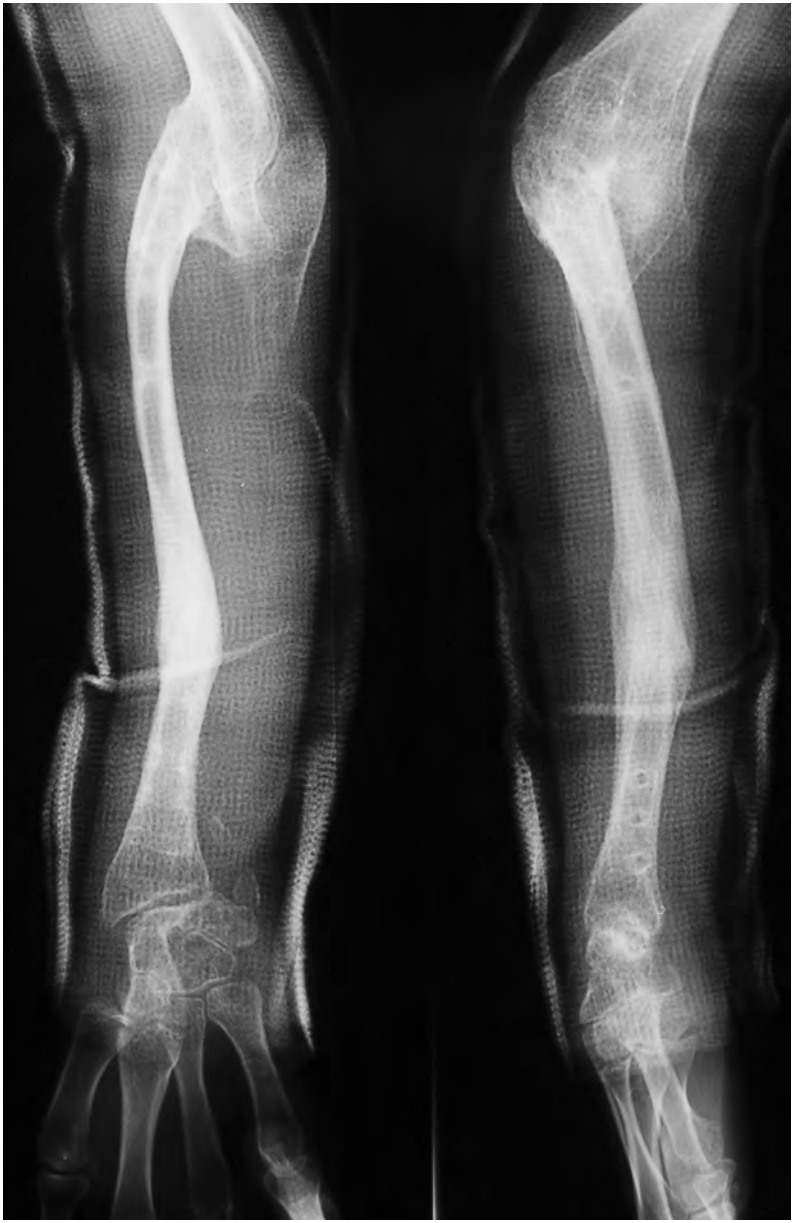

**Fig. 4 G** 8 months later, Scotch plaster fixation due to collapse of bone regenerate after extraction of device.

**Fig. 4 H** The local finding of the right upper extremity in 17 years: shortening of the right forearm about 9 cm, humerus about 3 cm, elbow joint range of motion from 40 do 60°, supination of forearm from 0 do 30°, volar flexion of wrist from 0 to 20°.

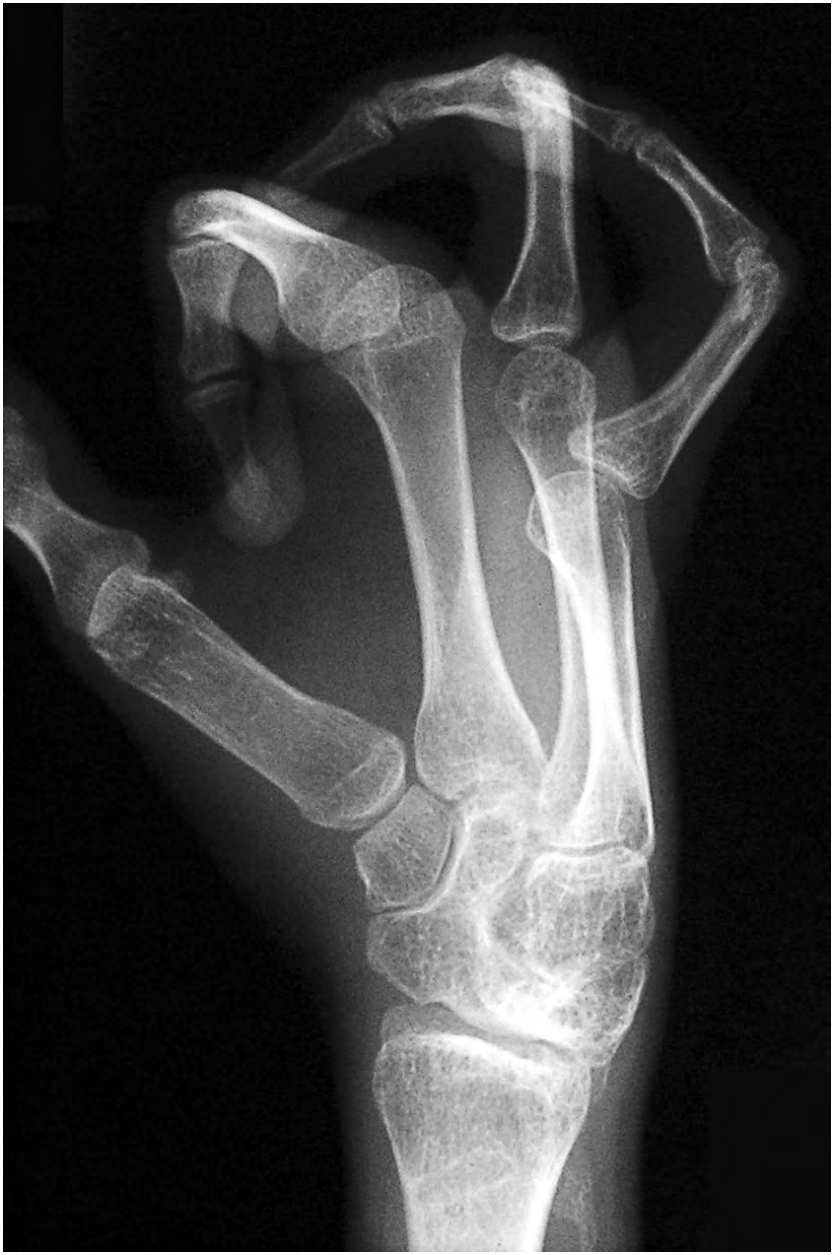

**Fig. 4 CH** Contracture 90° of PIP joint of 3rd right digit.

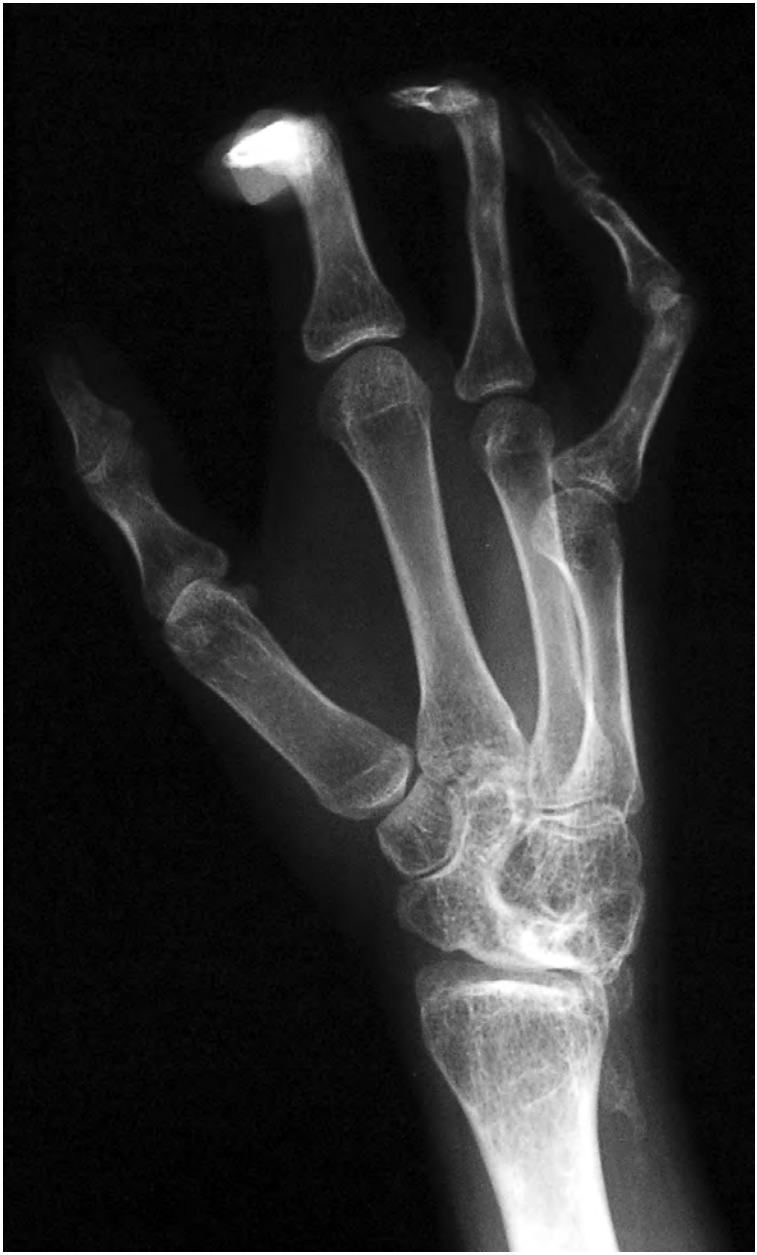

**Fig. 4 l** Surgical fusion was carried out in 17 years 9 months.

# ANGLESPINE – PROGRAM PRO METROLOGII DEFORMIT PÁTEŘE A KOLENNÍCH KLOUBŮV OBDOBÍ RŮSTU

# ANGLESPINE – PROGRAM FOR METROLOGY OF SPINAL AND KNEE DEFORMITIES IN GROWTH PERIOD

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## ABSTRAKT

Volně šířený program AngleSpine, který byl napsán autorem, umožňuje na počítači jednoduchým způsobem hodnotit jednak rotaci obratlů a velikost skoliotického zakřivení z RTG snímků v digitální podobě, jednak tibio-femorální úhel zjišťovaný původní antropometrickou metodou a metodou z fotografie. Je nezbytné mít k dispozici příslušné digitální obrázky ve vhodné velikosti a kvalitě.

Je popsána nejen základní nabídka menu programu, ale i jednotlivé kroky k získání zjišťovaných veličin v jednotlivých metodách.

Metrologie (nauka o přesném měření) hodnocení deformit páteře a kolenních kloubů s využitím PC programu **AngleSpine** poskytuje možnost mezioborového využití. Jednoduché a dostatečně přesné hodnocení souborů pacientů stejnou metodou dává možnost nejen dokumentovat vývoj deformit páteře a dolních končetin v období růstu, ale i porovnávat výsledky léčení na mezinárodní úrovni.

**Klíčová slova:** RTG snímek, fotografie, úhel, axiální rotace páteře, skolióza páteře, deformity kolenních kloubů

## ABSTRACT

A free program AngleSpine, which was written by the author, enables both the evaluation of the vertebral rotation and the Cobb's angle from digital X-ray pictures of the scoliosis and the evaluation of the tibio-femoral angle according to the original anthropometric method and

according to the method from a photography. It is necessary to use digital pictures in convenient size and quality.

There is described not only a basic offer in a menu of the program but also various steps to evaluate examined values in separate methods.

A metrology of the evaluation of spinal deformities and knee joints using the computer program AngleSpine offers an opportunity of its interdisciplinary use. Simple and sufficiently accurate evaluation of the groups of patients examined using the same method provides not only a documentation of the evolution of spinal and leg deformities at the growth period but also a comparison of the treatment results on the international level.

**Key words:** X-ray picture, photograph, angle, axial spine rotation, spine scoliosis, knee deformity

# ÚVOD

V odborných a vědeckých kruzích, a v posledních letech i v medicíně, se klade čím dál větší důraz na získávání objektivních informací na základě důkazů. Hovoří se o medicíně založené na důkazech (evidence based medicine). K tomu, abychom taková data mohli získávat či precizovat je zapotřebí nalézat nové přístupy, postupy a metody v dané problematice. Metrologie (nauka o přesném měření) skeletárních deformit u dětí v období růstu a dospívání je jednou z neodmyslitelných součástí. Jde nejen o co nejpřesnější zhodnocení okamžitého stavu pacienta, ale i o možnost určení změn zdravotního stavu za sledované období. K tomu, abychom mohli takto postupovat, je nezbytné mít vhodnou a jednoznačnou terminologii (**11**) a mít k dispozici vhodné měřící metody. U dětí v období růstu je sledováno mnoho kritérií – mezi velmi sledovaná patří páteř a dolní končetiny.

Deformity páteře mají obvykle třídimenzionální charakter (**11**). Standardní snímky pro hodnocení deformit páteře jsou zhotovovány ve frontální a sagitální rovině na dlouhý formát (**10**). V sagitální rovině hodnotíme odchylky od fyziologického zakřivení. Ve frontální rovině měříme typická skoliotická zakřivení (vybočení páteře), která jsou často doprovázena rotací páteře, což je odchylka v rovině transverzální. Pro sledování deformit páteře máme k dispozici několik metod.

Ke stanovení deformity ve frontální rovině z předozadního (AP – antero-posterior) RTG snímku jsou nejvíce používány metody dle Cobba nebo Fergusona. V naší zemi je používáno hodnocení křivek podle Cobba (**10**). Jde o jednoduchou a přitom velmi exaktní a přesnou metodu, při které lze pomocí několika přímek, proložených liniemi přechodových obratlů (tj. obratlů, kde se mění smysl orientace křivek), získat úhel přímo měřitelný úhloměrem (**3**). Program **AngleSpine** využívá princip měření úhlů dle Cobba s tím, že stačí jen proložit přímky přechodovými obratli a úhel se vypočítá automaticky. Stejnou metodou lze postupovat i v rovině sagitální. V rovině sagitální lze měřit i sagitální tilt (sklonění) T3 nebo sagitální rovnováhu, tj. tilt 9 dle Duval-Beaupére (**6, 10**).

Standardním RTG vyšetřením páteře ve stoje ve 2 na sebe kolmých projekcích nemáme k dispozici transversální řezy rotovaných obratlů, které lze zobrazit velmi přesně metodami CT a MRI. Tyto metody jsou cíleně indikovány pouze u vrozených defektů páteře nebo při hodnoce-

ní operačního léčení. Běžně pro určení rotace obratlů se užívají metody, jimiž lze z RTG snímku zhotoveného v AP projekci ve stoje získat axiální úhel nepřímo. V naší zemi je nejvíce používána metoda podle Nash-Moe (**8**), která je nepřesná, orientační, protože poskytuje pouze 5 hodnot (0 až 4) rotace v rozmezí 0 až 90°. Mezi nepřímé, avšak dostatečně přesné a jednoduché metody patří použití Perdriolle torsion-metru (**7**), Raimoundiho šablony (**7**), nebo nové radiografické metody, která byla publikována v roce 2014 v časopise Scoliosis (**3**). Poslední zmíněnou metodu hodnocení rotace páteře využívá program **AngleSpine**, protože je velmi jednoduchá, nezáleží na absolutní velikosti RTG snímku a dosahuje podobné přesnosti jako Perdriolle metoda (**3**). Postup stanovení axiální rotace obratlů pomocí programu **AngleSpine** bude popsán dále.

Další častou deformitou skeletu u dětí v období růstu je valgozita nebo varozita dolních končetin. V průběhu růstu batolat je obvyklý jistý fyziologický stupeň varozity ve věku do 2 let. Fyziologická varozita přechází dalším růstem do valgozity, která se projevuje v období 3 až 5 let (**1, 5, 9**). Právě proto je velmi potřebné hodnoty varozity či valgozity dolních končetin správně a jednoduše měřit, aby bylo možné stanovit závažnost odchylky od fyziologických ještě tolerovatelných hodnot (**1, 9**). Jako jednoduchá, ale nejméně přesná metoda se v klinické praxi používá měření intermaleolární vzdálenosti (IMD) u případů valgozity kolenních kloubů, nebo interkondylární vzdálenost (IKD) v případě varozity kolen a bérců (**5**). Nová antropometrická metoda (4) zjišťuje definované svislé a vodorovné vzdálenosti na DK u stojícího dítěte a tibiofemorální (T-F) úhel je vypočítán pomocí goniometrických funkcí. Je sledována poloha velkých trochanterů, dolní okraj (apex) čéšky a střed hlezenního kloubu. Konečně byl vypracován postup změření T-F úhlu z fotografie pacienta při asistovaném postoji a vleže, kde se hodnotí poloha spin (spina illiaca anterior superior – SIAS), dolní okraj (apex) čéšky a střed hlezenního kloubu (**12**). Měření T-F úhlu na RTG snímcích zhotovených ve stoje nebo vleže se ukázalo jako nepřesné (pozn. autora). Program **AngleSpine** využívá antropometrickou metodu i měření T-F úhlu z fotografie.

## METODY

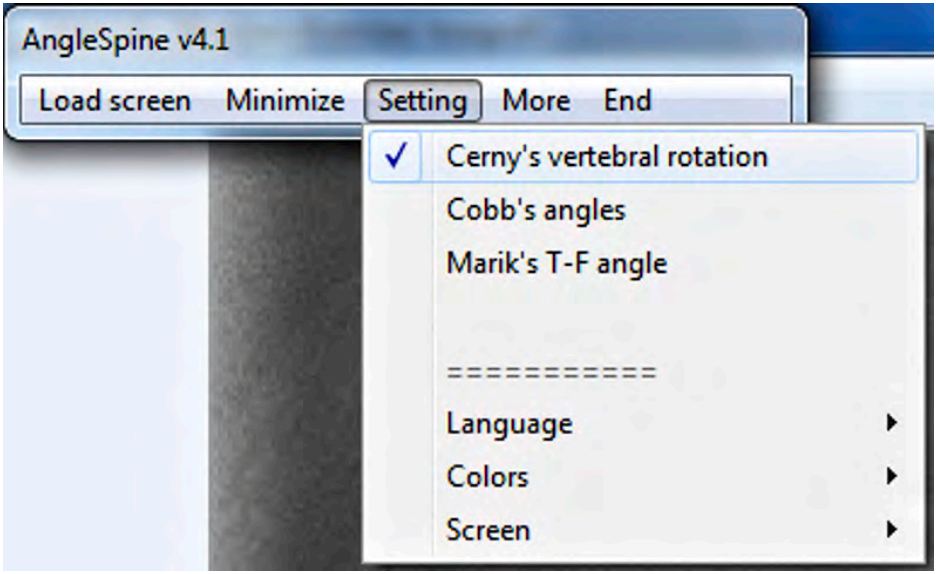
Program je koncipován tak, že po jeho spuštění se minimalizované okno trvale usadí v levém horním rohu, **obr. 1**, v režimu „trvale v popředí" – TopMost.

Menu je standardní. Příkazem „**Načíst**" („Load screen") je do maximalizovaného okna programu **AngleSpine** načten aktuální obsah monitoru se zkoumaným RTG snímkem. Je tedy zapotřebí si připravit zkoumaný obrázek na obrazovce ve vhodné velikosti, protože v takové podobě je z obrázkem v programu **AngleSpine** pracováno.

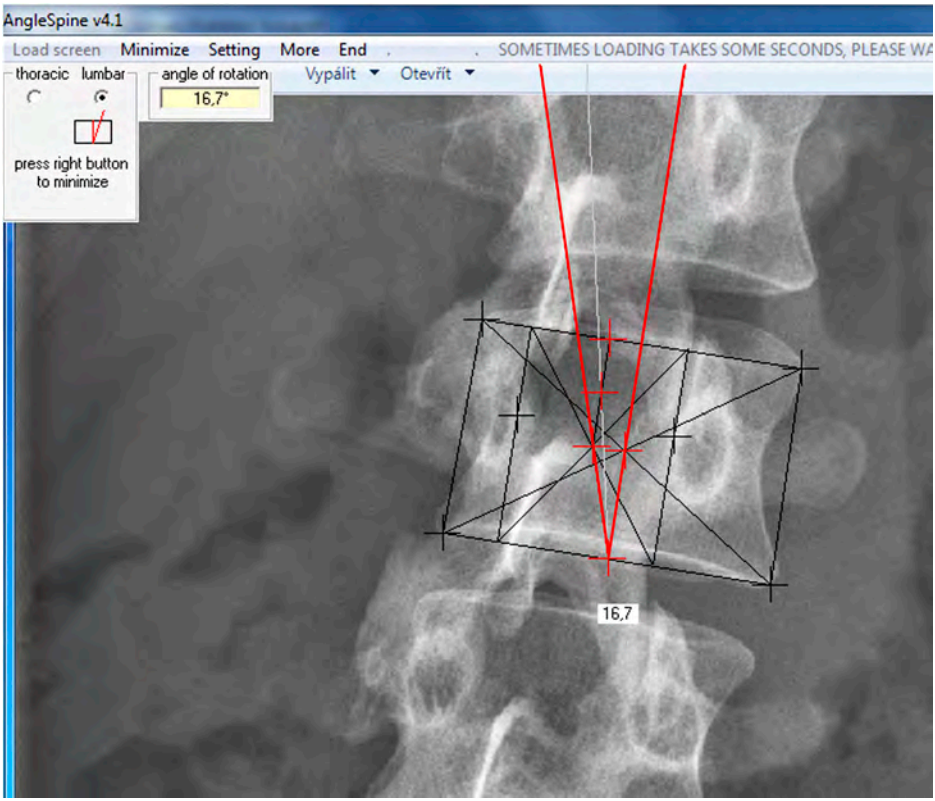
Kdykoliv je možné program minimalizovat příkazem „**Minimalizovat**" („Minimize"). Rozpracované měření parametrů je minimalizací ztraceno. Tohoto postupu je možné někdy využít v případě nutnosti změnit připravený podklad, nebo v případě, že jsme udělali nějakou chybu.

Další v nabídce menu je „**Nastavení**" („Setting"), **obr. 2**, kde obvyklým způsobem nastavíme jednu ze tří procedur měření. Z procedur jsou v nabídce měření axiální rotace obratlů hrudní a bederní páteře podle nové radiografické metody (**3**), měření Cobbova úhlu obvyklým způsobem a měření tibio-femorálního úhlu z fotografie (**4**). Dále lze nastavit jazyk, barvy čar a aktuální rozlišení monitoru (vysoké nebo nízké rozlišení).


**Obr. 1** Znázornění standardního umístění minimalizovaného okna programu AngleSpine v levém horním rohu v režimu „trvale v popředí".



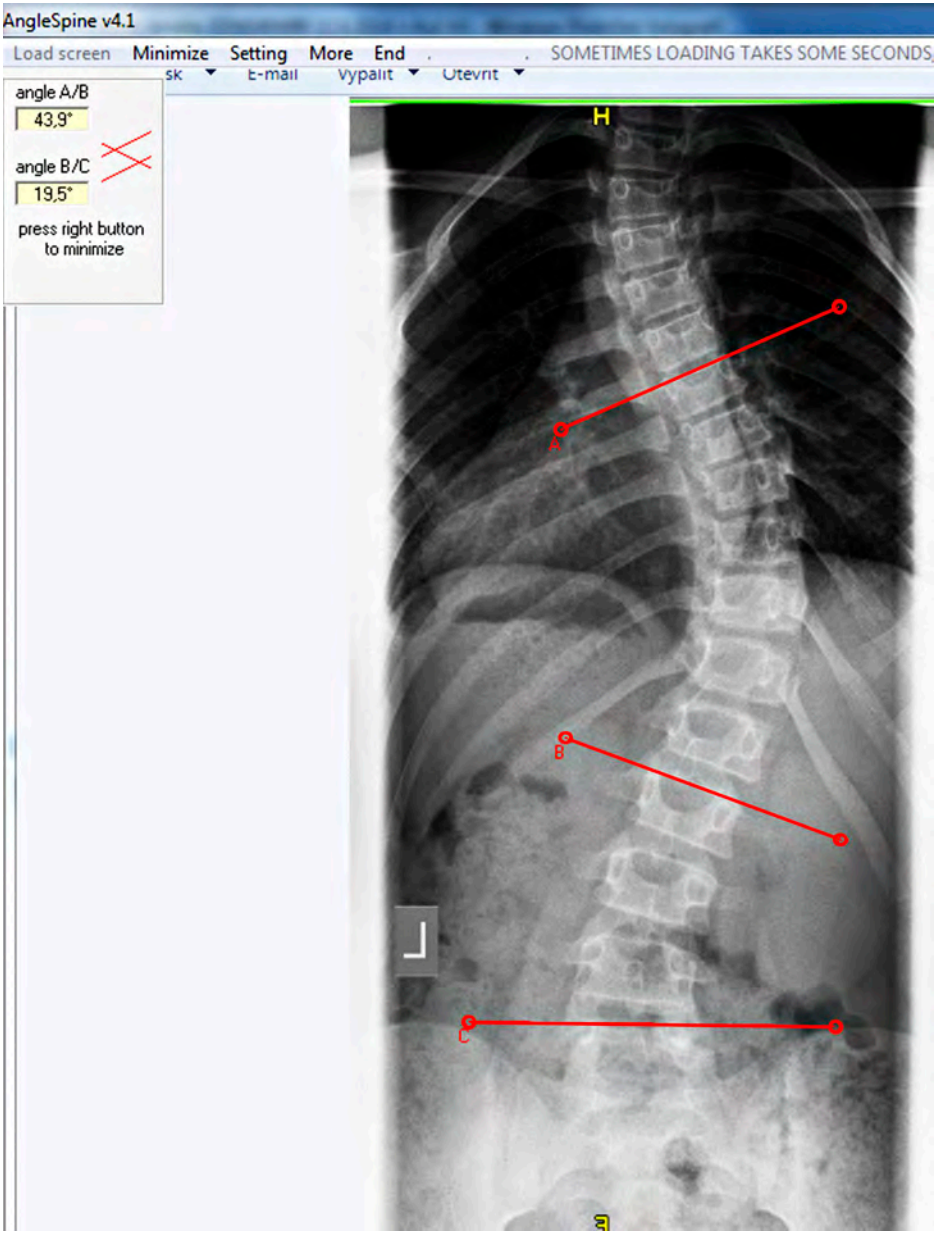

**Obr. 2** Znázornění nabídky metod a možnosti dalšího individuálního nastavení.



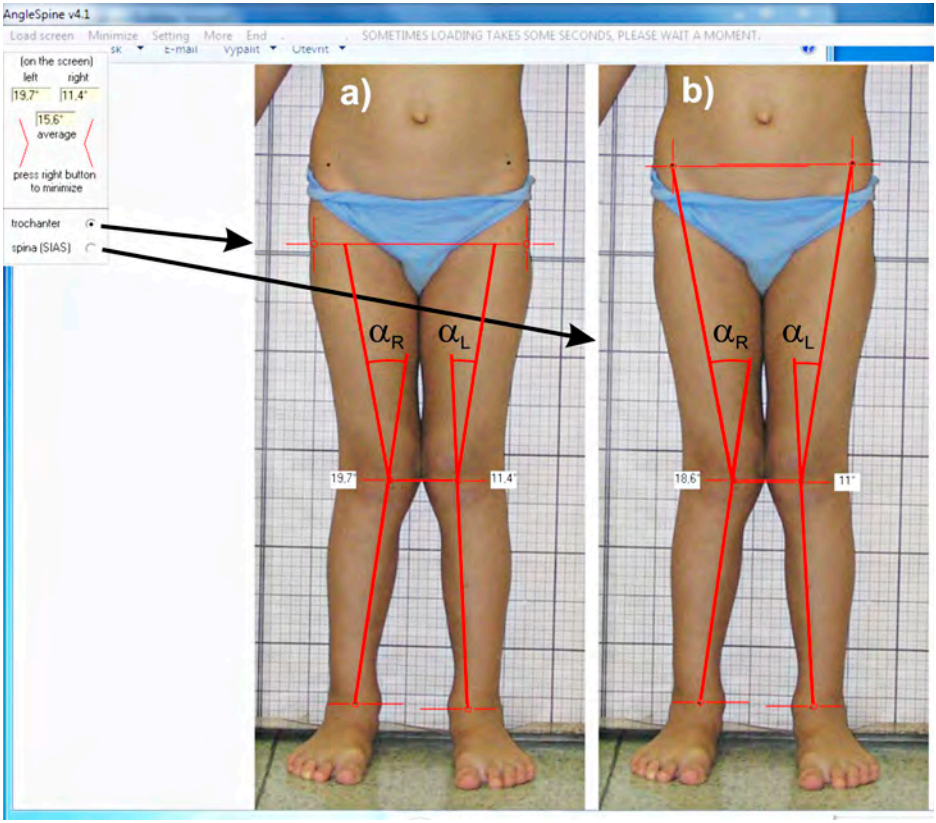

**Obr. 3** Ukázka odečítání axiální rotace obratlů původní radiografickou metodou (**3**).

**Axiální rotaci obratle** zjistíme jednoduchým způsobem po načtení příslušného obrázku prvními čtyřmi kliknutími pravým tlačítkem myši v rozích obrysu obratlového těla nebo příslušného kompromisního obdélníku či kosodélníku (**3**) a pátým a šestým kliknutím na vnitřních obrysech stínů pediklů (pedikl je oválný obrys odstupujícího oblouku obratle v ortográdní projekci). Úhel axiální rotace obratle je okamžitě znázorněn a vypočítán a uveden v místě pod zkoumaným obratlem. Nesmíme zapomenout správně zvolit, zda jde o hrudní, nebo bederní obratel označením v rámečku vlevo pod lištou menu. Toto lze provést kdykoliv v průběhu měření, tedy i po zobrazení úhlu. V takovém případě se úhel jednoduše překreslí a přepočítá. Pro další práci s počítačem můžeme program **AngleSpine** minimalizovat zpět do levého horního rohu pomocí menu, nebo kliknutím pravým tlačítkem myši. Výsledné změření úhlu rotace je uvedeno na **obr. 3**.

Úhly podle Cobba jednoduše stanovíme obvyklým způsobem tak, že po načtení monitoru s obrázkem skoliotické páteře uchopíme levým tlačítkem myši krajní body zobrazených úseček (A, B, C), zobrazených v okně programu **AngleSpine**, a posuneme jimi tak, aby úsečky na přísluš-




**Obr. 4** Ukázka způsobu zjednodušeného měření Cobbova úhlu. Program AngleSpine nabízí 3 předdefinované úsečky, jejichž krajní body lze uchopit myší a umístit je s liniemi přechodových obratlů.




**Obr. 5** Dva způsoby měření tibio-femorálního úhlu. **Obr. 5a** znázorňuje antropometrickou metodu (**4**), kdy je sledována poloha trochanterů, na **obr. 5b** je výsledek metody z fotografie (**12**). Z obrázků je zřejmé označení antropologických bodů černou barvou.

ných místech splývaly se sklonem přechodových obratlů. Úhly jsou automaticky počítány a zobrazeny v samostatném rámečku vlevo pod lištou menu. Příklad měření je na **obr. 4**. Standardně se měří Cobbův úhel od spodní kontury dolního přechodového obratle k horní kontuře horního přechodového obratle. Počet tří předdefinovaných úseček umožňuje měřit nejen standardně každé zakřivení zvlášť s využitím pouze dvojice úseček, ale i zjednodušeně tak, že jsou využity nejlépe viditelné kontury tří přechodových obratlů nebo linie pediklů a pak je třeba počítat s případnou malou nepřesností.

**Tibio-femorální úhel** (T-F) můžeme na obrázku měřit dvojím způsobem. Jak pro antropometrickou metodu výpočtu T-F úhlu (**4**), tak pro měření T-F úhlu z fotografie (**12**) je třeba na kůži pacienta přesně označit antropometrické body, které odpovídají poloze spin (spina illiaca anterior superior – SIAS), velkým trochanterům, středům kolenních kloubů (apex pately) a stře-

dům hlezenních kloubů (bod ležící ve středu mezi malleolus medialis a lateralis). Podle původní antropometrické metody se T-F úhel vypočítá na základě skutečných změřených šířkových a délkových hodnot (**4**). V případě stanovení tibio-femorálního úhlu z polohy velkých trochanterů je v proceduře programu **AngleSpine** použit pouze koeficient antropometrické metody (4), samotné úhly jsou vypočítány jen z geometrického postavení proložených přímek, **obr. 5a**. Při stanovení T-F úhlu z pozice spin (SIAS) jsou v původní fotografické metodě tibio-femorální úhly $\mathbf{a_R}$ a $\alpha_L$ měřeny ručním goniometrem (**12**). V programu **AngleSpine** jsou vypočítávány opět pouze z geometrického postavení proložených přímek, **obr. 5b**. Proložení předdefinovaných úseček se provádí v programu **AngleSpine** podobně jako při měření Cobbova úhlu. Po načtení zkoumané fotografie do okna programu lze konce úseček uchopit myší a postupně je přetáhnout do požadovaných antropometrických bodů. Úhly $\mathbf{a_R}$ a $\alpha_L$ jsou vypočítány automaticky a jsou znázorněny nejen v oblasti kolen zkoumaného obrázku, ale i v rámečku vlevo pod lištou menu, kde je navíc uvedena i hodnota průměrného T-F úhlu (vypočítaná z hodnot pravé a levé dolní končetiny). Výsledky měření obou způsobů jsou na **obr. 5**.

Čtvrtou položkou v menu je „**Více**" („More"), kde je k dispozici nejen stručný manuál, ale i instruktážní videa pro jednotlivé procedury, návod jak uložit změřený obrázek na paměťové médium (HDD, USB-disk), dotaz na update a možnost zaslat e-mailem komentář.

Poslední položkou menu „**Konec**" („End") je program ukončen.

Program **AngleSpine** byl napsán autorem v prostředí Visual Basic 6.0 a byl dán k volnému stažení na stránkách www.anglespine.com.

# ZÁVĚR

Metrologie hodnocení deformit páteře a kolenních kloubů v období růstu s využitím PC programu **AngleSpine** poskytuje možnost mezioborového využití v klinických i preklinických oborech medicíny (dětská ortopedie, ortopedická protetika, spondylologie, antropologie, biomechanika aj.). Jednoduché a dostatečně přesné hodnocení souborů pacientů stejnou metodou dává možnost nejen dokumentovat vývoj deformit páteře a dolních končetin, ale i porovnávat výsledky léčení (konzervativního a operačního) na mezinárodní úrovni.

V článku byly stručně popsány metody a postupy, jak deformity měřit.

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Společnost pro pojivové tkáně ČLS J.E. Purkyně
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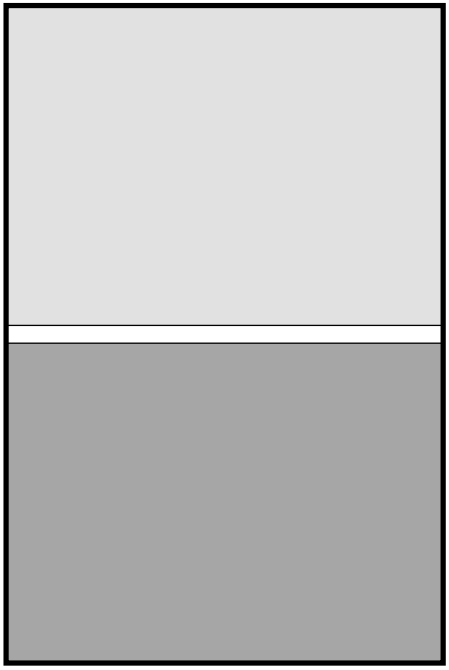

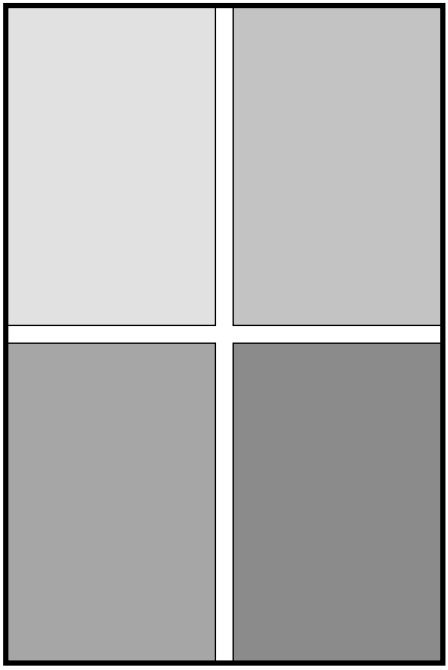

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## Deadline for Abstract Submission: May 31, 2015.

**Both Forms submit by E-mail to the Secretary of the Symposium:**

Assoc. Prof. Ivo Marik, MD, PhD, E-mail: ambul_centrum@volny.cz and/or Petr Krawczyk, MD, E-mail: petr.krawczyk@seznam.cz

**International Organizers of the Symposium:**

**Assoc. Prof. Ivo Marik, MD, PhD & Petr Krawczyk, MD**,

Faculty of Medical Studies, West Bohemia University, Pilsen & Ambulant Centre for Defects of Locomotor Apparatus l.l.c., Prague, Czech Republic, E-mail: ambul_centrum@volny.cz

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ОГОНЁК

# INFORMACE O SPOLEČNOSTI PRO POJIVOVÉ TKÁNĚ ČLS J. E. PURKYNĚ (SPT)

Vážená paní kolegyně, vážený pane kolego,

dovolujeme si Vás informovat o možnosti stát se členem **Společnosti pro pojivové tkáně** (SPT), která v roce 2004 navázala na plodnou desetiletou činnost Společnosti pro výzkum a využití pojivových tkání vedenou panem prof. MUDr. M. Adamem, DrSc. Posláním SPT je podpora rozvoje výzkumu pojivových tkání, šíření nových poznatků týkajících se všestranných analýz tkání z obecného pohledu, moderních klinických přístupů k diagnostice a léčbě. Dalším posláním SPT je usnadnění styků mezi jednotlivými odborníky navázáním spolupráce s různými vědeckými, odbornými, výrobními a farmaceutickými společnostmi.
Vědecké poznání a aplikace nejnovějších poznatků v klinické praxi nabyly v posledních letech nebývalého zrychlení, a to nejenom v zahraničí, ale i u nás. Tato skutečnost bezprostředně souvisí s kvalitativním rozvojem poznání i v nebiologických vědách a v moderních inženýrských přístupech. Stále více se prokazuje, že vše se vším souvisí – není náhodou, že nové poznatky a objevy vznikají na rozhraní oborů a různých vědních disciplin. Lidská společnost v posledních desetiletích dosáhla nové civilizační kvality – ve vědě a v jejich aplikacích zcela jistě, avšak v morálce a etice ne tak příliš. Biomedicína je v současné době rozsáhlou interdisciplinární vědou, která bez kooperace s jinými vědními obory by byla odsouzena ke stagnaci. Proto cílem SPT je nejenom integrovat odborníky v biomedicíně, ale i v technických sférách.
Prioritní snahou SPT je presentovat odborné veřejnosti a specialistům v klinické praxi nejnovější poznatky v oblasti pojivových tkání. SPT je i společenskou organizací klinických pracovníků, vědců, pedagogů, která si klade za cíl společensky sblížit nejenom pracovníky v aktivní službě, ale i kolegyně a kolegy v důchodovém věku a v neposlední řadě i studenty a mladé doktorandy z vysokých škol, universit a akademických ústavů.
SPT bude organizovat během každého roku alespoň dvě odborná a společenská setkání, kde vedle odborných přínosů bude kladen důraz také na společenské – přátelské diskuse všech vás, kteří nechtějí stagnovat, a kteří nechtějí přemýšlet o nových poznatcích izolovaně a osamoceně.
Pro uhrazení nejzákladnějších nákladů na korespondenci se členy společnosti, jejich informovanost a pořádání odborných kolokvií, symposií a společenských odborných setkání byl stanoven **roční členský příspěvek pro aktivní kolegyně a kolegy 200 Kč** a **pro studenty a důchodce 100 Kč.**
SPT vydává časopis Pohybové ústrojí – pokroky ve výzkumu, diagnostice a terapii, do kterého se i vy můžete aktivně zapojit odbornými články, vašimi zkušenostmi a slunečnou pohodou. **Předplatné časopisu** je **300 Kč ročně,** pro zahraniční odběratele **12 Euro.**
Milí kolegové, nestůjte (pro katastrofální nedostatek času) opodál a připojte se k české inteligenci – v oblasti pojivových tkání, ke které i Vy zcela jistě patříte. V naší krásné české zemi je třeba, aby prameny poznání byly stále živé a permanentně udržované. Poslání každého z nás není náhodné. Jsme velice zavázáni našim předkům, kteří rozvíjeli kvalitu odbornosti v naší zemi. Nepřipusťme útlum vědy u nás. Nenechme se zmanipulovat programovanou lhostejností, vyrůstající z neodbornosti, závisti a z patologického prosazování ekonomicko-mocenských zájmů.

Těšíme se na Vás a na Vaše zkušenosti – přijďte mezi nás!

**Za výbor společnosti:**
Předseda: Doc. MUDr. Ivo Mařík, CSc.
Čestný předseda: Prof. MUDr. Josef Hyánek, DrSc.
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# PŘIHLÁŠKA

řádného člena

## Společnosti pro pojivové tkáně ČLS JEP

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**Přihlašuji se za řádného člena Společnosti pro pojivové tkáně ČLS JEP (odborná společnost 1200) a souhlasím s posláním a cíli České lékařské společnosti J. E. Purkyně.**

**Datum** ..... **Podpis** .....

Stanovisko organizační složky:

**Přijat dne** ..... **Podpis** .....

Přihlášku do společnosti doručte na adresu:

**Společnost pro pojivové tkáně ČLS JEP, Olšanská 7,**
**130 00 Praha 3, ČR, tel./fax: 222 582 214, e-mail: ambul_centrum@volny.cz**

Informace uvedené na tomto formuláři jsou přísně důvěrné a nebudou poskytnuty žádné další osobě ani organizaci.

# INFORMATION ABOUT SOCIETY FOR CONNECTIVE TISSUES CMA J. E. PURKYNĚ (SCT)

Dear Sir/Madam, dear Colleagues,

We have great pleasure to inform you about the possibility of joining the **Society for Connective Tissues** (SCT) that was established in 2004 in order to continue the ten-year fruitful activities of the Society for Research and Use of Connective Tissue headed by Professor M. Adam, MD, DSc. The activities of the SCT are aimed at supporting the research development in the field of connective tissues, the dissemination of knowledge related to the all-purpose analyses of the tissues in general, and the application of the up-to-date approaches to the diagnostics and clinical practice. Further, the SCT is determined to facilitate contacts between the respective specialists by means of collaboration with various research, professional, production and pharmaceutical companies.

In the last few years, the scientific knowledge and the application of the latest findings in the clinical practice have accelerated on an unprecedented scale, not only abroad, but also in this country. This fact is closely connected with the qualitative development of the knowledge in the non-biological sciences and in the up-to-date engineering approaches. The fact that all things are mutually connected is becoming more and more evident. It is fairly obvious that the new knowledge and discoveries arise on the dividing line between the different fields and disciplines of science. In the last few decades, the human society has reached the new qualities of civilization. This applies, in particular, for the disciplines of science and their applications; however, this statement can hardly be used with reference to the moral and ethical aspects of the human lives. At present, the biomedical science is a wide-ranging interdisciplinary science which, in case of lack of cooperation with other scientific disciplines, would be condemned to stagnation. That is the reason why the SCT is aimed at integrating the specialists both within the biomedical science and within the engineering fields.

The priority objective of the SCT is to present the professional public and specialists involved in the clinical practice with the latest knowledge in the field of connective tissues. The SCT is also a civic society whose aim is to bring people close together by joining members of the clinical staff, researchers and teachers including the retired ex-colleagues and, last but not least, the undergraduates and PhD students from universities and academic establishments.

The SCT is planning to organize at least two professional and social meetings each year. Beside the professional contribution of these meetings, emphasis will be laid on social activities – informal discussions of all those who do not want to stagnate and who do not want to acquire the new knowledge in solitary confinement.

**The annual membership fee is 200 Czech crowns for full workers, and 100 Czech crowns for students and pensioners.** This membership fee shall be used to cover the basic costs on correspondence with the members of the Society in order to inform them about organizing colloquiums, symposiums and social meetings.

The SCT is also engaged in publishing of the interdisciplinary journal entitled Locomotor System – Advances in Research, Diagnostics and Therapy. You are invited to contribute to the journal writing professional articles, exchanging experience or, simply sharing your opinions. **The annual subscription is 300 Czech crowns, for foreign subscribers 12 euros** (incl. shipping).

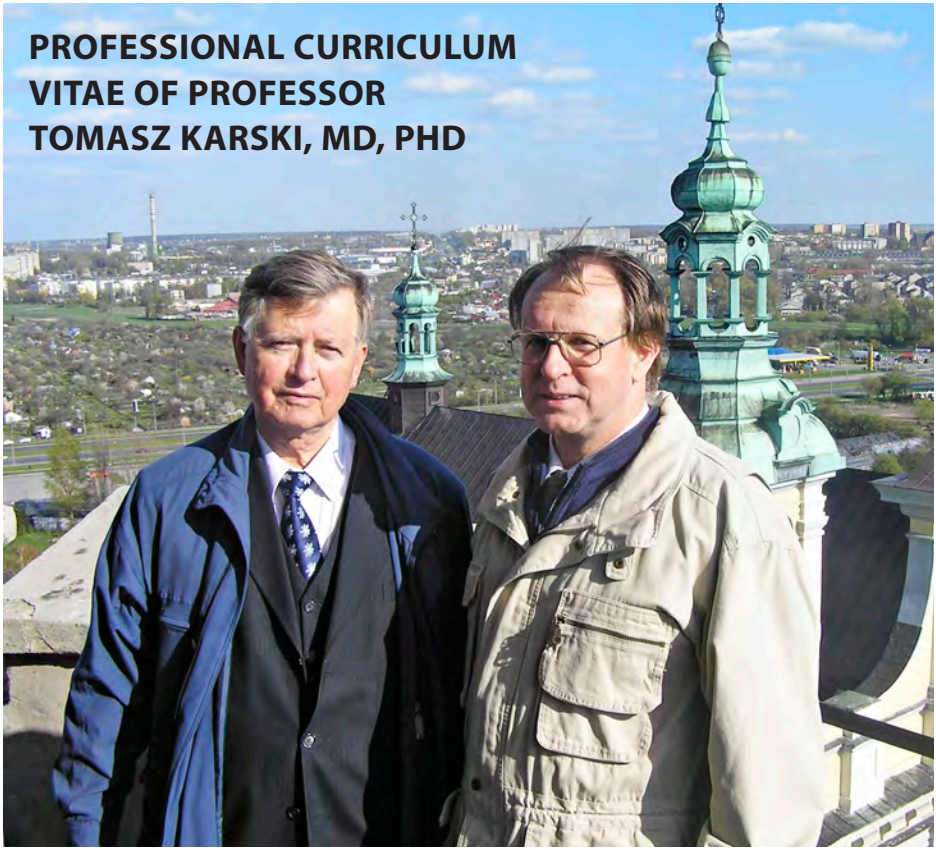
**Dear Colleagues, do not stand aside (suffering from terrible lack of time) and join the professional people in the field of connective tissues to whom you undoubtedly belong. In this beautiful country, the sources of knowledge should be kept alive and maintained permanently. Our role in this process is not accidental. We are much obliged to our ancestors who had developed the qualities of proficiency in this country. Do not allow the decline of science. Do not let the programmed indiffer-**

**ence arising from lack of professionalism, enviousness, and pathological promotion of economic and power interests manipulate us.**
**We are looking forward to meeting you. We will be pleased if you join us and share your experience with us.**

**On behalf of the committee of the Society for connective tissues:**

**Associate Professor Ivo Mařík, MD, PhD** – chairman
**Professor Josef Hyánek, MD, DSc** – honorary Chairman
**Professor Miroslav Petrtýl, MSc, DSc** – vice-chairman
**Martin Braun, Dr, PhD** – scientific Secretary
**Hana Hulejová, Eng** – secretary
**Jana Zelenková, Eng** – treasurer

# PROFESSIONAL CURRICULUM VITAE OF PROFESSOR TOMASZ KARSKI, MD, PHD



*Professor Tomasz Karski, MD, PhD (left) and Associate Professor Ivo Marik, MD, PhD*

Prague, 21st August 2014

**Professor Tomasz Karski, MD, PhD**

- **Professor Emeritus since 1st October 2009**
- **Former Head of Pediatric Orthopedic and Rehabilitation Department of Medical University in Lublin (1995–2009)**
- **53 years orthopedic activity to 2009**

Professor Tomasz Karski was born in January 2, 1939 in Rudka (Zwierzyniec) Zamość district (south – east part of Poland). Primary school in Zwierzyniec, secondary school in Zamość. In the years **1956–1963** he studied at Medical University in Lublin. In **1963** he received medical doctor degree. During the studies he worked 3 years in Students Scientific Orthopedic Association and later after graduation he began orthopedic career. In **1967** first grade of specialization), in **1971** second grade of specialization in orthopedics, orthopedic surgery and traumatology of movement apparatus. In **1972** and **1982** he passed degrees to receive **PhD** degree and A**ssociate Professor** title. In **1993** he was nominated for Professor and President of Poland confer him the scientific degree Professor ordinaries (full Professor). Since **1995 till 2009** he was a Head of Chair and Department of Pediatric Orthopedics and Rehabilitation of Medical University in Lublin/ Poland. It is the biggest University Pediatric Hospital in Eastern Poland (DSK in Lublin).

**He is a member** of Polish Orthopedic and Traumatology Association (PTOiTr) since 1963. For 12 consecutive years he was elected as Secretary of Lublin Branch (Section) of Polish Orthopedic and Traumatology Association, for 4 years he was Vice-President of the Section and for next 4 years he was President of the Lublin Section. He works in Editorial Board of Polish Hand Surgery, of the Journal of Paediatric Orthopaedics part-B (till 2004), of *Biblioteka Ortopedii Dziecięcej* (Pediatric Orthopedics' Library) and of the journal Locomotor System – „Pohybové ústrojí" (Czech Republic). He is a member of EPOS since 1985 and a member of *Société Internationale de Chirurgie Orthopédique et de Traumatologie* (SICOT) since 2002.

## Scholarships abroad

Orthopedic Departments: Neuruppin (German Democratic Republic – one month every year in years 1963–1972), Heidelberg (1972) – together 10 months & Essen (1973) – as DAAD scholarship holder, Budapest (one weeks – many times), Hajduszoboszlo (Congress), Szekesfehervar (Congress), Brno (one month), Neubrandenburg (German Democratic Republic Congress), Chemnitz (Congress), London (one month and Congress), Amsterdam (two weeks and Congress), Montpellier (Congress), Leipzig (one week and Congress), Erfurt (German Democratic Republic) one week and Congress, Paris (one week and Congress), Bratislava (many times), Szeged (many times), Debrecen (many times), Vienna (many times and EPOS Congress), Stolzalpe (three times, in period of one – two weeks), Berlin (many times), Hubertusburg (Wermsdorf – many times), Siebenlehn (as lecturer – many times), Rummelsberg (one month), Copenhagen (two weeks), Björred (Sweden – some days), Heinola / Finland (many times – every time – one month), Oulu (Congress), Milano (Italy – Congress), Lubjana (short stay), Hong Kong (2004 – one week stay and Symposium), Beijing (2005 – one week stay and Congress), Helsinki (2005 – lecturer at Orthopedic Summer School / Place: Invalid Foundation Hospital / Helsinki / Teholantie 10).

## Awards

He was awarded by the Rector (main Director of University) of Medical University of Lublin 39 times for scientific and educational work. He received three times award from the Ministry of Health of Poland (1975, 1986, 1993). He was also awarded with medals: "*Przyjaciel Dziecka*" (1978r.), "*Medal Pamiątkowy Sześćdziesięciolecia TPD*" and *„Międzynarodowego Roku Dziecka*"

(1979r.), *Złotą Odznakę TWK* (1984r.), *Złoty Krzyż Zasługi* (1987r.), Medal *im. dr Henryka Jordana* (2000r.) and Krzyż Kawalerski *Polonia Restituta* (2000r.) and Medal *Komisji Edukacji Narodowej* (2003r.), *medal Vincentego Pola* (2010). Since **1996** he is Honorary Member of Hungarian and since **2003** of Slovak Orthopedic and Traumatology Association and since **2005** of Czech Orthopedic and Traumatology Association. In 2006 he was awarded by Honorary Membership of The Society for Connective Tissues, Czech Medical Association, J.E. Purkynje, in 2008 by a Medal of honour of the Czech Medical Association J.E. Purkynje and in 2009 by a Medal for Clinical and Scientific Merits of The Society for Connective Tissues, Czech Medical Association, J.E. Purkynje.

In 2003 he was awarded by International Biographical Center Cambridge, England as Outstanding Intellectual of the 21th Century. Since 2005 his name is putting on list in The Contemporary Who's Who of Professionals ABI (USA).

He described the biomechanical etiopathogenesis of the so-called idiopathic scoliosis (1995–2007) and he is the author of a new rehabilitation treatment of this spine deformity. In the year 1997 he found that all children with scoliosis has the habit to stand 'at ease' only on the right leg and it was deciding for development of "C" II/A scoliosis and "S" II/B group of scoliosis and additional cause of development of "S" I group of scoliosis. In 2001 he described two etiopathological groups (I-st and II-nd) and in 2004 the III-rd group of the development of so-called idiopathic scoliosis which proved to be crucial for prophylactics and new conservative treatment. In 2006 he described the "model of hips movement" – deciding in "development of every types of scoliosis". In 2007 he found the answer – why the blind children do not have scoliosis and in this year he also described the "indirect influences coming from CNS in small children and their influence for development of scoliosis in future".

He published these clinical findings in numerous polish and foreign publications and also in four books on scoliosis (2000, 2002, 2003 and 2011). His articles have been published also by International Research Society or Spinal Deformities – IRSSD Meetings in Athens (2002), in Ghent (2006) and in Liverpool (2008) and in Poznań (2012) – together 5 articles. He presented his ideas about etiology of scoliosis during SICOT Congress in Egypt (2002), in Cuba (2004), in Turkey (2005), in Marrakech (2007) and in Prague (2011).

In years 2012–2014 he attended many Symposia and Congresses (IRSSD – Liverpool, SOSORT – Wiesbaden, in Hungary, in Czech Republic, in Germany, in Belgium, in England, in Greece, in Egypt). The recent information about so-called idiopathic scoliosis he published in three articles: in 2005, in 2007 and in 2010 in Pan Arab Journal of Orthopedics and Trauma and in 2011 in Spain and in US-China Orthopedic Journal (USA). In last 2 years (2013) the published two articles in Journal of Novel Physiotherapies in USA and in Surgical Science in USA (2014).

**His scientific interest** is first of all pediatric orthopedic surgery and specially:

1. DDH – etiopathogenesis, new functional treatment at newborn, babies and small children; new concept of femur osteotomy and innominate bone osteotomy of dysplasia hips – here many successes in treatment,
2. congenital feet deformities (club foot) – modification of skin incision,
3. *torticollis* – effective early new conservative treatment of new-born and small babies (described in Orthopädische Praxis in Germany),

4. *Morbus* Blount – explanation of etiology and operative procedures and since 33 years effective conservative treatment children in age of 1.5–3 years (described in Orthopädische Praxis in Germany),
5. *genua valga* – new operative procedure – "lateral high realize" (fasciotomy of tractus ilio – tibilis – it was described in the journal of Locomotor Apparatus that is edited in Czech Republic),
6. cerebral palsy (CP) – concept of new treatment through the RAO method [R – rehabilitation, A – apparatus, O – operation (if needed)]. It was described in the journal of Locomotor Apparatus that is edited in Czech Republic
7. coxarthrosis (arthrosis in hips) – adults patients, new concept for rehabilitation, new prevention's methods. This preventive method was presented in many Meetings in many countries.
8. gonarthrosis (arthrosis in knees) – adults patients, new rehabilitation, new prevention, preventive surgery (simple surgery) – fascjotomy of tracts ilio-tibialis
9. hallux valgus and other foot insufficiency - adults patients, new rehabilitation, new prevention. Importance of" *toes flexion test"* (described in Beitrage zur Orthopädie / GDR).
10. back pain – adults patients, new rehabilitation, new prevention = physiotherapy methods

He is author of 7 original orthopedic devices (apparatus).

## Publications in medical literature

Author of 6 monographs, author or co-author of 453 papers + 11 manuscripts after 2009 (plenty in English and in German). In 2011 he published a monograph about aetiology of the so called idiopathic scoliosis and about new treatment and causal prophylaxis of this spine deformity (4th Edition).

## Foreign languages

German (full active), English (full active), Italian (passive / active), French (passive / active), Russian (passive / active).

## Last five years

In 2009 (30th September / 1st October 2009) he become the status Professor Emeritus in Medical University. In next years (till now) he is working as Professor Lecturer in Vincent Pol University / Lublin / Poland, on Faculty of Physiotherapy. All years he is active and took place in many Congresses and Symposia in Poland and aboard (Orthopaedic Congresses in Hungary, in Germany, in SOSORT, SICOT, Prague-Lublin-Sydney-St. Petersburg Symposia. Since 2009 till now he is Orthopaedic Surgeon Consultant in Military Hospital in Lublin.

In 2013 he had the series of lectures for German Students in April (one week) in University in Dresden and in December (one week) in University in Indstein /north of Frankfurt / Main (in program of ERASMUS).

## Family of Professor Karski

Wife – Jolanta Wójcikowska-Karska MD – ophthalmologist.
Son – Jacek Karski MD PhD – orthopedic surgeon.
Daughter – Catherine Karska MA – English language lecturer.
Five grand – daughters and sons: one ground-daughter – Claudia Karska is since 2010 – doctor of medicine.

**At the occasion of the 75th anniversary of Professor Tomasz Karski, MD, PhD I sincerely wish him by the name of the Society for Connective Tissues Czech Medical Association J.E.Purkynje good health, personal fulfilment in his large family and further success during education of next professional generation.**

**Associate Professor Ivo Marik, MD, PhD, FABI**
Chief of the Centre for Patients with Locomotor Defects l.l.c., Prague 3, CZ
President of the Society for Connective Tissue, Czech Medical Association, J.E. Purkynje
Scientific secretary of the Society for prosthetics and orthotics Czech Medical Association J. E. Purkynje

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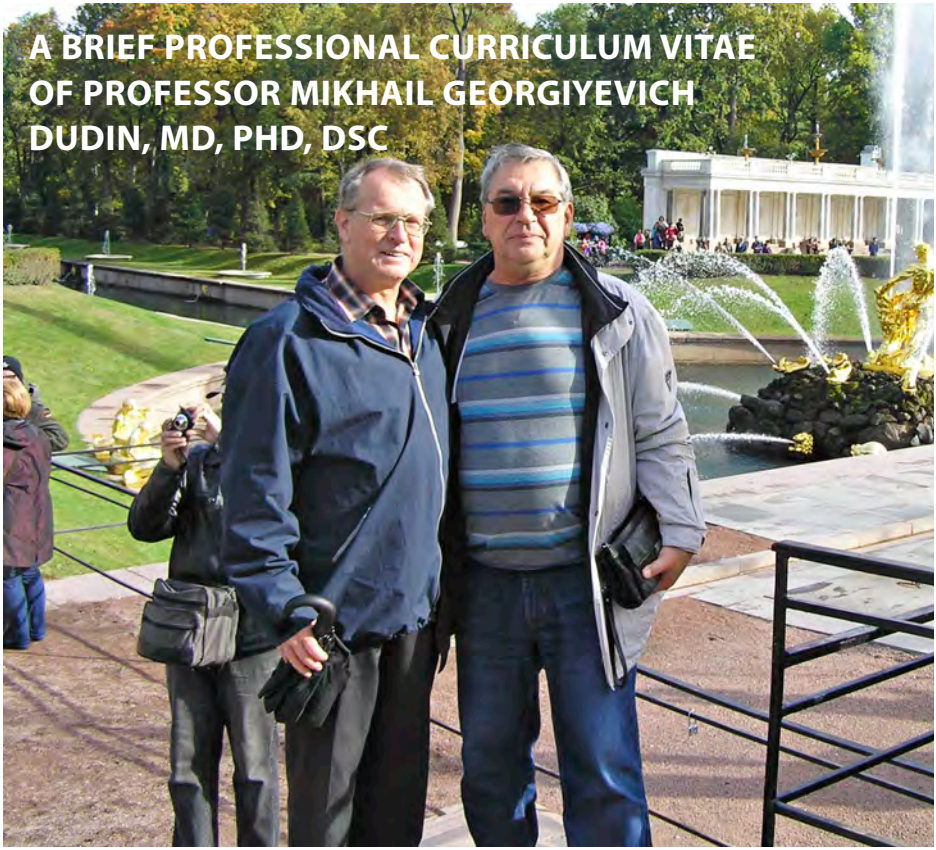
# A BRIEF PROFESSIONAL CURRICULUM VITAE OF PROFESSOR MIKHAIL GEORGIYEVICH DUDIN, MD, PHD, DSC



*Professor Mikhail Georgiyevich Dudin, MD, PhD, DSc (right) and Associate Professor Ivo Marik, MD, PhD*

This year one of the active participants of the symposium, Professor Dudin marks his 65th anniversary. He went in orthopedics long and thorny path during 42 years of his professional activity. Let me mention briefly the main stages of this glorious path.

**Mikhail Dudin was born on October 21, 1949.**

- 1972 – graduated with honors from the Leningrad Pediatric Medical Institute (now – St. Petersburg).
- 1972–1974 – specialization (residency) in pediatric orthopedics and traumatology in the Leningrad Research Institute of Children's health G.I.Turnera to obtain the status of a specialist orthopedic surgeon.

- 1974–1984 – the practical work in the clinic Leningrad Recovery Center of Pediatric Orthopedics and Traumatology "Spark".
- In 1982 he defended his candidate (PhD) thesis on "idiopathic scoliosis with atypical pathological vertebral rotation: diagnosis, course, treatment policy," which describes a special type of scoliosis with a benign course.
- 1984–1986 – consultant orthopedic surgeon specialist in child orthopedics and traumatology at the Lenin hospital in the city of Holguin, the Republic of Cuba.

After 16 years of work as an orthopedic surgeon, after gaining an experience and reflection on the results of this activity the conclusion was formed naturally: the large part of many treated patients could avoid surgery! But three conditions were necessary to do it:

**The first** one is the knowing of the etiology and pathogenesis of diseases (in pediatric orthopedics this information remains a big "white spot"!).

**The second** one is reliable early diagnosis and prediction of the development of musculoskeletal system lesions in children (in most cases, the solution of this problem is determined by the subjective experience of the individual physician and rarely has an objective basis).

**The third** one is available medical management technologies of all parts of the musculoskeletal system (bones and connective tissues, as well as neuro-muscular complex) vital functions.

Absence of these conditions fully determines the actual position of pediatric orthopedist – to wait until the indications for surgical intervention will develop. And during this waiting all activities were reduced to kinesotherapy and massage, often combined with the term "rehabilitation".

Based on this idea a new concept of pediatric orthopedics was conceived – it has to be a conservative. It should be emphasized that we are talking about a conservative orthopedics, not about rehabilitation. By the way, rehabilitation literally means restoring of lost health so the term expresses the main task of all medical specialties from classical therapy to modern HiTech surgery.

To implement the same ideas of conservative orthopedics a number of challenges was necessary to address. That is why in 1986–1996 Mikhail Dudin became the researcher at the Leningrad G.I. Turner's Scientific Research Pediatric Orthopedic Institute.

Here he analyzed the lot of world literature and as a result the control systems of the body (and in the first place – the endocrine and nervous) came in the spotlight.

Working in the region of Russia affected by the Chernobyl nuclear disaster, he gained invaluable experience in the study of these systems in children in the population and in various lesions of the musculoskeletal system. Appointment of Mikhail Dudin to the post of head of "orthopedic sector" of State Program "Children of Chernobyl" (1989–1996 years) was a "fluke".

The main question posed to the research group was: "How has reacted musculoskeletal system in the child population of the region on the factors associated with nuclear disaster?". It was supposed the main damaging factor is ionizing radiation from radioactive contamination. But there was obtained the conclusion: intervention in the metabolic processes of unstable isotopes of iodine (I129 – I131) and an excess of stable I127, widely used as a protector of the thyroid gland, had the greatest influence.

This new experience and focused study of osteotropic hormonal profile (growth hormone, cortisol, calcitonin, parathyrin) in children with the most common and defeat mysterious skeletal disorder – idiopathic scoliosis – allowed to see the pathogenetic role of these hormones. In addition the obtained data show the material basis of the most indisputable fact in the theory and practice of scoliosis – a direct dependence of the development of pathological three-plane deformation of the spinal column to the process of growth of the child.

– In 1993 he defended his doctoral (SciD) thesis entitled "Features of the hormonal regulation of metabolism in bone tissue as ethiopathogenetic factor of idiopathic scoliosis." Its main provisions were presented at the World Congress SICOT / SIROT in Amsterdam in1996, and in 1999, this work has received the first prize of the European GICD (Jean Dubousset) for new developments in the diagnosis and treatment of AIS in children and adolescents.

For the practical implementation of the findings obtained in the thesis it was necessary to work in practicioner clinic.

– From 1996 to the present – Director of the St. Petersburg Children's Rehabilitation Center of Orthopedics and Traumatology "Ogonyok".
– Since 1997 – Professor, Department of Pediatric Orthopedics and Traumatology of the St. Petersburg Medical University of graduate education, and since 2001– the title Professor.

Started his work at the Children's Rehabilitation Center of Orthopedics and Traumatology "Ogonyok" Mikhail Dudin began to form a diagnostic service and now the full arsenal of the hardware diagnostics is at the disposal of doctors: X-ray, ultrasound, computed topography, stabilometry, stabilography, EMG, EEG (including 3DLocEEG), ECG (including Holter monitoring), spiro-analyser, immunoassay analyser, thermography.

Using obtained objective diagnostic data specialists of the Center have the opportunity to see the prognostic criteria and the "targets" for their impact on pathogenetic links of numerous musculoskeletal disorders with different electric and magnetic fields, light and laser therapy, ultrasound, biologically active application etc. Using the world experience of pediatric orthopedics as well as the experience of other medical and biological specialties, such as biophysics, neuroscientists, endocrinologists and other colleagues in the biological sciences, orthopedists got a whole arsenal of techniques to effectively influence on the normal and pathological processes in the musculoskeletal system. Today, no one is surprised not only with the "stop" progressive scoliosis, but also a significant, sustained decrease in its clinical symptoms.

Today is no surprise correction of 1-2-centimeter-different-sized legs. Today, no one is surprised with remission of arthritis.

– In 2005 M.G.Dudin received the honorary title "Honored Doctor of Russia", and in 2009 the team of the Center was awarded A.N. Kosygin Prize (for new technology and innovation in pediatric orthopedics).

Today St. Petersburg Children's Rehabilitation Center of Orthopedics and Traumatology "Ogonyok" is a leading institution in the country in which the main idea is already being implemented – pediatric orthopedics should be conservative and the guarantee of its success in practice proved timely diagnosis and early treatment.

Professor M. Dudin is author of over 200 papers in medical journals in Russia and abroad, wrote 3 monographs (in 2009, 2011 and 2013), which present the main results of his research activities.

He has supervised 15 master's and one doctoral thesis. With every reason to conclude that Russia has formed a whole new direction – children's conservative orthopedics.

Professor M. Dudin with the team of Children's Rehabilitation Center of Orthopedics and Traumatology "Ogonyok" was the main organizer of The 15$^{Th}$ Prague-Lublin-Sydney Symposium that was held with success in St. Petersburg, Russia in September 15–22, 2013.

At this opportunity he was rewarded with the Honorary medal of the Czech Medical Association J.E. Purkynje and honorary membership of the Society for Connective Tissues CMA J.E. Purkynje.

Dear members of the presidium, Dear Colleagues,

let me, on behalf of all the participants of the symposium congratulate Professor Dudin with upcoming anniversary and wish him good health, long life and great success in scientific researches.

**Assistant professor Aleksey Shashko, MD, PhD**
Children's Rehabilitation Center of Orthopedics and Traumatology "Ogonyok"
St. Petersburg, Russia
Address: St. Petersburg, Strelna, Sankt-Peterburgskoye shosse 101
E-mail: shravan@mail.ru

At the occasion of the 65$^{th}$ anniversary of Professor Mikhail Georgiyevich Dudin, PhD, DScM I sincerely wish him by the name of the Society for Connective Tissues Czech Medical Association J.E.Purkynje good health, personal fulfilment and further scientific success as well as success during education of next professional generation.

**Associate Professor Ivo Marik, MD, PhD, FABI**
Chief of the Centre for Patients with Locomotor Defects l.l.c., Prague 3, CZ
President of the Society for Connective Tissue, Czech Medical Association, J.E. Purkynje
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**Tel.: (+420) 222 582 214, e-mail: ambul_centrum@volny.cz**

## SUBJECT MATTER OF CONTRIBUTIONS

The journal Locomotor System will publish the papers from the field of locomotor apparatus of man which are above all concerned with the function, physiological and pathological state of the skeletal and muscular system on all levels of knowledge, diagnostic methods, orthopaedic and traumatologic problems, rehabilitation as well as the medical treatment and preventive care of skeletal diseases. The objects of interest are interdisciplinary papers on paediatric orthopaedics and osteology, further object of interest are problems of biomechanics, pathobiomechanics and biorheology, biochemistry and genetics. The journal will accept the original papers of high professional level which were not published elsewhere with exception of those which appeared in an abbreviated form.

The editorial board will also accept the review articles, case reports and abstracts of contributions presented at national and international meetings devoted largely to locomotor system. The papers published in the journal are excerpted in EMBASE / Excerpta Medica and Bibliographia medica Čechoslovaca.

## MANUSCRIPT REQUIREMENTS

Manuscripts should be submitted in text editor Microsoft Word in format *.doc, docx or *.rtf. While no maximum length of contributions is prescribed, the authors are encouraged to write concisely. The first page of paper should be headed by the title followed by the name(s) of author(s) and his/her (their) affiliations. Furthermore, the address of the corresponding author should be indicated to receive correspondence and proofs for correction. Papers are reviewed by two (and/or three) reviewers.

The second page should contain a short abstract (up to 150 words) followed by the key words (no more than 6). The proper text of original paper is laid out into introduction, material and methods, results, discussion and if need be acknowledgement. The reviews, discussions and news from conferences are without summaries and their lay-out depends on the character of communication. The paragraphs should not begin with any spaces from the left margin nor tabs and should contain at least four rows.

## ILLUSTRATIONS AND TABLES

Authors should supply illustrations and tables on separate sheets in the document. They should be numbered in the same order as is their desired location in the text. The figures should include the relevant details. Pictures should have resolution min. 150 dpi, drawings and graphs in bitmap resolution 600 dpi. They should be saved as tif or jpg format, tables and graphs in Microsoft Excel or as vector graphics in formats *.eps or *.cdr. Figure legends should be provided for all illustrations on a separate page and grouped in numerical order of appearance. On the back of figures, their number and name of the author should be indicated.

## REFERENCES

References must be presented in a numerical style. They should be quoted in the text in parentheses, i.e. (1), (2), (3, 4), etc. and grouped at the end of the paper in alphabetical order. The references of books should contain the names and initials of the first three authors, with eventual supplement „et al.", title of book, number of edition, place of publishing, name of publisher, year of appearance and number of pages, for instance: Frost HM. The Laws of Bone Structure. 4. ed. Springfield: C.C.Thomas, 1964, 167 p.

The references of papers published in journals should be arranged as follows: the names and initials of the first three authors (eventually after the name of the third author introduce et al.), title of the paper, journal name or its abbreviation, year, volume, number and page numbers, for instance: Sobotka Z, Mařík I. Remodelation and Regeneration of Bone Tissue at Some Bone Dysplasias. Locomotor System 1995: 2, No.1:15–24.

The references of papers published in special volumes (in a book) should be arranged in the following order: names and initials of the first three authors, title of paper, editor(s), title of special volume (a book), place of publication, publisher, year of publication, first and last page numbers, for instance: Mařík I, Kuklík M, Brůžek J. Evaluation of growth and development in bone dysplasias.

In: Hajniš K. ed. Growth and Ontogenetic Development in Man. Prague: Charles University, 1986:391–403.

**Manuscripts and contributions should be sent to the Editor-in-chief:**

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**Phone: (+420) 222 582 214**
**e-mail: ambul_centrum@volny.cz**

# OBSAH ROČNÍKU 2013

## PERSPEKTIVNÍ PŮVODNÍ PRÁCE



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## ZPRÁVY

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**Résumé of the books**

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# Pohybové ústroji

## Pokroky ve výzkumu, diagnostice a terapii

The 16th Prague-Lublin-Sydney-St Petersburg Symposium

**Disorders of growth and Defects of growth epiphysis.**

21st – 25th September 2014
in the Military University's Hospital
Lublin, Poland (Al. Racławickie 23)

**Vydává**
**Ambulantní centrum pro vady pohybového aparátu, s.r.o.**
**Odborná společnost ortopedicko-protetická ČLS J. E. Purkyně**
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Society For Connective Tissues CMA J.E. Purkynje
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&
Czech Society of Biomechanics
&
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&
Medical University of Lublin
&
Vincent Pol University in Lublin

**invite you for**

# THE 16TH PRAGUE-LUBLIN-SYDNEY-ST. PETERSBURG SYMPOSIUM

Disorders of growth and Defects of growth epiphysis

## GENETICS OF GROWTH SKELETAL DISORDERS / DIAGNOSTICS AND COMPREHENSIVE TREATMENT

## ORTHOPAEDIC ANTHROPOLOGY, BIOMECHANICS / VARIA & WORKSHOP HAND SURGERY

The Symposium will be held on 21st – 25th September 2014
in the Military University's Hospital, Lublin, Poland (Al. Racławickie 23)

# SYMPOSIUM PROGRAMME

## SUNDAY, SEPTEMBER 21, 2014

Arrival of participants to Lublin, Poland. Accommodation in The HUSAR Hotel, Lublin (Spadochroniarzy Street 9, bystreet of Al. Raclawickie)

## MONDAY, SEPTEMBER 22, 2014

8.30 – 9.30 REGISTRATION OF PARTICIPANTS

9.30 Zbigniew Kędzierski & Marik Ivo, Mikhail Dudin & Tomasz Karski
OPENING OF THE SYMPOSIUM

75TH ANNIVERSARY OF **PROFESSOR TOMASZ KARSKI**
& THE 65TH ANNIVERSARY OF **PROFESSOR MIKHAIL DUDIN**

10.00 – 14.00 MORNING SESSIONS
Note: In every session every lecture 20 min. (with discussion)

### SESSION I – **GENETICS OF GROWTH SKELETAL DISORDERS**

**Chairmen**: IVO MARIK, MILOSLAV KUKLIK

Zemkova Daniela[1)], Marik Ivo[2, 3)] (Prague, Czech Republic)
**Development and growth of skeleton. Growth cartilage**
*[1)] Pediatric Dpt., University Hospital Motol, Prague, Czech Republic*
*[2)] Ambulant Centre for Defects of Locomotor Apparatus, Prague, Czech Republic*
*[3)] Faculty of Medical Studies, West Bohemia University, Pilsner, Czech Republic*

Kuklik Miloslav (Prague, Czech Republic)
**Material properties of connective tissues across syndromology genetic skeletal disorders and pathobiomechanics**
*Genetic department Olšanská 7, Prague, Czech Republic*
*Department of molecular endocrinology, Institute of Endocrinology, Prague, Czech Republic*

Smrcka Vaclav[1), 2)], Marik Ivo[3), 5)], Kuzelka Vitezslav[4)] (Prague, Czech Republic)
**Congenital defects of the upper extremity – phylogenesis, ontogenesis, and tissue systems**
*[1)] ESME l.l.c. & [2)] Plastic surgery Clinic, University Hospital Bulovka, Prague, Czech Republic*
*[3)] Ambulant Centre for Defects of Locomotor Apparatus, Prague, Czech Republic*
*[4)] Dpt. of anthropology, National Museum, Prague, Czech Republic*
*[5)] Faculty of Medical Studies, West Bohemia University, Pilsner, Czech Republic*

## SESSION II – **DIAGNOSTICS AND COMPREHENSIVE TREATMENT**

**Chairmen**: KARSKI TOMASZ, VACLAV SMRCKA

Marik Ivo[1, 5)], Myslivec Radek[2, 1)], Marikova Alena[1)], Zemkova Daniela[3, 1)], Petrasova Sarka[1)], Smrčka Vaclav[4)] (Prague, Czech Republic)
**Reconstructive surgery of rare upper limb congenital defects: 3 case reports**
*[1)] Ambulant Centre for Defects of Locomotor Apparatus, Prague, Czech Republic*
*[2)] Othopaedic-Traumatologic Department, Regional Hospital Pribram, Czech Republic*
*[3)]Pediatric Dpt., University Hospital Motol, Prague, Czech Republic*
*[4)] ESME l.l.c., Prague, Czech Republic*
*[5)] Faculty of Medical Studies, West Bohemia University, Pilsner, Czech Republic*

Popko Janusz, Karpiński Michał, Guszczyn Tomasz (Białystok, Poland)
**Clinical value of neonatal screening for congenital dysplasia of the hip: 20 years evaluation of the effectiveness of ultrasound screening**
*Department of Pediatric Orthopedics and Traumatology Medical University of Bialystok, Poland*

Karski Tomasz[1)], Karski Jacek[2)], Kędzierski Zbigniew[3)] (Lublin, Poland)
**"Imperfect hips" - clinical symptoms in two types of functional insufficiency with pain – after years with full signals of arthrosis**
*[1)] Vincent Pol University in Lublin,*
*[2)] Medical University of Lublin,*
*[3)] Military Hospital in Lublin, Poland*

Yefimov Aleksandr A., Strelnikov Aleksandr V., Kleymenov V.N. (Kaliningrad, Russia)
**Anatomic and functional profile and index of therapeutic reactivity as a means of treatment and rehabilitation programme management**
*Federal State Institution Children's Orthopedic Sanatorium «Pionersk», Ministry of Health, Russia*

## POSTER SESSION – **GENETICS OF GROWTH SKELETAL DISORDERS**

**Chairmen**: DUDIN MIKHAIL, KARSKI TOMASZ
**Speaker**: SHASHKO ALEKSEY

Dudin Mikhail, Kazemirsky V., Tsvetkov T., Hadzhaev B. (St. Petersburg, Russia)
**The question of coxarthrosis early diagnosis in teenagers by "tensometry"**
*Children's Rehabilitation Center of Orthopedics and Traumatology „Ogonyok" St. Petersburg, Russia*

Khaimina Tatiana[1)], Avaliani Tatiana[2)], Karpenko Marina[2)], Dudin Mikhail[1)] (Saint-Petersburg, Russia)
**Features the right and left scoliosis**
*[1)] State Institution of Health Service Saint Petersburg Rehabilitative Centre of Pediatric Trauma and Orthopaedics "Ogonyok", Saint-Petersburg, Russia*
*[2)] Institute of experimental medicine of the NorthWest Branch of the Russian Academy of Medical Sciences, Saint-Petersburg, Russia*

Bitiyukov Konstantin (Saint-Petersburg, Russia)
**Scoliosis curve effect on external respiration**
*State Institution of Health Service Saint Petersburg Rehabilitative Centre of Pediatric Trauma and Orthopaedics "Ogonyok". St. Petersburg, Russia*

Rybka Dina, Arseniev Aleksey, Arsenieva Marina (St. Petersburg, Russia)
**Age differences of ultrasound features of lower limbs germ zones in children**
*Children's Rehabilitation Center of Orthopedics and Traumatology „Ogonyok" St. Petersburg, Russia*

Yefimov A.A., Gurinovich Y.V. (Kaliningrad, Russia)
**The results of the screening diagnosis of spinal pathology in children through mobile orthopaedic laboratory in Russia and Poland in the framework of international cooperation**
*Federal State Institution Children's Orthopedic Sanatorium «Pionersk», Ministry of Health, Russia*

Karski Tomasz[1)], Karski Jacek[2)] (Lublin, Poland)
**So called idiopathic scoliosis. Biomechanical aetiology. New classification. Treatment and prophylaxis**
*[1)] Vincent Pol University in Lublin,*
*[2)] Medical University of Lublin, Poland*

FAMILY PHOTO OF PARTICIPANTS ON HOSPITAL'S STAIRS AND BEFORE HOSPITAL

LUNCH BREAK (Lunch in the HUSAR Hotel, 14.00)

15.30 – 18.30 AFTERNOON SESSIONS

## SESSION III – **DIAGNOSTICS AND COMPREHENSIVE TREATMENT**

**Chairmen**: MIKHAIL DUDIN, IVO MARIK, MOHAMED ALAMELDIN

Dudin Mikhail, Pinchuk Dmitry, Pechersky Viktor, Avaliany Tatyana, Khaymina Tatyana
(St. Petersburg, Russia)

**Risk group of AIS is the key to its prophylaxis**

*Children's Rehabilitation Center of Orthopedics and Traumatology „Ogonyok" St. Petersburg, Russia*

Akizhanova Irina, Kassenova Madina, Svetlichnaya Snezhanna (Almaty, Kazakhstan)

**Echographic peculiarities of the growing zones of humerus, femur and tibia in different age of children**

*Department of radiological and functional diagnostics,, Institute of postgraduate education, Asfendiyarov Kazakh National Medical University, Almaty, Kazakhstan*

Akizhanova Irina, Artykbayeva A.R. (Almaty, Kazakhstan)

**Ultrasound visualizations of pathomorphologic changes in joints of patients with rheumatic diseases**

*Department of radiology and functional diagnostics, Institute of postgraduate education, Asfendiyarov Kazakh National Medical University, Almaty, Kazakhstan*

Marik Ivo[1, 3)], Marikova Alena[1)], Zemkova Daniela[1, 2)], Myslivec Radek[1, 4)], Kuklik Miloslav[5)], Smrčka Vaclav[6)], Kozlowski Kazimierz[7)] (Prague, Czech Republic, Sydney, Australia)

**Possibilities of comprehensive care for genetic skeletal disorders at present**

*[1)] Ambulant Centre for defects of Locomotor apparatus, l.l.c., Prague, Czech Republic*
*[2)] Pediatric Dpt., University Hospital Motol, Prague, Czech Republic*
*[3)] Faculty of Medical Studies, West Bohemia University, Pilsner, Czech Republic*
*[4)] Othopaedic-Traumatologic Department, Regional Hospital Pribram, Czech Republic*
*[5)] Genetic department Olšanská 7, Prague, Czech Republic*
*[6)] ESME l.l.c., Prague, Czech Republic*
*[7)] Radiological Department of Westmead NSW 2145, Sydney, Australia*

Kolesnichenko Vera, Litvinenko Konstantin, Ma Cong (Kharkov, Ukraine)

**Comparison of postural control in unilateral stance between healthy control and patients with lumbar disc herniation and degenerative lumbar spondylolisthesis before and after lumbar posterior fusion**

*SI "Sytenko Institute of Spine and Joint Pathology National Academy of Medical Sciences of Ukraine", Kharkov, Ukraine*

Pugacheva Natalya (St. Petersburg, Russia)
**Conservative treatment effect on AIS progression**
*Children's Rehabilitation Center of Orthopedics and Traumatology „Ogonyok" St. Petersburg, Russia*

AlamEldin Mohamed (Sohag, Egypt)
**Anterior cervical discectomy for one- and two-level cervical disc disease: the effect of anterior plating**
*Sohag faculty of medicine, Sohag, Egypt*

## TUESDAY, SEPTEMBER 23, 2014

9.00 – 14.00 MORNING SESSIONS
Note: In every session every lecture 20 min. (with discussion)

### SESSION IV – **ORTHOPAEDIC ANTHROPOLOGY. BIOMECHANICS**

**Chairmen**: JACEK KARSKI, ALEKSEY SHASHKO

Shashko Aleksey, Kurchenko Sergey (St. Petersburg, Russia)
**Study of photodynamic impact on growth plates of long tubular bones in growing animals**
*Children's Rehabilitation Center of Orthopedics and Traumatology „Ogonyok" St. Petersburg, Russia*

Arseniev Aleksey, Khaymina Tatyana, Dudin Mikhail (Saint-Petersburg, Russia)
**Asymmetrical limb growth in a patient with curtius syndrome: a case study**
*Children's Rehabilitation Center of Orthopedics and Traumatology „Ogonyok" St. Petersburg, Russia*

Kałakucki Jarosław, Karski Jacek, Kandzierski Grzegorz (Lublin, Poland)
**Temporary asymmetric blocking of growth plates in treatment of long bone axis and length disturbances in children.**
*Medical University of Lublin, Poland*

Petrasova Sarka[1)], Myslivec Radek[1, 3)], Zemkova Daniela[1, 2)], Marik Ivo[1, 4)] (Prague, Czech Republic)
**Hemi-epiphysiodesis at the knee region: long-term results of Ambulant Centre for Defects of Locomotor Apparatus, Prague, CZ**
*[1)] Ambulant Centre for Defects of Locomotor Apparatus; Prague; Czech Republic*
*[2)] Dept. of Paediatrics; University Hospital Motol; Prague; Czech Republic*
*[3)] Orthopaedic and Traumatology Department, Hospital Pribram, Czech Republic*
*[4)] Faculty of Medical Studies, West Bohemia University, Pilsner, Czech Republic*

Karski Jacek[1)], Karski Tomasz[2)], Kałakucki Jarosław[1)], Okoński Marek[1)] (Lublin, Poland)
**"Syndrome of contractures and deformities" and its causal influence in dysplasia of hips, wry neck, Blount disease and so-called idiopathic scoliosis**
*1) Medical University of Lublin*
*2) Vincent Pol University in Lublin, Poland*

Okoński Marek, Karski Jacek (Lublin, Poland)
**Spastic hip - clinical and radiological development**
*Medical University of Lublin, Poland*

## SESSION V – **ORTHOPAEDIC ANTHROPOLOGY. BIOMECHANICS**

**Chairmen**: DMITRI TESAKOV, PYRC JAROSLAW

Tesakov Dmitry K., Tesakova D.D., Beletsky A.V., Gigko-Mikhasevitch N.O. (Belarus, Minsk)
**Radiological features of bone growth of the pelvis and spine in patients with idiopathic scoliosis**
*Republic Scientific-Research Center of traumatology and orthopedic surgery Belarus, Minsk*

Cerny Pavel[1, 3)], Marik Ivo[2, 3)], Pallova Iveta[1)] (Prague, Czech Republic)
**The radiographic method for evaluation of axial vertebral rotation – presentation of the new method**
*[1)] ORTOTIKA I.l.c., Prague, Czech Republic*
*[2)] Ambulant Centre for Defects of Locomotor Apparatus I.l.c., Prague, Czech Republic*
*[3)] Faculty of Medical Studies, West Bohemia University, Pilsner, Czech Republic*

Domański Krzysztof, Kwiatkowski Michał, Popko Janusz (Bialystok, Poland)
**Effect of bracing on the quality of life of adolescents with idiopathic scoliosis**
*Department of Pediatric Orthopaedics and Traumatology, Medical University of Białystok, Poland*

Pyrc Jaroslaw (Dresden, Germany)
**Biomechanics of proximal femur due to pertrochanteric fracture**
**How important are accurate reduction and implant placing by treatment of proximal femur fractures**
*Centre of orthopaedic and trauma surgery, University Carl Gustav Carus, Dresden, Germany*

Karski Jacek, Okoński Marek (Lublin, Poland)
**Sinus tarsi – key in the treatment of flat feet**
*Medical University of Lublin, Poland*

15.30 – 18.30 AFTERNOON SESSIONS

## SESSION VI – **BIOMECHANICS**

**Chairmen**: MIROSLAV PETRTYL, JANA PARIZKOVA

Petrtyl Miroslav[1)], Denk Frantisek[1)], Marik Ivo[2, 3)] (Prague, Czech Republic)

**Acceleration of new bone formation in callus**

*[1)] Laboratory of Biomechanics and Biomaterial Engineering, Faculty of Civ. Engineering, Czech Technical University in Prague, Czech Republic*

*[2)] Ambulant Centre for Defects of Locomotor Apparatus, Prague, Czech Republic*

*[3)] Faculty of Medical Studies, West Bohemia University, Pilsner, Czech Republic*

Myslivec Radek[1, 3)], Marik Ivo[1, 4)], Petrasova Sarka[1)], Zemkova Daniela[1, 2)], Marikova Alena[1)]
(Prague, Czech Republic)

**Radiographic assessment of lengthening callus strength: comparison of achondroplasia and unilateral hypoplasia**

*[1)] Ambulant Centre for Defects of Locomotor Apparatus, Prague, Czech Republic*

*[2)] Paediatric Department, University Hospital Motol, Prague, Czech Republic*

*[3)] Othopaedic-Traumatologic Department, Regional Hospital Pribram, Czech Republic*

*4) Faculty of Medical Studies, West Bohemia University, Pilsner, Czech Republic*

## SESSION VII – **VARIA**

**Chairmen**: JANA PARIZKOVA, MIROSLAV PETRTYL

Sedlak Petr[1)], Pařízková Jana[2)], Vignerová Jana[3)], Daniš Robert[1)], Dvořáková Hana[4)]
(Prague, Czech Republic)

**Changes of body composition and motor abilities of preschool children during last five decades**

*[1)] Department. of Anthropology and Human Genetics, Faculty of Science, Charles University in Prague, Prague, Czech Republic*

*[2)] Obesity Management Centre, Institute of Endocrinology, Prague, Czech Republic*

*[3)] The National Institute of Public Health, Prague, Czech Republic*

*[4)] Faculty of Education, Charles University in Prague, Prague, Czech Republic*

Michał Karpiński[1)], Galicka A.[2)], Milewski R.[3)], Popko Janusz[1)] (Bialystok, Poland)
**Risk factors of low-energy fractures in children from mixed rural and urban Podlasie region**
*[1)] Department of Pediatric Orthopedics and Traumatology*
*[2)] Department of Medical Chemistry*
*[3)] Department of Statistics and Medical Informatics, Medical University of Białystok, Poland*

Pařízková Jana (Prague, Czech Republic)
**Bone fractures in obese children and adolescents**
*Obesity Management Centre, Institute of endocrinology, Prague, Czech Republic*

Csenge Szeverenyi (Debrecen Hungary)
**Historical review of clubfoot treatment**
*Department of Orthopaedic Surgery, University of Debrecen, Clinical Center, Debrecen, Hungary*

Wamser-Krasznai Waltrud, Krasznai Petúr (Frankfurt am Main, Germany)
**Symptoms of disease on antique figures?**
*DE- Butzbach / Frankfurt am Main*

Romanowski Richard (Malmoe, Sweden)
**Evidence Based Intermittent Pneumatic Compression (EBIPC) method**
*Rehabilitation Praxis. Malmoe, Sweden*

23rd SEPTEMBER (TUESDAY) Banquet in HUSAR Hotel. Beginning at 19.30

## WEDNESDAY, SEPTEMBER 24, 2014

8.45 – 12.00 MORNING SESSIONS
Note: In every session every lecture 20 min. (with discussion)

### SESSION VIII – **VARIA**

**Chairmen**: ZBIGNIEW KĘDZIERSKI, IVO MARIK

Ochen Paul[1), 2)] (Uganda)
**Challenges for treating and managing disabilities in Uganda (20 min.)**
*[1)] Afaayo Child Health education and Rehabilitation Unit (ACHERU), Mukono, Uganda*
*[2)] Bachelor of Science Physiotherapy student, University of Vincent Pol, Lublin- Poland*

Neff Georg (Berlin, Germany)
**Orthopaedics, Prosthetics and Orthotics in the Third World Countries (45 min.)**
*Berlin, Germany*

10.00 – 12.00 WORKSHOP HAND SURGERY

### APPLICATION DURING THE SYMPOSIUM REGISTRATION

**Chairmen**: KARSKI JACEK
**Lecturer**: SMRCKA VACLAV (PRAGUE, CZECH REPUBLIC)
*ESME l.l.c. & Plastic surgery Clinic, University Hospital Bulovka, Prague, Czech Republic*

**Titles of lectures:**
1. Flexor Tendon Repair
2. Extensor Tendon Repair (with Mallet Finger, Swan-neck Defomity and Boutonniére Deformity)
3. Skin Loss Defects and Replantation
4. Carpal Tunnel Syndrome/Release,
5. Tendinitis
6. Dupuytren´s Disease.

EXCURSION TO KOZŁÓWKA BY BUS AT 12.00.
Visiting of two museums Maybe it will not be possible!

On back journey lunch / dinner at DWÓR ANNA (16.00 – 19.00).

**UNCEREMONIOUS CLOSING OF THE SYMPOSIUM**

About 19.30 back travel to Lublin / Hotel.

**NOTES FOR ALL PARTICIPANTS**
Lectures and text slides will be presented in English. Time of the individual lectures contains time for discussion – about 20 min! A list of lectures (posters) and chairmen of sessions can be changed!

**Conference fee 10 Euros will be paid during registration. Payment for Banquet in HUSAR Hotel approximately 44 Euros and for Dinner / Supper in Dwor Anna approximately 20 € also paid during registration. Accommodation in Hotels everybody pays independently.**

Abstracts of lectures will be published (electronic edition) in the Supplement of the journal Locomotor System 3–4/2014 (http://www.pojivo.cz/en/newsletter).
Participants will receive the Symposium programme and Certificate of Attendance

## THURSDAY, SEPTEMBER 25, 2014 – DEPARTURE

ADDITIONAL INFORMATION

The HUSAR Hotel is located within a walking distance from the Symposium venue (8–10 minutes on foot, approx. 350 meters)

The cost of the stay in the Husar Hotel is: Double room – 22 € / Single room – 31 €

Coffee & tea during Symposium in the Hospital

**Secretary of the Symposium**
**Associate Professor Ivo Marik, MD, PhD.**
Prague, Czech Republic, E-mail: ambul_centrum@volny.cz

&

**Jacek Karski MD PhD.**
Lublin, Poland, E-mail: jkarski@vp.pl

Speech of welcome to

# The 16th Prague-Lublin-Sydney-St Petersburg Symposium – Disorders of growth and Defects of growth epiphysis

Prague, September 22, 2014

Ladies and Gentlemen, Dear Colleagues

It is my great pleasure to welcome you all at the 16th Symposium Prague-Lublin-Sydney-St Petersburg taking place on the days between the 21st and the 25th of September 2014, here in Lublin.

It is an honor for us to host the participants of the Symposium, which is an important event for orthopedics in Europe.

I am very happy and proud that it is taking place right now and right here in Lublin in our Hospital.

I would like to thank the members of the Scientific Committee for preparing and now participating in the Symposium. Many thanks to the authors for their contributions and numerous works prepared for the Symposium.

Two organizers of the Symposium should be greeted especially warm and these are:

– Professor Ivo Marik with his team from Prague
– Professor Michail Dunin with his team from St. Petersburg

Welcome to all our guests from Czech Republic, Russia, Hungary, Germany, Kazakhstan, Ukraine, Egypt, Sweden, Uganda, and Poland.

I hope that the hospitable atmosphere of the Symposium in Lublin will stimulate the exchange of specialist knowledge during the sessions as well as allow to relax and enjoy the stay in our city.

**Colonel Zbigniew Kędzierski MD, PhD**
Commandant of the 1st Military Clinical Hospital with Policlinic in Lublin, Poland

Ladies and gentlemen, dear colleagues,

I and my team from St. Petersburg Children's Rehabilitation Center of Orthopedics and Traumatology "Ogonyok" are heartily glad to congratulate all the participants of the 16th Prague-Lublin-Sydney-St. Petersburg Symposium with a new meeting in the welcoming Lublin.

We are very pleased that after our memorable meeting with Professor Tomasz Karski in Poznan at the Congress IRSSD 2012 you took us in your community. I hope that you still have a good impression of the XV Prague-Lublin-Sydney Symposium at St. Petersburg, where there was a discussion on various aspects of the musculoskeletal system problems.

I, as participant of many international symposia and congresses in orthopedics, want to emphasize that only in interdisciplinary cooperation we could achieve success in our ancient profession – medicine. I hope that the new exchange of views and opinions would serve as an impetus to creative research for all the participants of the Symposium.

Sincerely yours

**Professor Mikhail Dudin**
Director of Children's Rehabilitation Center of Orthopedics
and Traumatology "Ogonyok" St. Petersburg, Russia

Dear Ladies and Gentlemen, dear Participants and Friends
of the 16th Prague-Lublin-Sydney-St. Petersburg Symposium

I am honoured to welcome you at this 16th Scientific International Orthopaedic Meeting. It was and it is possible thanks to Professor Ivo Marik from Prague – thanks to his open-mindedness and willingness to review tendencies and interdisciplinary problems in research and treatment of musculoskeletal disorders especially from the point of orthopaedic surgery, rehabilitation, orthopaedic prosthetics and biomechanics view, as well as his endeavour to learn and to teach mutually.

I met my friend Professor Ivo Marik in Bratislava in Cervenansky Days, many years ago (1997/1998). After my lectures about spine disorders Professor Marik come to me and ask for a more detailed explanation of my lecture. That is how our friendly meetings in field of orthopaedics started. Since then the permanent and fruitful cooperation between Prague – Lublin has been going on.

I wish all orthopaedic surgeons to be as open and active and searching for the truth in science as Professor Ivo Marik. We all should remember the words of Hippokrates: "There are in fact two things; science and opinion. The former begets knowledge, the latter – ignorance".

I wish all participants of this Symposium to stay really connected with knowledge and science. I wish you all to have interesting presentations and successful discussions, as well as pleasant stay in Lublin. You all, from all countries, are our friends, you all are welcome in Lublin.

**Prof. Tomasz Karski MD PhD**
Former head of the Paediatric Orthopaedic and Rehabilitation Department
of Medical University in Lublin (1995–2009)
Actually: Professor Lecturer in Vincent Pol University in Lublin

Dear participants, my dear colleagues,

As a founder and one of the organizers of the Symposium I would like cordially to welcome you at this international event that is also held on the opportunity of anniversaries of Professor Tomasz Karski, MD, PhD and Professor Mikhail Dudin, MD, DSc. I am very pleased that from the bilateral Symposium Prague-Sydney in the year 1998 the Symposium has gradually spread to the Prague-Lublin-Sydney and the Prague-Lublin- Sydney-St. Petersburg Symposium. According to the programme this year we can look forward to outstanding lectures of colleagues from Australia, Belarus, Czech Republic, Egypt, Germany, Hungary, Kazakhstan, Poland, Russia, Sweden, Uganda, Ukraine, i.e. representatives of 12 nations.

My warm thanks belong to all organizers and mainly to the General Director Dr. Zbigniew Kedzierski MD, Mgr. Beata Slowinska from Military University's Hospital and Lady Secretary - Mrs. Halinka Wolyniec in Lublin, last but not least then to Professor Tomasz Karski MD, PhD, Jacek Karski MD, PhD and their family team. I believe that we all spend together three days which amplified our experience and knowledge in the comprehensive care and treatment of disabled patients. I am sure that we enjoy not only from new scientific information, but we can look forward to social occasions due to kind hospitality of the Lublin organizers.

Let me a reminiscence of a few famous persons who significantly inspired me to carry the torch of the Prague-Lublin-Sydney-St. Petersburg Symposium.

Associate Professor Ivo Marik, MD, PhD, FABI

See photos on the next page

1. Professor Kazimierz Kozlowski, Poznaň, Poland 2010
2. Professor Michael Bellemore, Pilsen, Czech Republic, 2014
3. Professor Tomasz Karski, Sarbinowo, Poland, 2012
4. Professor Mikhail Dudin, St. Petersburg, Russia, 2013

I sincerely wish the great success to the 16th Prague-Lublin-Sydney-St Petersburg Symposium and I consider the Symposium to be open.

Professor Kazimierz Kozlowski (right), Poznan, Poland 2010


Professor Michael Bellemore (right) Pilsen, Czech Republic, 2014

Profesor Tomas Karski (left), Sarbinowo, Poland, 2012

Professor Mikhail Dudin (left), St. Petersburg, Russia, 2013

**PERSPECTIVE REVIEW ARTICLE**

## VÝVOJ A RŮST SKELETU. RŮSTOVÁ CHRUPAVKA. DEVELOPMENT AND GROWTH OF SKELETON. GROWTH CARTILAGE.

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Development and growth of skeleton. Growth plate

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In the last 20 years, considerable progress was made in our genetic and molecular understanding of the process of skeletal development, chondrogenesis, joint formation, and osteogenesis. This review is focused on endochondral ossification, especially on the growth plate. Understanding of the processes running on the growth plate allows us to elucidate a large part of both primary and secondary growth disorders and skeletal deformities and helps us to search for the appropriate treatment.

Growth plate is an avascular structure occupying a narrow space at each end of the expanding bone. Within the growth plate the various subpopulations of chondrocytes, resting, proliferating, and hypertrophic, are arranged in columns, representing the entire sequence of cell differentiation. The zone of hypertrophic chondrocytes deserves special attention because 90% of bone growth is attributable to increase in cell size and deposition of extracellular matrix and these hypertrophic chondrocytes prepare conditions for removal by bone. In this zone provisional calcification occurs. Hypertrophic chondrocytes died through apoptosis, after vascular invasion cartilaginous ECM is replaced by a bone ECM secreted by osteoblasts.

Extracellular matrix presents not only "building material" but also regulates the chondrocytes differentiation. In the resting and proliferating zones the main components of ECM are collagen II, IX and XI and glycosaminoglycans, in hypertrophic zone collagen X. Mutation in collagen II produces a wide range of systemic (intrinsic) growth disorders with typical clinical and rentgenological manifestation which place to various nosological entities according to type and localization of the mutation: from lethal achondrogenesis, spondyloepiphyseal dysplasia, Kniest dysplasia, spondyloperipheral dysplasia, Stickler syndrome, spondyloepiphyseal dysplasia with short metatarsals (former Czech dysplasia). Mutations damaged further components of cartilaginous ECM result in multiple epiphyseal dysplasia, pseudoachondroplasia (COMP), diastrophic dysplasia (SLC25A2). Mutations in various genes could have very similar clinical picture, but on the other hand mutations in one gene can cause different nosological entities (i.e. genetic heterogeneity and/or genetic variability). Disruption of hypertrophic zone development cause mainly metaphyseal changes (e.g. Schmid dysplasia, COL X) Collagen I is the overriding organic component of bone ECM. Mutations in this gene are the most frequent cause of osteogenesis imperfecta. The development of chondrocytes and bone cells is influenced by a number of factors which control their proliferation and maturation whereas these processes are tightly counterbalanced. Transcription factor SOX9 (among others) plays a major role during nonhyperthtrophic chondrocyte differentiation and stimulates together with SOX6 and SOX5

the synthesis of cartilaginous ECM. The consequence of mutation in this gene is campomelic dysplasia. On the other hand RUNX2/Cbfa1 stimulates the development of osteoblasts and is required for hypertrophic chondrocytes differentiation. Haploinsufficiency of this gene leads to cleidocranial dysplasia. Indian hedgehog (IHH) stimulates chondrocyte proliferation and together with RUNX2 also osteoblast differentiation, on the other hand indirectly (through TGF beta, PTHrP) slowing down the process of chondrocyte hypertrophy. FGFR3 reduces the cell proliferation rate and negatively regulates chondrocytes hypertrophy. On the other hand FGF signaling positively regulates osteoblast proliferation. Gain-of-function mutations in FGFR3 in man are the causes of achondroplsia, hypochondroplasia and thanatophoric dysplasia. SHOX gene is a transcription factor regulating the expression of further genes and through SOX5 and SOX6 regulates aggrecan expression. Haploinsufficiency or mutation of this gene are the main causes of short stature in Turner syndrome, dyschondroosteosis Leri Weil and Langer dysplasia and some cases of idiopatic short stature. In addition to FGF and Ihh signaling, one other growth molecular C-type natriuretic peptide (CNP) has been shown to affect chondrocyte proliferation. CNP favors chondrocyte proliferation and longitudinal growth of fetal bone. Homozygous mutations of the transmembrane natriuretic peptide receptor (NPR-B) gene (NPR2) caused acromesomelic dysplasia type Maroteaux and heterozygous mutation manifested by idiopatic short stature. How this pathway relates to the FGF, TGF or Ihh pathways has not yet been elucidated. New studies suggest that CNP analogues may provide a novel therapeutic approach to growth disorders. Growth hormone produced by the pituitary gland and IGF1 produced by proliferating and hypertrophic chondrocytes, appear to act largely independently to control the rate of chondrocyte proliferation. They appear to be the major regulators of linear bone growth and body size in mammals. Lower expression of IGF1 due to malnutrition and chronic inflammation is the cause of secondary growth failure in number of chronic diseases. Thyroidal hormones also participate in the processes of chondrocyte maturation through wnt signaling. In the past, vitamin D dependent rickets was one of the frequent causes of growth failure. The disorders of calciophosphate metabolism may be congenital or accompanying some chronic diseases. Apart from mentioned genetic, hormonal and metabolic influences, the resulting shape and architecture of the skeleton is determined by intermittent cyclic supraliminal loading that stimulates osteoresorption or osteoformation through RANKL-RANK-OPG pathway (that is coupled to the dual action of tumour growth factor beta -TGF-beta) and by effect of periosteal membrane and perichondrium (in the region of growth plates). The global thickening of the bone tissue includes the sequence of biomechanical-chemical processes (i.e. biochemical reactions and steady states) whose result is the increase of density in the bone tissue.

The review is documented on patients diagnosed and in the long term treated in the Ambulant Centre for Defects of Locomotor Apparatus.

**Key words:** growth plate, growth failure, skeletal biology, bone dysplasia

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**REVIEW ARTICLE**

## MATERIAL PROPERTIES OF CONNECTIVE TISSUES ACROSS SYNDROMOLOGY GENETIC SKELETAL DISORDERS AND PATHOBIOMECHANICS

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## Introduction

The material properties of connective tissues (skeleton, tendons, joints) at the genetic skeletal disorders (inborn and connective tissue diseases, bone or skeletal dysplasias and congenital limb defects) are important as for abnormal development of musculoskeletal system as for results of symptomatic comprehensive treatment i.e. physiotherapy, orthotic treatment and prosthetic fittings, surgical therapy (e.g. endoprostheses, transplantations, reconstructive surgery of bone and joints, etc.) and administration of calciotropic drugs. Surgeons should respect pathophysiological changes of connective tissue and individually abnormal pathobiomechanics of musculoskeletal system.

## Methods and patients

The genetic analysis explains changes of tissues material properties on the basis of molecular genetic examination, genealogy, biochemical investigation, rentgenology, nuclear magnetic resonance, ultrasound picture and on the basis of somatoscopy, anthropology and biometrics including dermatoglyphic picture and craniometry.

We describe the material properties at disproportional bone dysplasias – e.g. achondroplasia, hypochondroplasia, diastrophic dysplasia, pseudoachondroplasia, mesomelic bone dysplasias, metaphyseal dysplasias, multiple epiphyseal dysplasias and some collagenopathies like osteogenesis imperfecta (OI), Marfan syndrome. Further diseases with chaotic growth of connective tissues as multiple cartilagineous exostoses and enchondromatosis are mentioned. Congenital isolated defects of extremities are in many cases a part of typical symptomatology, e.g. proximal femoral focal dysplasia (PFFD), femur-fibula-ulna syndrom (FFU, fibular hemimelia), femur-tibia-radius syndrom (FTR). All these limb defects have a scale of very peculiar abnormalities of tissue material properties which are important for course of skeletal and joints pathobiomechanics.

## Results

We described a few nosologic units where on mutational changes basis are present aberrant genes products determining connective tissue material properties aberration with many primary or secondary biomechanical effects on musculoskeletal system.

The achondroplasia (ACH) is characterised by rhizomelic shortening of extremities and typical spondylo-metaphyseal changes and deformities at X-rays. The cause is abnormal endochondral ossification due to FGFR3 gene mutation. The gene is located to the 4p (short arm) region. Primarily, the upper segments of all extremities are symmetrically shortened (it is called rhizomelic dwarfism) and vertebral bodies of thoracic and lumbar region are wedged.

Biomechanical changes of extremities and spine and hypermobility lead to abnormal ventral position of pelvis and flexion contractures of hips and elbows. Toddlers with achondroplasia (ACH) have more pronounced problems with locomotion. Auxologic biometric changes determine atypical and retarded motor development.

The abnormal biomechanical changes of skeleton and disproporcionality determine predisposition to osteoarthritis and spondylarthritis. The achondroplastic patients suffer from spine stenosis (due to defect of endochondral ossification) and are candidates for spine surgery. Endoprostheses of big joints are usually not indicated. There is a problem with a size of acetabular and femoral components. The material tissue properties of long bones are not deteriorated and lengthening procedures can be individually indicated. Lengthening of extremities in achondroplastic patients leads to improve stature proportionality.

Similar problems are presented at hypochondroplasia (a mild form of ACH from another mutation position in the gene FGFR 3).

Diastrophic dysplasia (DD) is rhizomelic bone dysplasia with radiological dysplastic changes of epi-, metaphyses and vertebrae. The bone growth is more affected as at above reported ACH. The shortening of long bones is accompanied by torsion. Typical is a progressive kyphoskoliosis with growth. The term diastrophicus is derived from Greek and indicate skeletal torsion changes, which are described mathematically. From etiopatogenic point of view (genetic cause) cartilage and bone disturbancies arise from insufficient sulfatation of proteglycans. The sulfatation is very important and necessary for metabolic pathways (heparansulfate, dermatansulfate and chondroitinsulfate). Etiology of the disease is gene mutation for enzyme sulfate transporter. The mutation is autosomal recessive character (the metabolic disease sui generis). The most affected chondrocytes are both in joint and growth cartilage. So deteriorated growth gives to severe skeletal deformities and preliminary osteoarthritic changes. The patients are candidates for reconstructive surgery of clubfeet, corrective osteotomies and endoprostheses in early age. Material properties of bone tissue are not basic problem for lengthening but joint contractures are contraindication of this procedure. Therapeutic philosophy resulted from constitutional cartilage undersulfatation and medicament repair.. Pharmacological compensation with chondroitinsulfate administration is very difficult, dubious, controversary and problematic.

Pseudoachondroplasia (PSACH): disproportional changes and growth retardation develop in first 2 years of life when the clinical picture is expressed. Symptomatology of bone dysplasia is not highlighted prenatally and after birth. The causative mutation has autosomal dominant (AD) character and it has impact on production and polymerisation of cartilage oligomeric matrix protein (COMP). The finally gene product is posttranslation homopentamer (similar composition as immunoglobuline M). COMP is compound from identical chains (in the normal conditions without mutation). AD mutation cause posttranslation disturbations in the polymer composition. According to combinatoric laws only 3 % pentamers are normal polymers and 97 % included mutations. The gene is located to the 19p (short arm) region, near to the receptore gene for apolipoprotein E. The primary gene product – monomer COMP is expressed in joint cartilage and tendons. The macromolecule COMP is visible in electron microscopy.

Leri – Weill disease is caused SHOX gene mutation in pseudoautosomal Xp PAR 1 region. The gene (gene product respectively) called short sature homeobox gene regulates via FGFR 3 pathway bone ossification and determine previously mesomelic skeletal shortening of extremities. The term mesomelic means shortening of middle segments of extremities. Second one sign typical for Leri – Weill syndrome are deformities and radioulnar synostoses. We talk about pseudorheumatic and osteoarthritis changes. The gene mutation is obviously in heterozygote

allelic configurations. Homozygotes represent more severe form of disease, allelic form for the same gene is called Langer dysplasia.

Metaphyseal dysplasia, type Schmid is collagenopathy, especially for the triple helix of collagen X (homomeric triple helix of collagen X). Phenotype of Schmid dysplasia is the typical disproportional shortening of the lower body segment and genua vara. Metaphyseal dysplastic radiographic features are a little similar to hypophosphatemic rickekts but markers of calciophosphate metabolism are normal. Collagen X is expressed previously in the metaphyseal area of bones. The gene expression situation is well documented with help of histochemical staining of collagen X mRNA (silver staining).

Genetically determined material bone tissue changes express as the varosity of legs. Asymmetrical pressure and forces gives disposition to pre-osteoarthritis of knee joints. Corrective osteotomies in childhood are a method of choice.

Multiple epiphyseal dysplasia is from the genetic and etiopathogenetic point of view – heterogenic disease. It is typical pre-osteoarthritis caused by mutation of collagen II or COMP and sulphate transporter (autosomal recessive form). Epiphyseal dysplastic radiographic features and bone maturation retardation have diagnostic value. From the pathogenetic point of view there are important the collagen II solvations envelope changes. The collagen II mutation affection leads to the pre-osteoarthritis. The abnormal pressure in arthrotic joints is determined via cell membrane minorite gene activation for another types of collagene in the joint cartilage (e.g. IX, X, XI). The non obvious collagen types have little solvatation water envelope again and do not provide sufficient protection of joint cartilage.

The children have painful locomotion and in this situation is necessary protection before locomotion stress. Adults are candidates for early endoprostheses.

We know the overlaping syndromes to the pseudoachondroplasia in many cases COMP mutations (we talk about heterogeneity).

Osteogenesis imperfecta – is the group very heterogenous diseases. Osteogenesis imperfecta (OI) is very heterogenous, but in most cases (previously) determined mutation in the alfa 1 or alfa 2 chain for bone collagen, type I. Genetic determined disease osteogenesis imperfecta is widespread and common in all populations of the world. We don´t know the predilection for some ethnical groups. The frequency of disease is unclear and many cases fade the diagnostics. The mild cases are diagnosed as osteoporosis at an advanced age. It is impairment (or defect) of osteoblasts and or from the osteoblastic lines derivated cells. The disease is previously advanced from the collagen I (bone collagen). The diagnostics on the molecular level is important and facilitates the treatment. Bone is present as non mature tissue, typical is liability to fractures and or microfractures with tendency to skeleton deformities.

Sillence (1979) recognised according to different phenotypes of OI, type I, II, III and IV, which are determined by collagen mutations. The other very rare (11 types OI) are the results of genes mutations for non – collagen proteins. The mutations in the alfa-1 chain are most often, the second one are alfa-2 chain mutations. Because other 11 types are very rare, our aim is detection the point mutations alfa-1 and alfa-2 collagen I chains. The heredity is mostly autosomal dominant (AD). Some cases are autosomal recessive (AR) type, namely at non – collagenous peculiary types of OI. This is the order pathobiomechanical consequencies leading to instability triple helix collagen and insuficient ossification and calcification. The mutations caused lower melting

temperature (Tm) DNA – lower termoresistance double helix DNA. Contemporary is noted the lower melting temperature of collagen macromolecules heterotrimers. The macromolecule stability is totally affected.

From the methodic point of view DNA isolation and their analysis from peripheral blood samples were carried out in the accredited molecular laboratory GENVIA. In years 2010 – 2013 DNA samples of 36 probands were analysed with using PCR methods and following direct PCR products sequencing. The investigation was focused on the causative mutation detections in coding gene regions for COLI alfa-1 and alfa-2 chains that are responsive for OI type I, II, III and IV. The methods are provided according to Gajk-Galicka et al. 2002 and Politts, R., 2006.

Results of a cohort of 36 OI patients. The causative mutations were detected at 32 patients and negative were 4 patients (which are probably non collagenous types). The most common are mutations in glycine triplets – 12 cases and each one mutation is located to the alfa 1 chain. At 24 from 32 positive patients mutations are displaced at alfa-1 chain, only 8 cases at alfa-2 chain.

There were described (Marini et al. 2007) about 832 causative mutations up to date 2007, which cause OI type II, III and IV. More obvious are variants in the alfa-1 chain: 1352 variants including 790 substitutions, 107 non sense and 171 frame shift mutations. The interpretation of variants is not clear, yet. The variants in the alfa-2 chain are not so numerary as in the previously alfa-1 chain.

The clinical – anthropological classification is used so far for the orientation. There are the intrafamiliar relatively variable expresivity and penetrance in the families with multiple incidence and there are different suffering patients in the same family. It is very difficult to estimate the connection between mutation and therapy ability and its efficiency.

The amino acid glycin is most obvious in the collagen linear sequency and correlate with frequency of targeted mutations which were founded. All from detected mutations were in heterozygotes composition. Another mutations changes were detected in codons for prolin, asparagin, arginin, glutamin and tyrosin. Accidentally we found suspected splicing error.

All mutations result from mentioned lower melting temperature for the triple helix and damage its thermo resistance as well as this phenomena correlate with the lower melting temperature for double helix DNA. In these directions the posttranslations changes at compound triple helix collagen I macromolecules are disturbed.

Dysplasia cleidocranialis – is heterogenic group of diseases, most often AD type of heredity. CBFA gene mutation determines low density of skeleton from disturbance of ossification. CBFA gene is the regulatory gene. There are demonstrated systemic changes of skeleton (previously at bones which have desmogenic origin).

Osteopetrosis – heterogenous group of the diseases with mendelian type of the inheritance. There is high density of skeleton from the failure of osteoclastic function and with bone fragility. Sclerotic bones are very hard but fragile.

Marfan syndrome is autosomal dominant, heterogenous disease of connective tissue previously caused by fibrillin mutations.

There is high laxity of connective tissues and hypermobility of joints with many dangerous symptoms as rupture of aortal aneurysma, progressive scoliosis, lens dislocation, etc.

Multiple cartilagineous exostoses (MCE) belong to the group of chaotic growth of connective tissues. There are isolated defects the glykosyltransferases exostosin 1 – 8q, exostosin 2 – 12p and 3 (19p).

Enchondromatosis like to the MCE belongs to the group of chaotic growth of connective tissues, but another character. Obviously is known as fresh AD somatic mutation, so-called hemimelic forms (morbus Ollier). Although we talk about the autosomal dominant mendelian inheritance, the mutation is not able to go through germinal lines to the next generation. Variant of the disease when signs included the presence hemangiomatosis is designed as Maffuci syndrome. Both mentioned disorders have high disposition to malignant degeneration.

Longitudinal extremities defect are known as femur-fibula-ulna (FFU) or femur-tibia –radius (FTR) syndrome. Both syndromes are biomechanically important from the point of leg length discrepancy and joint instability view. The prosthetic fitting and/or lengthening procedures are methods of symptomatic therapeutical choice in the most of cases FFU, FTR and PFFD.

## Discussion

Common pathology of the connective tissue diseases are contractures, hyperlaxity, osteoporosis, osteosclerosis, premature osteoarthritis, spondylosis and spondyl-arthritis. The basic knowledge of genetic skeletal disorders (inborn and connective tissue diseases, bone or skeletal dysplasias and congenital limb defects) is very important for physicians and surgeons who are interested in comprehensive treatment of musculoskeletal and neuronal diseases. Each nosologic unit is characterised by genetically programmed specific tissue material properties that influence development of skeleton, tendons, joints and their biomechanics. Abnormal material tissue properties significantly influence and direct application of the most appropriate methods of treatment. Physiotherapy, orthotic treatment, prosthetic fitting, surgical treatment, transplantation and bone and joint reconstructive surgery must respect this tissue pathology and pathobiomechanics of musculoskeletal system.

**Key words:** material tissue properties – epigenetic signs – mendelian and polygenic inheritance – osteoporosis – osteoarthritis – bone and joint pathobiomechanics

## ABSTRACT

### CONGENITAL DEFECTS OF THE HAND – ONTOGENESIS, PHYLOGENESIS AND TISSUE SYSTEMS

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The findings of palaeontology point to the phylogenetic evolution of the hand. The findings of palaeopahtology help to find the origin of congenital deformities.

For ontogeny we used embryologic diagrams of Wolpert and 30 palaeopathological specimens of extremities from the 19th century.

Untreated palaeopathological cases served us as a model for clinical insufficiencies, for example for aplasias of the metacarpi.

Drafts of the algorithms with techniques in congenital deformities from the point of view of the affected system of flexors, extensors, ligaments and bone system are presented.

The affection of the flexor system manifests itself by contractures which appear with acceleration of the bone growth, in the period of the growth acceleration, especially around the 7th and 15th years of age. We talk about retarded congenital deformities.

Affection of the flexor system by a congenital deformity can be solved in surgical manner and by splinting, the extensor system usually by splinting. Bone system affected by a congenital deformity must be treated in surgical way.

To treat congenital deformities of the hand a co-operation of plastic surgeon, orthopaedist, anthropologist and geneticist is suitable.

**Key words:** Congenital defects, upper extremity, hand, ontogenesis, phylogenesis, comprehensive treatment

## ABSTRACT

### RECONSTRUCTIVE SURGERY OF RARE UPPER LIMB CONGENITAL DEFECTS: 3 CASE REPORTS

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The main objective is to present rare congenital differences of the upper extremity that belong to Category II of the modified classification of congenital hand deformities by Ogino et al. (1986). This classification was adopted by the Japanese Society for Surgery of the Hand in 1996. Category II includes incomplete formation of the joint, contracture and deformities due to failure of differentiation of parts and tumor-like conditions. It may result in synostosis, ankylosis and congenital dislocation.

## We present

**1. Proximal radioulnar synostosis and ulnar hypoplasia**

Radioulnar synostosis can take 2 forms: congenital (described by Sandifort in 1793) and posttraumatic (described first by Gros in 1864).

Congenital forms occur:

- By itself (in isolation)
- In association with problems of the heart, kidneys, nervous or GIT system
- In association with certain skeletal abnormalities and genetic syndromes (e.g. Holt-Oram syndrome, fetal alcohol syndrome – about 1/3 cases)

It affects both arms about in 60 %. Boys and girls are equally affected.

## Embryological pathogenesis

The humerus, radius, and ulna become visible at 37 days. Initially, the cartilaginous humerus, radius, and ulna are connected before segmentation. For a short time, the radius and ulna share a common perichondrium. Abnormal events at this time can lead to a failure of segmentation.

Two congenital cases are presented and the results of surgery documented. Conclusin: The method of choice is derotative osteotomy in the place of synostosis aimed to correction of hyperpronation or supination. Separation of synostosis is not indicated.

In suitable cases lengthening of distal ulna to prevent pseudo-Madelung deformity is carried out or partial radial epiphyseodesis to correct this one (and/or corrective OT of radius when growth is finished).

**2. Partial ulnar deficiency associated with dislocation of radial head and humeroulnar synchrondrosis**

Ulnar ray deficiency is rare and has a variable presentation. The developmental biology of the anomaly is still not fully understood.

By T. Ogino (1988) the degree of ulnar arrest was closely related to the severity of deficiency of the fingers and also to abnormalities of the elbow joint. Ulnar deficiency was induced by busulfan in rat fetuses. The critical period of ulnar deficiency was earlier than that of other anomalies and it corresponds to the period of a high mortality rate of fetuses.

We present step by step surgical treatment of this rare deficiency and long-term result.

Conclusion: Resection of ulnar fibrocartilago as soon as possible to prevent radial bowing and Madelung deformity (the same approach as in cases of fibular hemimelia). Individual comprehensive treatment (physiotherapy, orthotic fitting). Corrective OT of radius when growth is finished.

**3. Humero-radial and humero-ulnar synostoses, partial aplasia of scapula, humerus, radius and ulna and ankylosis of metacarpo-phalangeal joints associated with cleft hand.**

No similar case was described. The functional rudimental of upper extremity is the aim of comprehensive treatment. Orthotic and prosthetic fitting should prevent a static scoliosis (due to uneven weight of upper extremities). Conclusion: a partial correction of the shape of the partial defect of upper extremity can improve its working capacity.

## Conclusion

Individual comprehensive treatment of rare upper limb congenital defects needs close cooperation of paediatric orthopaedic and plastic surgeons with anthropologist and physiotherapist.

Note this lecture was presented at:

1. The 12th Congress of the Czech Society for Hand Surgery and The 1st Congress of the Czech Society for Hand Rehabilitation, 14. – 16. 11. 2013, Mountain Hotel Sepetná, Beskydy, CZ
2. The 19th Kubat´s day, 7. – 8.3.2014, Domus Medicorum, Prague, CZ

**Key words:** proximal radioulnar synostosis, ulnar ray deficiency, humero-radial and humero--ulnar synostoses

## ABSTRACT

### CLINICAL VALUE OF NEONATAL SCREENING FOR CONGENITAL DYSPLASIA OF THE HIP: 20 YEARS EVALUATION OF THE EFFECTIVENESS OF ULTRASOUND SCREENING

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Background Developmental dysplasia of the hip (DDH) is a term describing a hip abnormalities from a shallow acetabulum to a dislocated hip. The reported incidence of DDH varies (among countries, regions and races). In central Europe and Poland it is more common and it can be as high as 4%. Early diagnosis is the basis for the good outcome of treatment. Ultrasonography is now a standard procedure in the diagnosis of DDH. Together with the clinical examination it

can certainly determine the status of the development of the hip joint. Since the introduction of ultrasound to the study of the hip of newborns a variety of screening programs have been recommended. Starting from clinical screening of neonatal and further study of children at risk only, to clinical and ultrasound screening of all newborns.

## Material and methods

At the Department of Children Orthopedics of Medical University of Bialystok, hip ultrasound for newborns began in 1991. On average, 1,000 tests per year is performed. Particular attention is paid to children with risk factors such as breech birth, female gender, positive family history, congenital deformities of the lower limbs or intrauterine crowding syndrome. As a rule, a first ultrasound is performed in the first month of life (on average 4-6 weeks) and then after completing three months of age. During the first visit, we teach parents the proper care of a child with special attention to maintain abduction position of hips. In the case of hip dysplasia tests are carried out more frequently, until cure. For the study of newborn and older children we are using a linear probe 7.5 – 9 MHz.

## Results

Features of immaturity (type IIa hips according to Graf) was found in 2.8% of hip joints. Hip dysplasia (type IIb – IV according to Graf) were present in 2.3% of children. Only 20.3% of hip dysplasia occurred were in a high risk group. Treatment of dysplasia was dependent on the degree of immaturity of the hip and the age of the child, in which the diagnosis of hip dysplasia was made. In the treatment of low degrees of dysplasia we are using wide diapers, Frejka pillow and Pavlik harness. For higher grades especially with dislocation overhead traction, casting and surgical treatment are used. Surgical treatment was restricted gradually to 2–3 cases per year, and now we are forced to surgery only in rare cases (in the last 5 years, 2 cases). As compared to the period before introduction of screening, there is more than 10-times decrease in severe surgery of dislocated hips.

## Conclusions

The results support the aim of performing hip screening in all newborns in the proposed scheme. The examination of children at risk only could pose a risk of increase in number late recognition of dysplasia and hip dislocation. The proposed scheme of study in just 4-6 weeks of age and after completing three months of age is valued as effective, which confirms the decrease in the number of operated patients. We found ultrasound to be the test of choice in the infant (< 6 months) as the proximal femoral epiphysis has not yet significantly ossified. The costs of screening the whole population of children seems disproportionately low compared to the cost of the surgical treatment of congenital hip dysplasia resulting in disability and early osteoarthritis.

**Key words:** neonatal screening, hip congenital dysplasia, ultrasound screening

## ABSTRACT

### "IMPERFECT HIPS" – CLINICAL SYMPTOMS IN TWO TYPES OF FUNCTIONAL INSUFFICIENCY WITH PAIN – AFTER YEARS WITH FULL SIGNALS OF OSTEOARTHRITIS

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## Introduction

The presentation is based on the material from Paediatric Orthopaedic and Rehabilitation Department, from Out-Patient Clinic of authors and from Policlinic of Military Hospital in Lublin from the years 1995 – 2013. The authors presented the clinical and radiological features of hips, literature to these themes, methods of prevention and treatment. The lecture presents problems of pain syndrome as first sign of illness in left hip as results not full cured dysplasia, or in right hip as result of "Syndrome of standing on the right leg".

Newborns, babies and small children with hips problems. The beginning of treatment of hips should be performed as early as possible, the best in 1st – 3rd week of life (Ortolani, Vizkelety, Bjerkreim, Papp, Rigo, Szepesi, Meszaros, Dega, Szulc, Piatkowski, Karski and others). Only such early treatment of hips can protect against "imperfect hips".

What's mean "imperfect hips". In our orthopaedic praxis we see patients with various symptoms as pain, limited movement of hips, temporary limping. The X-ray examination in such patients shows us "almost normal joints". Exactly investigation of their X-ray pictures show normal Wiberg´s angle, normal CCD angle, normal AT angle and even good or almost good roof (covering of the femoral head) but the congruence of "femoral head in acetabulum" is not proper – the distance from femoral head to bottom of acetabulum is much bigger then distance of femoral head to the roof. Such hips are permanent overstressed during gait (in lecture is presented mathematical rules of function of hip joint) and the first symptoms are pain and later full sign of arthrosis. The arthrosis of left hip is mostly connected with primary hip dysplasia, not sufficient treated in childhood period. The arthrosis of right hip is connected with "the syndrome of standing on the right leg" over years. The first symptoms of "imperfect hips" appear in age of 35 – 45 (90%). Only in few cases in age of 16 – 25 (10%).

## Material

The patients with incidence "of pain syndrome in hip" in material of all authors are in the years 1995 – 2013 (N) 552. Age of patients 16 – 85 years.

## Clinic of "imperfect hips"

Every of adult people lose with years of life – abduction, internal rotation and extension of the hips. Some patients present „such limitation of movements" of left side (30%) others of right side (70%). The pain syndrome of the left hip as the first sign of illness is result of not full cured dysplasia, or of the right hip as result of "Syndrome of standing on the right leg". The first symptoms of insufficiency of hips are: pain – very often on beginning of day, only temporary, pain after long wandering, after sport. Sometimes patients present limping – in beginning period only temporary. The pain is in inguinal region, sometimes on lateral side of hip, at some patients in lateral upper part of femur.

## The prophylaxis and treatment of "imperfect hips"

The aim of treatment and prophylaxis (in many cases it is equal) is to restore the full movement of hips and changes the direction of loading during standing and gait for every day. The lecture present exercises (kinesiotherapy elaborated in 25 years, method of physiotherapy and exercises in geothermal waters (the best in Hungary).

## Conclusions

1) The hips in newborn, babies and small children must be cured in 100% (restitutio ad integrum)
2) Not fully treated hips with years will be only worse (imperfect hips)
3) Remember about "Syndrome of standing on the right leg – and change loading in life of every patient for the same percentage – on left, on right and on both legs
4) Proper physiotherapy can protect before coxarthritis for many years.

Literature in authors and in www.ortopedia.karski.lublin.pl

## ABSTRACT

### ANATOMIC AND FUNCTIONAL PROFILE AND INDEX OF THERAPEUTIC REACTIVITY AS A MEANS OF TREATMENT AND REHABILITATION PROGRAMME MANAGEMENT

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The issue of assessing the quality of healthcare provision is an important professional and social problem. This problem is multi-factorial and includes a number of elements. One of such elements is the assessment of the actual medical interventions aimed at correcting and restoring malfunctions of the patient body. These interventions must be of a systematic nature, take

into account the complex and multi-dimensional relationships, and may be called treatment and rehabilitation programs (TRP).

Currently, the standards of healthcare provision developed by the Ministry of Healthcare and Social Development of Russia can serve as an example of such programs. However, despite all the advantages of such standards their application to each specific patient is quite a challenge, for they do not fully take into account the individual characteristics. To manage the development of treatment and rehabilitation programs computer technologies have been increasingly employed. Solution to this problem in the PION-SE system is based on the most accurate and objective description of the initial state of the patient using formalized protocols of examination by specialists, as well as laboratory and instrumental methods of examination. From this raw data Anatomic and Functional Profile of the Patient (AFPP) is created, which serves as the basis for tracking the dynamics of the patient in the course of implementation of an individual TRP.

For better monitoring of the patient's condition and evaluation of efficiency of the activities being implemented the system tracks the dynamics of indicators by means of generating additional AFPPs revealing positive or negative parameter changes resulting from the set of undertaken interventions. The dynamics of these indicators allows to evaluate the effectiveness of interventions and to conduct their timely correction. This allows calculate the index of therapeutic reactivity of a patient (ITRP). The frequency of AFPP generation is decided upon by the doctor in charge depending on the obtained data, severity of the patient's condition and requirements of the standards. ITRP is an important indicator, since it can serve as the basis for assessing the rehabilitation potential, which solves the complex and urgent problem of a short-term forecast of interventions effectiveness. In addition, this approach makes it possible to conduct the TRPs in a well-documented manner, make them transparent for monitoring and assessment, and, due to good visualization and a high degree of automation allows facilitate the work of medical staff at all stages of management.

**Key words:** quality of healthcare, index of therapeutic reactivity, treatment and rehabilitation programs

**POSTER SESSION**

**Chairmen:** Dudin Mikhail, Karski Tomasz
**Speaker:** Shashko Aleksey

## ABSTRACT

### THE QUESTION OF COXARTHRITIS EARLY DIAGNOSIS IN TEENAGERS BY "TENSOMETRY"

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### Introduction

Because of unexpressed X-ray-signs and clinical manifestations of coxarthritis in the early stages of the disease in adolescents is a delay of the adequate treatment.

Objective coxarthritis early diagnosis in teenagers by "tensometry"

### Materials and Methods

The study was carried out using measuring platform tensor „MIN ^ EMED". 5 measurements were performed for each foot. Total 670 measurements were performed. For the analysis of measured data was used appropriate software (Novel-win v.95121 & Novel-orto v. 95121). The control group included well-known 48 healthy adolescents – research data in the control group was used to determine variant of norm. Then the survey was exposed a group of 49 adolescents diagnosed with coxarthritis using other research methods.

### Results

Adolescents with coxarthritis have significantly less (<= 15N/CM2) pressure on the heel and increased substantially while relying on the anterior part of the metatarsals and toes on the affected side. There is different behavior of the velocity of the center of pressure of time. For healthy curve of these changes has one or two maxima: the first one 0 – 50 – 70% of the time rolling when the heel of the foot and the average loaded, followed by a very short period of minor changes 88 – 94% of the time rolling when driving only the anterior part of the metatarsal and fingers. The second one – the end of reliance on the fingers. For teenagers with coxarthritis velocity of the center of pressure oscillates near the midline. Path of the center of pressure on the affected side is more than a „healthy" side.

### Conclusion

Initial signs of coxarthritis in adolescents can be identified on the basis of the pressure distribution on the sole much earlier than with traditional methods of research.

**Key words:** coxarthritis early diagnosis, "tensometry", center of pressure

## ABSTRACT

### FEATURES THE RIGHT AND LEFT SCOLIOSIS

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The features of neurohumoral regulation in children with right and left-scoliosis. With left--sided scoliosis in serum have higher levels of oxytocin than in right-sided scoliosis. The ratio of vasopressin to oxytocin in children depends on the degree and severity of scoliosis.

### Introduction

Movement disorders of central origin, stroke due to ischemia or injuries alter tonic muscle reaction is usually preferably at the same side.

These movement disorders accompanied by synthesis in the hypothalamic-pituitary system and release into the cerebrospinal fluid and blood of bioactive peptide substances. Abnormalities in the muscle of the right extremities accompanied by arginine vasopressin synthesis and by sinistral disorders reveal an increased content of oxytocin (**3**). Scoliosis violation anatomical relations between the longitudinal dimensions of the bone of the spine and spinal cord also occurs due to failure of functional regulatory units on the hypothalamic-pituitary level (**2**). We hypothesized that children with right and left-scoliosis in serum are present peptide factors causing bioassay with serum (SC) models motor disturbances on the same side as that of the sick child, and the relationship of these factors will depend on type of scoliosis.

### Aim

To identify the features of neurohumoral regulation in children with right and left-scoliosis.

### Methods

Blood serum was examined in a cohort of 121 children (age from 6 to 13 years) with diagnosed scoliosis, 70 of them with right-and left-hand 51. Bioassay SK model (Wistar rats): analysis of changes in EMG responses in antagonist muscles of the hind limbs in spinalizirovannoy thoracic rats after administration of 0.1 ml SC donor in lumbar spinal cord. The level of vasopressin and oxytocin was determine by ELISA in the serum of children (1).

## Results

The method of bioassay recipients revealed changes tonic reactions (70–150% increase from baseline) primarily in the flexor muscles on the affected side and a violation reciprocal value between flexor and extensor muscles on the same side as that of the donor. Also, irradiation of excitation in muscle lesions in hand muscle stimulation opposite conditionally healthy limb. Total fertility (in basis points) on 24 indicators (spontaneous and evoked EMG, reciprocity, irradiation of excitation in muscle electrostimulation at the opposite side, etc.) depend on the degree of abnormality of the patient and the type of flow of idiopathic scoliosis (progressive, indolent, nonprogressive form ). In right-sided scoliosis EMG EMG-change indicators were more pronounced than in left-sided scoliosis of the donor. The ratio of vasopressin to oxytocin in the UK children with right scoliosis was equal to 0.439, and with left-sided scoliosis – 0,219

## Discussion

Character changes in posture due to violation of the recipients of the interaction of muscle groups under the action of neurohumoral factor donors – children with the right-and left scoliosis. Bioassay results indicate precedence violations side, allows define and predict the development of scoliosis. As with other motor disorders of central origin, revealed differences in the groups in the level of oxytocin and vasopressin: in children with left-sided scoliosis have higher levels of oxytocin in the blood serum than in children with right scoliosis.

## Conclusion

Scoliosis in the UK children is present by neurohumoral factors peptide (vasopressin and oxytocin). Level and the ratio of these peptides depend on lateralization of motor disorders in scoliosis and severity of motor disorders. The data obtained should be used in the selection of treatment strategy.

**Keywords:** scoliosis, vasopressin, oxytocin

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## ABSTRACT

### SCOLIOSIS CURVE EFFECT ON EXTERNAL RESPIRATION

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**Keywords:** scoliosis, external respiration

The aim of this study was to examine the scoliotic arch influence on respiratory function in children with idiopathic scoliosis (IS).

## Materials and methods

Were examined 46 patients from 11 to 18 years with IS or dysplastic scoliosis of II – IV degrees without the presence of chronic respiratory diseases in case history. Patients were divided into groups according to the degree of scoliosis as follows: a group of children with II IS grade – 18 patients; with III grade – 20, with IV grade – 8 patients.

The study was carried out with the help of multifunction diagnostic complex „Valenta", which possesses also the function of a spirometer. Before the start of the study were recorded the following patients' data: passport and diagnosis, as well as anthropometric data – height and weight. During the study was estimated the maximum volume of air exhaled by the patient after a full expiration expressed in liters, as well as a percentage of average calculated values for patients with these anthropological indicators called „ vital capacity of lungs" (VCL). Was also estimated „forced VCL" or volume of air that can be exhaled as quickly as possible in full exhalation after maximal inspiration.

## Results

In the group of children with the II IS degree the minimum values for VCL and FVCL amounted to 64 and 69% with maximum – 103 and 102%. Average values – 87.8/89.1%. In patients more often were recorded minimal deviations from the age/gender standards. Significant reductions – less than 75% of the VCL/FVC L were noted in two patients (11% of the entire group).

In the group of children with the III IS degree the minimum values amounted to 48/55% of standard, maximum – 109/109%. Average values – 85.2/86.3%, which was regarded as the minimum deviation from the age/gender standards. Significant data reductions were observed in four patients (20% of the entire group).

In the group of children with the IV IS degree the minimum values amounted to 45 and 44% of standard, maximum – 96 and 113%. Average values were equal to 79.6/74.4%, which was regarded as the minimum deviation from the age/gender standards. Significant reductions were observed in three patients (37.5% of the entire group).

## Conclusion

Scoliosis arch affects the respiratory function of the patients worsening it. Such deterioration was clearly determined in patients with the IV IS degree.

## ABSTRACT

### AGE DIFFERENCES OF ULTRASOUND FEATURES OF LOWER LIMBS GERM ZONES IN CHILDREN

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## Abstract

Objective is evaluation of germ zones of lower limb bones in children, especially in part of their functional activity that is necessary for the treatment of a number of orthopedic diseases. We studied ultrasound features of the germ zones in 124 children of both sex aged 3 to 16 years. The obtained results show that the thickness and structure of the germ zones depend on the age and sex of children.

**Keywords:** germ zones of low limbs, ultrasound diagnosis, age features.

## Introduction

Ultrasonic method has been successfully applied in the diagnosis of diseases and injuries of the musculoskeletal system. An extensive experience of the survey of the spinal column, large and small joints, tendon-muscle structures is accumulated. The anatomical and physiological age features of these structures are identified. At the same time, significantly less attention is paid to ultrasound imaging of germ zones of bones. Meanwhile, the objective assessment of the germ zones of lower limb bones in children, especially in part of their functional activity, is necessary for the treatment of a number of orthopedic diseases. Nowadays this problem in practical medicine is solved using classical radiological diagnostic techniques (radiography, magnetic resonance imaging, computed tomography, scintigraphy of the skeleton).

Our experience in this field has shown promising application of ultrasonic diagnostic imaging of germ zones. The advantages of this method are: security, non-invasive, high information content, accessibility for widespread use, no special requirements for the preparation of the child to study the possibility of multiple patient studies in dynamics, safety and efficiency in the delivery of information.

Given the fact that the generally recognized criteria for assessing ultrasonic germ zones of lower limb bones are missing, we performed the study to determine the ultrasound patterns of germ zones.

## Material and methods

As a diagnostic ultrasound device we used ALOKA SSD-1100 (high linear ultrasound probe with a frequency of 7.5 MHz scanning) that allows to evaluate the structures, permeable to X-rays: surface of the bone cortex, cartilage, tendons, ligaments, muscles.

Germ zones of the femur and tibia in all studied patients were presented as hyperechoic plates between the metaphyseal and epiphyseal part of the bone (subchondral layer) and were studied by two main criteria: width (mm) and ultrasound structure (density, looseness).

124 children were examined. The children were divided into six groups according to their sex and age (**Table 1**).

**Table 1**

| Age group | Boys | Girls |
|---|---|---|
| 3-5 years | 15 people | 21 people |
| 9-11 years | 20 people | 29 people |
| 14-16 years | 17 people | 22 people |

## Results

The obtained results of the survey indicate that the width of the germ zones is rather constant. At the age of 3-5 years and 9-11 years it is 2±0,3 mm. And only in children of 14-16 years the width of the germ zones decreases in almost 2 times – 1±0,5 mm. Such changes occur in girls for 2-3 years earlier then in boys. More differences were noted by the second criterion – the structure of the germ zones. At the age of 3-5 years the structure was not changed. At the age of 9-11 years a looseness of subchondral layer was observed. At the age of 14-16 years the structure of the subchondral layer was varied (depending on the growth and the onset of puberty). If the rates in the first and the second age group were the same for boys and girls, in the third one they differed. The closing of germ zones in girls usually occurred earlier then in boys (**Table 2**).

**Table 2**

| Age group | Average width of the subchondral layer | Looseness of subchondral layer |
|---|---|---|
| 3-5 years | 2,0±0,3 mm | Unremarkable |
| 9-11 years | 2,0±0,3 mm | Increased looseness |
| 14-16 years | 1±0,5 mm | Various picture |

## Discussion

1. Ultrasound features of germ zones differ depending on age and sex.
2. Functional activity of germ zones may be indirectly estimated by a set of ultrasound criteria.
3. The ultrasonic method allows to evaluate the efficiency of treatment when exposed to germ zones.

**PERPECTIVE ORIGINAL ARTICLE**

## THE RESULTS OF THE SCREENING DIAGNOSIS OF SPINAL PATHOLOGY IN CHILDREN THROUGH MOBILE ORTHOPAEDIC LABORATORY IN RUSSIA AND POLAND IN THE FRAMEWORK OF INTERNATIONAL COOPERATION

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In 2006 sanatorium „Pionersk" concluded a cooperation agreement with the Voivodeship rehabilitation hospital for children in Ameryka settlement, Poland. Within the framework of that cooperation, as of today we have implemented 5 international projects aimed at improving the health of children in border areas and the Kaliningrad region and Warmia and Mazury, as well as significantly developed the two partner institutions. At the moment sanatorium "Pionersk" and the hospital in Ameryka settlement are implementing a large-scale project „Programme for the prevention of postural disorders and scoliosis in children from small towns and rural areas" within Lithuania-Poland-Russia ENPI Cross-border Cooperation Programme 2007-2013. This is rather a large-scale project in terms of the volume of survey work, reach of child population and the number of units of equipment employed in the screenings. According to our information no such surveys have been carried out in Russia and Poland before.

According to statistical data, over 40% of children in the Russian Federation have postural disorders and nearly 9% – scoliosis (Sadovoy M.A. et al, 1997, 2004, Novosibirsk CRITO), according to Professor Ulrih E.V. („Private vertebrology", 2006), the prevalence of idiopathic scoliosis in the population reaches 15.3%. In Poland, 50-60% of the total child population have incorrect posture, including scoliosis – 5.19% of child population aged 0-18 („Prevention of postural disorders in children and youth in the learning environment and education", Warsaw 2009 recommendation by Prof., MD Andrzej Gerecski – national consultant in orthopedics and trauma of the organs of movement). Taking into account the fact that the official statistics reflects morbidity level based on visits to doctors, which to some extent depends on accessibility of medical care and socio-economic conditions, we can assume that the true incidence rate is even higher. Scoliosis is a progressive disease, but when it is diagnosed early in pre-clinical stage of development and addressed through treatment and prevention activities the disease can be stopped by modern healthcare. Diagnosed in later stages of its development the process becomes irre-

versible, and in 50-75% of cases results in permanent disability (Haybulina D.H., Kazan Medical University, 1998).

To date, in Russia and in Poland there are no government programs aimed at the reduction of morbidity level related to diseases of the spine in children. We are experiencing an increase in incidence rates and acceleration of growth rates of disability of the child population in Russia and in Poland. The quality and standard of living of affected children decreases. Government spending aimed to support people with disabilities, ensure their rehabilitation and social benefits inevitably increases, whereas fewer young men of conscription age are fit for service in the armed forces.

Therefore, a comprehensive treatment and prevention program for the prevention of postural disorders and scoliosis among school-age children developed by the authors of the project is justified from medical, social and economic points of view, is timely and relevant. The comprehensiveness of the program is in the planning and implementation of 2 consecutive interconnected modules: a diagnostic module and a treatment and prevention module with emphasis on prevention undeservedly forgotten today, that will create sufficient conditions for improvement of children's health and effective prevention of child disability.

As part of the diagnostic module of the program a massive diagnostic examination of school students of the Kaliningrad region and the region of Warmia and Mazury is currently underway. Screening tests will cover at least 9500 people (equally split between Russia and Poland). The main objective of the survey is the identification of spinal pathology, such as pre-clinical stages of development of scoliosis. The survey is conducted primarily among 10-15 year-old students, as idiopathic scoliosis is practically nonexistent in younger children, whereas at older age scoliosis is usually established and early screening is not expedient.

To be able to carry out the mass screenings, we have created a mobile orthopedic diagnostic laboratory. The architecture of the laboratory presents a vehicle equipped with 4 units of medical diagnostic and treatment equipment: a computer optical topograph, a plantoscope, a stabilometric complex and an electroneuromyograph.

The diagnostic laboratory is staffed with international crews of medical personnel: an orthopedic surgeon and a functional diagnostics doctor from Russia, two physiotherapists from Poland and medium-level staff from the two countries. Work of the diagnostic laboratory crews is implemented in monthly sessions: screening examinations in the course of 1 week followed by 3 weeks of processing of the obtained statistical data. The mobile laboratory operates in the Kaliningrad region for 1 month, which is followed by 1 month of work in Warmia and Mazury. The overall duration of planned operation of the laboratory is 19 months. The average monthly workload is 500 examined children (around 100 people in 1 working day at 5-day working week). The screenings are conducted in district secondary schools.

Prior to performing the screenings we had developed and installed in sanatorium "Pionersk" and in the hospital in Ameryka settlement a medical information system – an electronic database. It records data obtained in the course of the diagnostic examination. The capabilities of the information system are extensive and have great potential for development in terms of diagnosing accompanying pathology and the possibility of constructing the functional profile of a patient. The system allows one to create statistical sampling by almost 100 parameters and present

them in different combinations. In addition, all parameters can be chosen for target groups of a particular age and place of residence with the possibility of rapid changes of parameters.

As part of the second (medical and preventive) module of the program, children with pathology of the spine from the Kaliningrad region receive appointment cards to undergo inpatient treatment at pediatric orthopedic sanatorium „Pionersk", and children from the Warmian-Mazurian voivodeship – at rehabilitation hospital for children in Ameryka settlement. The treatment is carried out at the expense of the project budget.

To date, nearly 9000 students have passed through the screenings. All data have been processed for statistical analysis:

**Table 1a**

| | | | Orthopedic traumatologist no. 1 | | | | Orthopedic traumatologist no. 2 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Postural disorder | | Scoliosis | | Postural disorder | | Scoliosis | |
| Date of the screening | Place | Overall no. of people examined | % | Number of people | % | Number of people | % | Number of people | % | Number of people |
| 11-15.02.13 | Russia | 536 | | | | | 14.0 | 75 | 7.8 | 42 |
| 11-15.03.13 | Poland | 421 | | | | | 7.6 | 32 | 16.6 | 70 |
| 08-12.04.13 | Russia | 498 | 16.0 | 80 | 15.6 | 78 | | | | |
| 20-24.05.13 | Poland | 540 | 18.9 | 102 | 1.5 | 8 | | | | |
| 10-14.06.13 | Poland | 521 | | | | | 12.2 | 64 | 10.1 | 53 |
| 09-13.09.13 | Russia | 472 | | | | | 16.1 | 76 | 30.9 | 146 |
| 07-11.10.13 | Poland | 629 | 22.9 | 144 | 0.0 | 0 | | | | |
| 21-25.10.13 | Russia | 485 | 28.2 | 137 | 0.4 | 2 | | | | |
| 11-15.11.13 | Russia | 476 | | | | | 14.9 | 71 | 34.8 | 166 |
| 09-13.12.13 | Poland | 524 | | | | | 8.2 | 43 | 29.9 | 157 |
| 20-24 & 31.01.14 | Russia | 522 | 40.2 | 210 | 20.9 | 109 | | | | |
| 17-21.02.14 | Poland | 579 | 26.3 | 152 | 0.0 | 0 | | | | |
| 11-14.03.14 | Russia | 488 | | | | | 13.9 | 68 | 15 | 74 |
| 31.03-04.04.14 | Poland | 534 | | | | | 5.9 | 32 | 32.9 | 176 |
| 21-25.04.14 | Russia | 487 | | | | | 16.1 | 79 | 23.8 | 116 |
| 19-23.05.14 | Russia | 682 | 9.1 | 62 | 8.2 | 56 | | | | |
| 05-11.06.14 | Poland | 594 | 17.0 | 101 | 6.57 | 39 | | | | |
| | **Total** | **8988** | | | | | | | | |

**Table 1b**

| | Kaliningrad region (Russia) | | Warmian-Mazurian voivodeship (Poland) | |
|---|---|---|---|---|
| Total examined | 4646 people | 4342 people | | |
| | % | No. of people | % | No. of people |
| Scoliosis detected | 17% | 789 | 11,6% | 503 |
| Postural disorders detected | 18,5% | 858 | 15,4% | 670 |

At first glance, the obtained results correlate with each other and with the data of the official statistics. But a closer analysis of the data obtained by different doctors in the course of the screenings returned the following results:

**Table 2**

| | | Orthopedic traumatologist no. 1 | | | | | Orthopedic traumatologist no. 2 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Postural disorder | | Scoliosis | | | Postural disorder | | Scoliosis | |
| Date of the screening | Place | Overall no. of people examined | % | No. of people | % | No. of people | Overall no. of people examined | % | No. of people | % | No. of people |
| 11-15.02.13 | Russia | | | | | | 536 | 14,0 | 75 | 7,8 | 42 |
| 11-15.03.13 | Poland | | | | | | 421 | 7,6 | 32 | 16,6 | 70 |
| 08-12.04.13 | Russia | 498 | 16,0 | 80 | 15,6 | 78 | | | | | |
| 20-24.05.13 | Poland | 540 | 18,9 | 102 | 1,5 | 8 | | | | | |
| 10-14.06.13 | Poland | | | | | | 521 | 12,2 | 64 | 10,1 | 53 |
| 09-13.09.13 | Russia | | | | | | 472 | 16,1 | 76 | 30,9 | 146 |
| 07-11.10.13 | Poland | 629 | 22,9 | 144 | 0,0 | 0 | | | | | |
| 21-25.10.13 | Russia | 485 | 28,2 | 137 | 0,4 | 2 | | | | | |
| 11-15.11.13 | Russia | | | | | | 476 | 14,9 | 71 | 34,8 | 166 |
| 09-13.12.13 | Poland | | | | | | 524 | 8,2 | 43 | 29,9 | 157 |
| 20-24 & 31.01.14 | Russia | 522 | 40,2 | 210 | 20,9 | 109 | | | | | |
| 17-21.02.14 | Poland | 579 | 26,3 | 152 | 0,0 | 0 | | | | | |
| 11-14.03.14 | Russia | | | | | | 488 | 13,9 | 68 | 15,0 | 74 |
| 31.03-04.04.14 | Poland | | | | | | 534 | 5,9 | 32 | 32,9 | 176 |
| 21-25.04.14 | Russia | | | | | | 487 | 16,1 | 79 | 23,8 | 116 |
| 19-23.05.14 | Russia | 682 | 9,1 | 62 | 8,2 | 56 | | | | | |
| 05-11.06.14 | Poland | 594 | 17,0 | 101 | 6,57 | 39 | | | | | |
| | **Total** | **4529** | **21,8** | **988** | **6,5** | **292** | **4459** | **12,0** | **540** | 22,4 | 1000 |

As one can see, of all the examined polulation orthopedic traumatologist no. 1 diagnoses scoliosis in just 6.5% of cases, and postural disorders in almost 22%. Orthopedic traumatologist no. 2 diagnoses scoliosis in 22% of cases, and postural disorders in only 12%.

Even more interesting data can be observed after analyzing separately the screening results obtained by different doctors for the Kaliningrad region and for Poland:

**Table 3**

| **Russia** | Orthopedic traumatologist no. 1 | | | | | Orthopedic traumatologist no. 2 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Postural disorder | | Scoliosis | | | Postural disorder | | Scoliosis | |
| Date of the screening | Overall no. of people examined | % | No. of people | % | No. of people | Overall no. of people examined | % | No. of people | % | No. of people |
| 11-15.02.13 | | | | | | 536 | 14,0 | 75 | 7,8 | 42 |
| 08-12.04.13 | 498 | 16,0 | 80 | 15,6 | 78 | | | | | |
| 09-13.09.13 | | | | | | 472 | 16,1 | 76 | 30,9 | 146 |
| 21-25.10.13 | 485 | 28,2 | 137 | 0,4 | 2 | | | | | |
| 11-15.11.13 | | | | | | 476 | 14,9 | 71 | 34,8 | 166 |
| 20-24 & 31.01.14 | 522 | 40,2 | 210 | 20,9 | 109 | | | | | |
| 11-14.03.14 | | | | | | 488 | 13,9 | 68 | 15,0 | 74 |
| 21-25.04.14 | | | | | | 487 | 16,1 | 79 | 23,8 | 116 |
| 19-23.05.14 | 682 | 9,1 | 62 | 8,2 | 56 | | | | | |
| | **2187** | **22,4** | **489** | **11,2** | **245** | **2459** | **15,0** | **369** | **22,1** | **544** |
| Total number of people with pathology of the spine | 734 people or 33,6% | | | | | 913 people or 37,1% | | | | |

After analysis of the obtained data it was found that in the course of the screenings orthopedic traumatologist no. 1 was guided by the accepted standard of diagnosis of scoliosis – frontal curvature in excess of 100Cobb. All cases of up to 100Cobb were qualified as postural disorders, whereas those of over 100Cobb – as scoliosis.

Orthopedic traumatologist no. 2 was oriented towards the earliest possible diagnosis of scoliosis and cases of a 3-plane deformation of the spinal column, even with the frontal arc of less than 100Cobb were diagnosed as scoliosis. He interpreted such cases as a pre- or subclinical stage of development of scoliosis. Accordingly, all cases with frontal curvature of up to 100Cobb with no 3-plane deformation of the spinal column were diagnosed by him as postural disorder.

We can say that orthopedic traumatologist no. 1 is inherently for under-diagnosis, whereas orthopedic traumatologist no. 2 is in favor of overdiagnosis.

We do not insist on our findings and assumptions, and only describe what and how happened within our organization internally, and how we tried to handle this.

**Table 4**

| **Poland** | Orthopedic traumatologist no. 1 | | | | | Orthopedic traumatologist no. 2 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Postural disorder | | Scoliosis | | | Postural disorder | | Scoliosis | |
| Date of the screening | Overall no. of people examined | % | No. of people | % | No. of people | Overall no. of people examined | % | No. of people | % | No. of people |
| 11-15.03.13 | | | | | | 421 | 7,6 | 32 | 16,6 | 70 |
| 20-24.05.13 | 540 | 18,9 | 102 | 1,5 | 8 | | | | | |
| 10-14.06.13 | | | | | | 521 | 12,2 | 64 | 10,1 | 53 |
| 07-11.10.13 | 629 | 22,9 | 144 | 0 | 0 | | | | | |
| 09-13.12.13 | | | | | | 524 | 8,2 | 43 | 29,9 | 157 |
| 17-21.02.14 | 579 | 26,3 | 152 | 0 | 0 | | | | | |
| 31.03-04.04.14 | | | | | | 534 | 5,9 | 32 | 32,9 | 176 |
| 05-11.06.14 | 594 | 17,0 | 101 | 6,57 | 39 | | | | | |
| | **2342** | **21,3** | **499** | **2,0** | **47** | **2000** | **8,6** | **171** | **22,8** | **456** |
| Total number of people with pathology of the spine | 546 people or 23,3% | | | | | 627 people or 31,4% | | | | |

Despite the fact that the obtained data are the data of the screenings, while the final diagnosis is made at the point of admission of the child for inpatient treatment through R-diagnostics, preliminary analysis of the data allows us to draw some conclusions:

1. The actual prevalence rate for scoliosis is greater than that reflected in statistical data. The situation in the Kaliningrad region is worse than in Warmia and Mazury. In order to prevent further deterioration of the situation it is necessary to continue the launched comprehensive intervention program involving public and private funds, and to extrapolate the lessons learned to other regions of the Russian Federation.
2. During the screening diagnostics the preliminary diagnosis made by the orthopedic traumatologist largely depends on his/her subjective assessment. Interpretation of the same problem by different specialists may result in different outcomes for a particular patient. It is essential to minimize the subjective component of a physician's work through the development of unified forms of screenings, standardization of application of the diagnostic equipment, and approval of the algorithms of screening diagnostics. This needs to be performed with the fullest possible involvement of the medical community.
3. As of today, we have developed a piece of medical computer software that allows one to solve almost all of the above problems and standardize processes. And by analogy with the above we can offer standardization of diagnostic and treatment processes not only in traumatology and orthopedics, but also in other branches of medicine.

## ABSTRACT

### SO-CALLED IDIOPATHIC SCOLIOSIS. BIOMECHANICAL AETIOLOGY. NEW CLASSIFICATION. TREATMENT AND PROPHYLAXIS

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## Introduction

The biomechanical aetiology of so-called idiopathic scoliosis called AIS is described in Polish, English, German and in Spanish Journals in years 1995 – 2007 (T. Karski) and presented since 1995 in many Congresses and Symposia.

## Material

In 2012 the whole material gathered 1950 cases. Patients were 2 to 60 years old. Explanation of biomechanical aetiology of scoliosis in points. (1) "Syndrome of contractures" [SofC] (Siebenersyndrom) according to Prof.Hans Mau. In 2006 called also "Syndrome of Contractures and Deformities" (SofCD – T. Karski and J. Karski) because to the seven contractures (H. Mau) we added the extensive varus deformity of shank also connected with the "foetus period of life". (2) Asymmetry in movement of hips connected with SofCD. In all scoliosis children the adduction of right hip is limited (smaller than in left hip – examination in straight position of hip joint). In some children there is even abduction contracture of right hip, plus external rotation and flexion contracture (see later – in I epg). (3) Influence on spine comes by walking (gait) and because of habit of permanent standing 'at ease' on the right leg. (4) Every type of scoliosis starts to develop in 2 – 3 year of life of children.

New classification as important information for physiotherapy. There are three groups and four types of scoliosis (T. Karski 2001 – 2004). (1) "S" I etiopathological (epg) scoliosis. Double curves. Influenced by the "gait" and the permanent "standing at ease on the right leg". Stiff spine. 3D. Progression. (2A) "C" II/A epg scoliosis. Influenced by the permanent "standing at ease on the right leg". One curve. Flexible spine. 1D. No or slight progression. (2B) "S" II/B epg scoliosis. Influenced by the permanent "standing at ease on the right leg", plus – laxity of joints or/and incorrect exercises in previous treatment. Flexible spine. 2D or mix. Moderate progression. (3) "I" III epg scoliosis. Influenced by the "gait" only. Stiff spine. No curves or small. No progression.

## Physiotherapy

All previous extensions, its mean "muscles strengthening exercises" were incorrect and caused only bigger curves and made more stiff spine. Because of this the orthopaedic surgeon used to speak about "Natural History of Scoliosis". All stretching exercises for spine and hips are proper for treatment and for prophylaxis. They lead to symmetry of movements and symmetry of function.

## Conclusions

(1) All scientists and all Institutions engaged with scoliosis should learn about "biomechanical reasons in development of scoliosis". (2) All orthopaedic surgeons, rehabilitations and physiotherapists should be introduced to the new conception of treatment and of causal prophylaxis in children with so–called idiopathic scoliosis on own material in own countries.

**Key words:** idiopathic scoliosis, biomechanical aetiology, new classification, treatment, prophylaxis

Literature www.ortopedia.karski.lublin.pl

## ABSTRACT

### RISK GROUP OF AIS IS THE KEY TO ITS PROPHYLAXIS

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## Introduction

One of the fundamental properties of typical AIS is its monomorphism. The C-shaped scoliosis is a "pure" 3D deformation, while S-shaped form consists of two 3D curves, etc. Mathematical modeling has shown a steady sequence of forming units of 3D deformation. Real clinical manifestations in the initial period of development of typical AIS are identical to changes, predicted by mathematical modeling on the basis of identified consistent patterns.

## Objectives

To define the sequence of clinical symptoms and their importance in the transition of a healthy spinal column to „scoliotic" one, that will determine criteria for risk group. It allows us to develop a treatment at the preclinical stage of typical AIS, that is the basis for its prophylaxis.

## Material and Methods

During 2012-2013 we observed 600 children of both sexes, aged 9 to 13 years, residing in one settlement. The group included children without signs of AIS. During this period physical and instrumental examination of all these children were carried out every 8-12 months. The instrumental examination included: CDOT, EMG, stabilometry and immunoferment analysis of of neuropeptides (oxytocin and arginine-8-vasopressine) level, as posture asymmetry factor.

## Results

1. The following sequence of clinical symptoms at risk group of typical AIS was defined: normal spine → flat-back (sagittal plane) → flat-back + torsion of all trunk from spine lumbar zone (the first stage of horizontal plane). It is the pre-clinical development of the typical AIS (risk group of typical AIS).

But "flat-back + torsion of spine lumbar zone" leads to detorsion of the shoulder girdle or upper part of the trunk (the second stage of horizontal plane). The projection of the spinal canal is straight (not deformed), while in the column of vertebral bodies can be seen two "anticircuits" (opposite direction twisting), which finish the emergence of 3D deformation. It is the beginning of the clinical development of the typical AIS.

2. The obtained data of instrumental examinations were completely identical to described above sequence of clinical symptoms. The greatest interest was aroused by the results of neuropeptides investigation. The altering of their levels was observed even at the end of flat-back formation.

## Conclusion

On the basis of obtained data the complex of therapeutical interventions was created to prevent typical AIS. Currently the clinical testing of this complex is carried out in a representative group of the child population and preliminary results (only for 2013) are encouraging.

## ABSTRACT

### ECHOGRAPHIC PECULIARITIES OF THE GROWING ZONES OF HUMERUS, FEMUR AND TIBIA IN DIFFERENT AGE OF CHILDREN

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This pilot study reflects the results of the ultrasound examination of the musculoskeletal system (MSS): the epiphyses of the shoulder, hip, and tibias of healthy 125 children of various age from 1 month to 18 years. Echographic features of the growing zones of the limb's bones in children of different age from position of histological concept of the structure of epimetaphyseal areas of the skeleton are identified, and ultrasound characteristics of the different layers of the growth zones are given.

## The aim

Determine the echographic age peculiarities of the growing zones of limbs in children from position of histological concept of the structure of epimetaphyseal areas of the skeleton.

## Materials and methods

The study was conducted by the regulations of the ethics committee, providing guarantee for ethnicity of research and maximum safety for the participants, includes analysis of echograms of growth zones of shoulder's proximal epiphysis, hip's proximal and distal epiphysis and tibias's proximal epiphysis of 425 children of various age from 1 month to 18 years. All patients were divided into 5 groups according to the stages of skeletal ossification by Sadofyeva V.I. [5]:

the first group – children under 1 year old –135 patients;
the second group – children aged from 1 to 5 years old – 88 patients;
the third group – children aged from 5 to 10 years old – 32 patients;
the fourth group – children aged from 10 to 15 years old – 70patients;
the fifth group – children aged from 15 to 18 years old – 100 patients.

According to all echograms of the shoulder, hip and knee joints in all age groups at the same echogenicity and ultrasound were let in the following structures: fibrous cartilage, joint capsule, perichondrium, intermuscular fascia, ligaments.

## Results of research and conclusions

On the contrary, the epiphyses with adjacent metaphysis were areas with varying echocharacteristics not only among the five proposed groups, but also directly to the „inside" age groups. We refer the complex „growth zone" as we believe should be also included the secondary center of ossification and its surrounding epiphyseal cartilage, and also a layer of growth plate where mature and growing bone is remodeled.

This new ultrasound concept of visualization on epimetaphyseal area where the hypertrophic zone of cartilage component without radiation exposure is the most vulnerable part of the growth zone has a distinct clinical significance. We consider the epiphysis including the ossification nucleus, epiphyseal cartilage and growth plate over a long period from birth until ossification is being a „growth area" and its growth is due to two areas : 1) the vascularized area of cartilage, which is responsible for the growth "inside the join" and 2) the epiphyseal plate which is responsible for bone growth in length. Using this new ultrasound concept can give important criteria of the growth zone and beginning of synostosis in epimetaphyseal and apophyseal growth zones of the limb's bones in children without radiation exposure. In this connection, we consider it reasonable and promising further research in this area.

## ABSTRACT

### ULTRASOUND VISUALIZATIONS OF PATHOMORPHOLOGIC CHANGES IN JOINTS OF PATIENTS WITH RHEUMATIC DISEASES

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**Key words:** ultrasound, rheumatic diseases, rheumatoid arthritis, ultrasonic protocols, screening technology, joints

### Aims & Objectives

The aim to optimize the musculoskeletal ultrasound of upper and lower extremities for rheumatologists, and to leads to faster diagnoses in different rheumatic diseases for quicker initiation of early treatment.

### Patients and Methods

Our own patented ultrasonic screening technology to study joints of the upper and lower extremities – "MSS -FAST – rheuma – 12 steps" was performed in 1455 patients at the age from 15 to 68 during the period from 2007 to 2013.This patients were with early arthritis, they had inflammation of the different joints. Ultrasonography (US) of the musculoskeletal system (MSS) have done in B-mode on the multifunctional US-diagnostic high class system Voluson 730 PRO ("Kretz" Austria) with a multi-frequency transducer 5-12 MHz and 10-12 MHz, on US-scanner SSI-I000 SonoScape Company (transducer L742), on US-scanner "SONOACE-8000 SE" "MEDISON" company. Application of portable SSI-I000 US-scanner (SonoScape Company) with applying transducer L742 made it possible to implement US of joint of patients who was "on the bed".

A determination of sensitivity and specificity for all patients has not donein ourresearch report due to the fact that the momentary MRI more than 2-large joints of the extremities at the individual patients not routinely performed.

The object of the study were periarticular tissues, capsule, synovium, synovial fluid, articular cartilage and subchondral bone of shoulder, elbow, wrist, metacarpophalangeal (MCP) joints, hip, knee, ankle, metatarsalphalangeal joints. In order to create comfortable conditions for the patient and to optimize the ultrasound examination this proposed protocol involves study of a patient in a caudal direction of „top-down", with the starts the scanning from the position of the patient sits on the bed, then the back, then to the abdomen. All scans of contralateral side are displayed on the double screen, on the first field – right sonogram scans, on the second field – left sonogram scans.

- First step (scan) – a longitudinal scan of the of shoulder joints for visualization subacromial space and subdeltoid bursa, at the beginning of examination a patient initially sits on the bed, arms down along the body. After that the transducer is moved distally.

- Second step (scan) – a longitudinal scan of the olecranon for visualization of the olecranon-bursa.
- Third step (scan) – a longitudinal scan of theradiocarpal joints (**Fig. 1**).
- Fourth step (scan) – a longitudinal scan II metacarpophalangeal (MCP) joints to produce images of heads II metacarpal bones, the most presentable localization of the pathological process in RA.
- Fifth step (scan) – a longitudinal scan of the hip joint for the visualization of the bony rim, bony roof, cartilageroof, neck space, due to the frequent complaints of patients on pain in this area
- Sixth step (scan) – a longitudinal projection of the knee (Fig. 2) – is investigated because there are frequent clinical manifestation in this area in patients with rheumatic diseases – arthritis, synovitis of the knee
- Seventh step (scan) – a transverse scan of the knee, the transducer is located above the superior pole of the patella
- Eighth step (scan) – obliquely transverse scan of the knee for visualization of the medial meniscus of the right and left knee
- Ninth step (scan) – a longitudinal scan of the ankle joints. A transducer is transferred distally, this longitudinal scans performed along the median line of ankle joints
- Tenth step (scan) – a longitudinal scanI metatarsophalangeal joints (Fig. 3). These scans are included in US-screening due to pathognomonic of joint involvement in gout
- Eleventh step (scan) – a longitudinal scan of the medial meniscus posterior horn of the knee.
- Twelfth step (scan) – a longitudinal scan of the Achilles tendonis included in the screening due to the commonly observed Achill-bursitis in rheumatic patients.

Time of evaluation varied from 15 to 30 min and increased with the degree of the disease. According to the research, is made a determination about all findings during ultrasound screening, preliminary nosological form is established considering patterns and evaluation of the joints involved. Also allocated the area with the most expressed exudative components, subsequently scanning the area is to be used for monitoring rheumatic process the patient with therapy.

## Results

The most significant ultrasound patterns included the presence of a pathological effusion, intra-articular chondral bodies, tophi, erosion, pathologicalhypervascularization.

A formal RA diagnosis was made owing toultrasound scoring systems ofultrasound patterns before laboratory issues in 41 patients – 2.8% from all patients.A formal goal diagnosiswas made before laboratory issuesowing to the visualization of fluid hyperechoic inclusion in the periarticular tissues (tophus) of the I metatarsophalangeal in 38 patients – 2,6% from all patients. The degree of protrusion of the medial meniscus is perfect to detect the degree of the osteoarthritis in 989 patients – 67% from all patients.The visualization of fluid in the neck space at the longitudinal scan of the hip joint helped for early detecting aseptic necrosis of head femur in 18 patients with pain in the knees – 1,2% from all patients.

A longitudinal scan of the of shoulder joints detected abnormalities at these sites such of the rotator cuff tears in 6 patients – 0,41%from all patients. After that this patient were need for surgery for arthroscopic versus open repair, subacromion impingement was in 16 patients – 1,09%, bursitis was in 14 patients 0,96%, but more often we detected loss the rotator cuff subacromion ) interval in 568 patients- 39,03% from all patients.

The visualization only of fluid in theretropatelar spice without other ultrasound patterns was in 160 patients – 10,9% from all patients, but it was provided that an objective criteria report about the status the musculoskeletal system of this patient.

As a reference method for some patients was performed MRI of 796 joints: knee, hip, wrist, and the ultrasound findings were confirmed in 784 cases (98,4%) from all performed MRI.

## Conclusion

The different main criteria have been widely described in this protocol "MSS FAST – rheuma – 12 steps". This tool provides more comprehensive information about different arthritis, connective tissue diseases and RA. At suspicion on rheumatic disease protocol "MSS FAST – rheuma – 12 steps" has allowed the radiologist to focus on main ultrasound scans and patterns, pathognomonic for different rheumatic diseases and demonstrate ultrasound scoring systems of ultrasound patterns, not only ultrasound scoring systems of synovitis (GLOSS). The proposed ultrasound screening of joints and periarticular soft tissues of the musculoskeletal system allows to quickly visualize „control points" provide an objective criteria report about the status the musculoskeletal system of the patient, to determine the activity of the inflammatory process, to establish a differential diagnosis. The next stage of US may be stage the most carefully multiply scanning or monitoring of joints and periarticular soft tissuesor MRI.

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## ABSTRACT

### POSSIBILITIES OF COMPREHENSIVE CARE FOR GENETIC SKELETAL DISORDERS AT PRESENT

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The lecture summarizes longstanding experience of the authors with comprehensive treatment and care for the Genetic Skeletal Disorders (GSD). The authors are familiar so with treatment of bone metabolic disorders as with common reconstructive orthopaedic surgical procedures orthotic therapy and prosthetic fitting of disabled children and adults.

GSD are distinguished as Primary Skeletal Dysplasias (SD) resulting from mutated genes that are expressed in chondro-osseous tissue and Secondary SD that are caused by abnormalities of extraosseous factors with secondary effects on skeletal system i.e. metabolic, enzymatic and hormonal disorders. Incidence is estimated 0.30 – 0.45 per 1000 live birth.

The final shape of skeleton of GSD patients is consequence of genetic defects, mechanical stimuli and functional adaptation of bones (according to Utah paradigma defined by H. Frost in 1994). Skeletal and joint deformities are pathognomonic symptoms for concrete GSD which lead to biomechanically severe deformities of skeleton with consequence of premature osteoarthritis, spondylarthritis and osteoporosis and/or osteosclerosis.

Symptomatic treatment of skeletal dysplastic deformities in childhood is early correction of both bone deformities and joint contractures (by physiotherapy, bracing, surgical procedures, prosthetic fittings etc.) with the aim to achieve an optimal growth, function of joints and spine and the anatomical shape and structure of the skeleton. Last but not least goal of comprehensive treatment is to correct bone metabolism (using calciotropic drugs) and biomechanical properties of the skeleton and to reach an individually ideal peak bone mass in adulthood.

Credo of the authors is the biomechanical aspects of orthotic and surgical treatment and physiotherapy. Some results of comprehensive treatment are demonstrated as concise case reports.

**Key words:** genetic skeletal disorders, diagnosis, comprehensive treatment

## ABSTRACT

### COMPARISON OF POSTURAL CONTROL IN UNILATERAL STANCE BETWEEN HEALTHY CONTROL AND PATIENTS WITH LUMBAR DISC HERNIATION AND DEGENERATIVE LUMBAR SPONDYLOLISTHESIS BEFORE AND AFTER LUMBAR POSTERIOR FUSION

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### Objectives

1. examine postural sway in healthy control and patients with lumbar disc herniation and degenerative lumbar spondylolisthesis before surgery;
2. study the effect of lumbar posterior fusion, correcting the spine sagittal contour, on the postural sway in patients with lumbar disc herniation and degenerative lumbar spondylolisthesis in the early and long-term follow-up.

### Methods

Group B – 42 patients with lumbar disc herniation aged 20-40 years (mean age 33,4±4,8 years), group C – 10 patients with lumbar degenerative spondylolisthesis L4 with small (1-2) degrees at the age of 46-65 years (55,4±7,8 years); a comparison group A - 30 healthy volunteers aged 20-30 years (22,4 ± 2,6 years). All patients had unilateral sciatica. Patients were examined before and after 3 months, 6 months, 1 year or more after surgery with a mean follow-up of 1,2 ± 0,8 years (6 months – 2 years). All patients was made lumbar posterior fusion L4-L5-S1 and L5-S1 segments (n=32 and n=20 respectively) using transpedicle constructions in the SI "Sytenko Institute of Spine and Joint Pathology NAMS" vertebropogy clinic.

Subjects performed unilateral stance tasks on a force plate. Three repetitions of a 10 s unilateral stance test were performed on each leg. Postural sway amplitude was determined.

### Results and discussion

Before surgery in both groups B and C magnitude of the lumbar lordosis (LL) and the sacral slope (SS) were significantly less compared to volunteers in group A ($p < 0,001$). The maximum amplitude of the postural sway was observed in the group B while relying on the pace with the sciatica pain, and in patients of the group C, while relying on the intact leg ($p < 0,01$ and $p < 0,05$, respectively). 3 months later after surgery in both groups B and C were significantly increased depth of lumbar lordosis ($p < 0,05$), and a statistically significant decrease in the degree of sacrum verticalization ($p < 0,05$) compared with these same parameters preoperatively. However, after operation GLL and SS values in each of the patients group remained lower than normal. There were no significant changes in the parameters of unilateral postural sway in groups B and C on postoperatively.

In the preoperative period in patients with lumbar disc herniation and degenerative lumbar spondylolisthesis revealed spinal-pelvic imbalance, as well as the change of postural control impaired. After posterior instrumental lumbar fusion improving the spinal sagittal alignment was not accompanied by the restoration of postural control. Therefore the functional outcome in these patients at the stages surgical treatment characterized by the imbalance and energy--intensive of vertical posture regulation mechanisms.

**Keywords:** postural control, unilateral stance, posterior instrumental lumbar fusion, the spine sagittal contour.

## ABSTRACT

### CONSERVATIVE TREATMENT EFFECT ON AIS PROGRESSION

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The new approach to conservative treatment of adolescent idiopathic scoliosis (AIS) in children was developed. It is composed of Schroth-Weiss program, apparatus physiotherapy and Chêneau brace. The long-term treatment results of 91 patients with a high risk of deformity progression were analyzed. The analysis of 91 patient's treatment results with a high risk of deformity progression has been carried out. The positive results suggest that early beginning of comprehensive treatment significantly reduces the probability of deformity progression and decrease the symptoms of the disease.

**Key words:** Idiopathic scoliosis, Schroth-Weiss "Best practice" program, Chêneau brace, conservative treatment.

## ABSTRACT

### ANTERIOR CERVICAL DISCECTOMY FOR ONE- AND TWO-LEVEL CERVICAL DISC DISEASE: THE EFFECT OF ANTERIOR PLATING

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Over a 5-year period, 60 patients with cervical spondylotic myelopathy were treated surgically with a one or two-level anterior cervical discectomy and fusion. 36 patients had cervical plates, whereas 24 had fusions with no plates. The followup period ranged from 16 to 40 months Clinical and radiographic follow-up data were obtained. The pseudarthrosis rates were 4% for

patients with plating and 12% for patients with no plating.. There was no statistically significant correlation between pseudarthrosis and gender, age, level of surgery., the plating procedure resulted in preserving overall lordosis.Accelerated degenerative changes at the levels adjacent to fusion were seen in 12% of patients with plating compared to 9% in patients without plating. According to Odom,s criteria the overall result was excellent to good in 95% of patifnts with plating compared to 75% in patients without plating.

## Conclusions

The addition of plate fixation for one and two-level anterior cervical discectomy and fusion is a safe procedure and does not result in higher complication rates. The use of plate fixation successfully maintains cervical spine alignment. Patients treated with cervical plating had overall better results when compared with those of patients treated without cervical plates.

**Keywords:** cervical spondylotic myelopathy, cervical discectomy, anterior plating

## ABSTRACT

### STUDY OF PHOTODYNAMIC IMPACT ON GROWTH PLATES OF LONG TUBULAR BONES IN GROWING ANIMALS

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## Introduction

The photodynamic impact (PDI) is based on the combination of laser irradiation and photosensitizers (PS). PS can accumulate selectively in intensively proliferating tissues and have selective sensitivity to certain light wavelengths of the optical range. The absorption of light quanta of PS molecules in the presence of oxygen leads to a photochemical reaction, resulting in a triplet molecular oxygen transformation into a singlet one, as well as a large amount of highly active radicals arising, that cause to necrosis and apoptosis of target cells.

PDI is able to supress tissues proliferating. It is used in treatment of cancer, as well as juvenile arthritis and degenerative diseases in children and adolescents. As shown earlier in the study of histological preparations, PDI on the growth plates of bones (which are tissues with high proliferative activity) causes their decreasing and reducing of the chondrocytes total number in them.

## Objectives

This research is devoted to the studying of the effects of PDI on growth plates at a macroscopic level by measuring the dynamics of growth of long bones of growing animals. The aim of this study is to prove that PDI with a transcutaneous administration of PS to the area of the growth plates inhibits the growth of long bones in growing animals.

## Material and methods

70 rats (males and females) were subjected to the single procedure of PDI on the knee joints area with transcutaneous PS (Chlorine-E6) administration in the age of 4, 4.5, 5, 5.5, 6, 7 and 8 months (10 in each age). The weight, body length and the length of the thighs and shanks (on radiographs at standard conditions) of all the animals were measured before the experiment and until the age of 8.5 months with an interval of 2 weeks. The results were compared with similar measurements of animals of the same age who were not exposed to PDI.

## Results

Comparison of the results convinced that the animals of the experimental group showed a slowdown in the hips and legs for 1.5 months after PDI, followed reclaimed normal growth.

## Conclusion

Thus PDI with a transcutaneous administration of PS to the area of the growth plates inhibits the growth of long bones in growing animals. The obtained results allow to expect a similar effect after PDI on the growth plates of the vertebral bodies, which offers the prospect of managing the growth of the spinal column at the AIS.

**Keywords:** PhotoditazinR, Chlorine E6, laser, chondrocytes, photosensitizer, growth

**ABSTRACT**

### ASYMMETRICAL LIMB GROWTH IN A PATIENT WITH CURTIUS SYNDROME: A CASE STUDY

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A patient with Curtius syndrome has been under our supervision for 8 years. The main clinical manifestation is progressive unilateral hemihypertrophy and the leading orthopedic

defect – different length of the lower extremities. At the time of initial treatment in our Center the child's age was 8 months. Observation time – 8 years.

**Keywords:** Curtius syndrome, hemihypertrophy, lower extremities different length.

## Introduction

Curtius syndrome is a rare genetic abnormality, first described in 1925 by German physician F. Curtius. Type of inheritance is unknown. Frequency in the population is not defined. The disease is characterized by the following clinical manifestations: one-half face local hypertrophy (mainly the upper jaw) or a separate limb's segment huge growth, endocrine disorders. The hypodontia, underdevelopment of tooth enamel and syndactyly (1) can be also observed. The leading clinical manifestation of the syndrome observed in the patient was a progressing unilateral hemihypertrophy, to the maximum manifested in the lower extremities. The child was born in the first pregnancy, childbirth term by cesarean section (indication of the mother), birth weight – 4190 grams, length – 54 cm. The left-sided hemihypertrophy and the difference in legs' length about 1–2 cm were marked at birth. The first stated diagnose – Wiedemann – Beckwith syndrome, which in the follow-up course was changed to Curtius syndrome.

At the time of initial treatment in our Center the child's age was 8 months. The difference in legs' length – 2.5 cm, the volume difference between the left and the right thigh was 4 cm, in shin – 2 cm. Thus, rapid hemihypertrophy progression, along with the overall growth of the child (+19 cm) was observed for eight postnatal months.

## Material and methods

An individual treatment plan was carried out for the patient: magnetic therapy to inhibit the functional activity of the germ zones in „giant„ limb and stimulation in the other one – lagging behind in growth (2), procedures to improve blood flow in germ zones of a short limb, dosed cuff axial traction of a short limb at the time of the day and partly night sleep, asymmetric differentiated massage, exercise and restorative therapy. As diagnostic techniques were applied anthropometry and radiography. The obtained results were subjected to statistical processing and mathematical modeling.

## Results

As it has been already noted, the leading and most clinically significant manifestation of the syndrome was the difference in length of the lower extremities progressing. Therefore, the main objectives of supervision of the patient were:

1. To stop the progression in the length difference of the lower extremities.
2. To insure adequate compensation to the already existing defect by using orthopedic shoes.
3. To prevent the spinal column deformation.
4. To inhibit/decrease the growth difference in limbs' volume.

An individual plan of treatment and observation was created for the patient. It consisted of several components: selective magnetic therapy to inhibit the functional activity of the germ zones of a „giant" limb (Patent RF № 2212258, 28.11.2001), the procedures/manipulation treatment/ to improve blood flow in germ zones of a short limb, based on the Gueter-Volkmann law, dosed axial cuff traction of a short limb in the daytime and partly during night's sleep, the asymmetric differentiated massage, exercise and restorative therapy. During the observation period the patient has already received more than 20 of such courses (up to 4 – 5 times a year).

## Discussion

In mathematical modeling of the defect's slew rate, along with the case history (at birth the difference – 1 cm, in 8 months – 2.5 cm), the expected difference in the length of the lower limbs was evaluated in more than 7 cm.

As a result of therapeutic interventions it became possible to „slow down" the left-sided hemihypertrophy progression and for the present moment the difference in lower extremities length is 5 cm (the increase is not more than 2.5 cm for 7 years, with a general increase in growth during the period – more than 50 cm). The treatment course is being continued.

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## ABSTRACT

### TEMPORARY ASYMMETRIC BLOCKING OF GROWTH PLATES IN TREATMENT OF LONG BONE AXIS AND LENGTH DISTURBANCES IN CHILDREN.


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## Introduction

Incidence of excessive valgosity and varosity of axis of lower extremities in children is constantly becoming higher. Radical increase of obesity in children and their less active, more sitting way of life could be among reasons. Long bone osteotomies performed in children to correct disturbances of axis of extremities require prolonged cast immobilisation and absence from school activities. Temporary asymmetric blocking of growth plates on the other hand,

allows controlled monitoring of axis correction without necessity to change child's normal daily habits.

## Aim

The aim of the paper is to present outcomes of temporary asymmetric blocking of growth plates in treatment of children with excessive valgosity, varosity or leg length discrepancy.

## Methods and material

Metaizeau method in children above 12 year of life, and „8-plate" method in younger children are minimal invasive procedures on growth plates, protecting from increase of deformity, and still leaving place for bone osteotomies in future.

For the last 5 years we have introduced procedures of temporary asymmetric blocking of growth plates in treatment of long bone axis and length disturbances in children. In the period 2010-03.2014 96 patients, aged from 8 to 15 years, underwent such treatment. 155 lower extremities have been treated: 116 with excessive valgosity and 13 with excessive varosity and 26 lower extremities with length discrepancy.

The group of children with axis disturbances comprised of: bilateral valgosity in 53 patients, one-sided valgosity in 10 patients, bilateral varosity in 6 patients and 1 patient with varosity of one lower extremity. Average value of valgosity before treatment was 14° (10° – 25°) in girls and 13° (8° – 20°) in boys.

The group of children with length discrepancy comprised of: idiopathic discrepancy in 16 patients; post inflammatory or congenital shortening in 5 patients; post traumatic lengthening in 4 patients; lengthening in the syndrome of one-sided overgrowth (Russell-Silver syndrome) in one patient. Average value of discrepancy before treatment was 2,3 cm (1.5 cm – 2.9 cm).

The last group where blocking of growth plates was performer were children with axis disturbances due to multiple exostoses (3 patients) and one patient with Blount diseases.

Problems and complications:

In 2 cases hypercorrection from valgosity into varosity was noted. One patient required second procedure to correct misplaced canulated screw and one with misplaced „8-plate". In one case the treatment had to be stopped and „8-plate" was removed due to allergic reaction and knee flexion contracture of 25°.

## Results

The treatment in 68% of patients was finished with axis of lower extremities back to physiological values. In girl the remaining valgosity was of 3,5° in boys 0°±. We noted 90% of good and excellent results no matter which method of epiphysiodes was used.

After the treatment was finished in the group of children with leg length discrepancy the final values were below 0,5 cm, giving 85% excellent results.

In children with axis deformity due to multiple exostoses temporary asymmetric blocking of growth plates seems a simpler and more effective method than osteotomies. Also in cases of Blount disease the method can support axial correction after osteotomies.

## Conclusions

The work presents our experience in temporary asymmetric blocking of growth plates in treatment of long bone axis and length disturbances in children. We find these procedures highly effective and safe. Guided growth procedures in children may diminish incidence of severe deformities at adult age.

## ABSTRACT

### HEMI-EPIPHYSIODESIS AT THE KNEE REGION: LONG – TERM RESULTS OF AMBULANT CENTRE FOR DEFECTS OF LOCOMOTOR APPARATUS, PRAGUE, CZ

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The Ambulant Centre for Defects of Locomotor Apparatus in Prague has achieved very good results with permanent epiphysiodesis that was carried out both in cases of unequal leg length and at deformities around the knee joint. The goal of the communication is to present our last ten years experience with anthropometric mesurement of tibio-femoral angle, indication and timing of the surgery and long-term results of permanent hemi-epiphysiodesis (carried out by modified Macnicol´s method using drilling of growth physis) that was indicated to children with deformities around the knee joint region.

Hemi-epiphysiodesis (HE) was indicated to growing children suffering from the knee joint deformities caused by idiopathic, metabolic, neuromuscular, genetic skeletal disorders. Partial permanent medial or lateral HE of distal femoral physis and/or proximal tibia one was done in a cohort of 28 patients aged 10.4 – 15.95 years. Totally

were made 47 medial and 10 lateral hemi-epiphysiodesis. Average age of surgery was 13.27 ± 1.31 years. Valgosity was indicated to HE in children with both the idiopathic cases (obesity, hypermobility) and in multiple exostoses, bone dysplasias (BD), etc. In patients with valgosity the average T-F angle was 13.62° ± 4.08° measured before surgery, the angle was normalized to 4.4° ± 1.39°. The evaluation showed that intermalleolar distance was decreased from 8.1 cm ± 2.63 cm to 0.91 cm ± 1.29 cm. Varosity was indicated to HE in children with bone dysplasias (achondroplasia, pseudoachondroplasia, hypophosphatemic rickets etc.). Average T-F angle in

these cases was -13.63° ± 2.29° measured before surgery, the angle was changed to -9.75° ± 2.36°. Intercondylar distance was decreased from 3.38 cm ± 1.25 cm to 2.2 cm ± 1.68 cm.

In the right time indicated HE results to excellent correction of tibio-femoral angle. Worse results were gained in patients with bone dysplasias and varosity of the knee joints due to late carrying out HE. In BD cases we begin to use so-called „guided growth method" which uses the special 8-plates in last two years.

The correction of the biomechanical axis of legs by HE is a mini-invasive surgical procedure that is indicated with the aim not only to prevent premature osteoarthritis of the knee joints but it improves the posture, walking stereotype and visual aspect, too.

**Key words:** Hemi-epiphysiodesis, tibio-femoral angle measurement, timing of surgery, knee valgus/varus deformity correction

## ABSTRACT

### "SYNDROME OF CONTRACTURES AND DEFORMITIES" AND ITS CAUSAL INFLUENCE IN DYSPLASIA OF HIPS, WRY NECK, BLOUNT DISEASE AND SO-CALLED IDIOPATHIC SCOLIOSIS

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## Introduction

In orthopaedic literature most authors speak about deformity in children and problem of pain in adults in context of "weakness of muscles, which mean – "the muscles are not enough strong". In our observations, the problem of deformity in children and pain in adult patients is connected with asymmetric or symmetric shortening of soft tissues even causing contractures of joints.

Causes of „syndrome of contractures" (SofC). The „syndrome of contractures" has been described primarily by Professor Hans Mau as "Siebener [Kontrakturen] Syndrom" (syndrome of seven contractures). This syndrome has been also described by: Hensinger, Howorth, Green & Griffin, Dega, Vizkelety, Komprda, J. Karski, Tarczyńska & T. Karski & M. Karska. The causes of the „SofC" are related to foetus: big weight, long body or with maternal conditions like: small belly during pregnancy, lack of amniotic fluids (oligohydramion), "androidal" or "platypeloidal" pelvic bone. In the asymmetric contractures of joints also CNS has influence as additional cause. The "left sided syndrome of contractures" is more common, as a result of first position (left sided) of foetus during pregnancy, which occurs in 85% – 95% of cephalic presentations pregnancy (Oleszczuk).

Clinical symptoms in the "syndrome of contractures" according to Mau are:

1. scull deformity (plagiocephaly),
2. torticollis muscularis (wry neck),
3. scoliosis infantilis (infantile scoliosis) – other than idiopathic scoliosis,
4. contracture (shortening) of adductor muscles of the left hip. Untreated contracture can lead to development of developmental hip dysplasia (DDH acc to Klisič),
5. contracture (shortening) of abductor muscles and soft tissues of the right hip (acc to T. Karski), described as Haltungsschwäche ("weak posture") by Mau. With time, asymmetry in movement causes asymmetry during gait and loading; causing so called idiopathic scoliosis (Karski 1995-2006);
6. pelvic bone asymmetry – the oblique pelvis positioning visible during X-ray examination for hip joint screening – [see above points 4 & 5];
7. Foot deformities – such as: pes equino-varus, pes equino-valgus, pes calcaneo-valgus.

In Lublin we also include in the "syndrome of contractures and deformities" in newborn and babies excessive shank deformity (crura vara) which later can lead to Blount disease [T. Karski, J. Karski and others 2006].

## Material

In the years 2005 – 2013 authors examined 818 newborns and babies with signs of "syndrome of contractures". The control group count 212 children presented by parents for examination, but they were without sign of "SofC".

Syndrome of contractures and its influence on locomotors system by youth and adults. In the lecture are presented cases of SofC with problems of (1) hip dysplasia, (2) Blount disease, (3) wry neck (torticollis), and there are given new observations connected with (4) biomechanical aetiology of so-called idiopathic scoliosis.

## Conclusions

1) Every paediatric orthopaedic surgeon and paediatric doctor should be familiarized with knowledge about "Syndrome of Contractures" according Prof. Hans Mau,
2) Every newborn and baby with SofC should be treated very early by proper nurseling, proper orthopaedic devices, older children by stretching exercises to reach symmetry of joints movements, sometimes by surgery,
3) Effective early therapy of "residual changes" in hips, in spine, in knees can look at an effective prophylaxis of movement insufficiency of knees, hips and spine in adult age of many people.

**Key words:** syndrome of contractures, dysplasia of hips, wry neck, Blount disease, idiopathic scoliosis

## Literature

By authors and www.ortopedia.karski.lublin.pl

**ABSTRACT**

### SPASTIC HIP – CLINICAL AND RADIOLOGICAL DEVELOPMENT

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Abstract was not sent.

## Session V. Orthopaedic anthropology. Biomechanics

**Chairmen:** Dmitri Tesakov, Pyrc Jaroslaw

**ABSTRACT**

### RADIOLOGICAL FEATURES OF BONE GROWTH OF THE PELVIS AND SPINE IN PATIENTS WITH IDIOPATHIC SCOLIOSIS

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### Introduction

Development of spinal deformity in patients with idiopathic scoliosis (IS) depends on the process of bone growth.

The aim of research is to study of the activity of the bone of the pelvis and the sprout of the spine to determine its age dynamics in patients with IS.

### Materials and methods

We investigated the age dynamics of bone growth of the pelvis and spine in 2006 of the patients who were at the age of 4-20 years and had spinal deformation in the main arc in the frontal plane from 5 up to 168 degrees. Applied x-ray research method. The activity of the pelvic

bone growth was evaluated by Risser-tests. The activity of bone growth of the spine was assessed by Sadofeva-tests. All tests were divided into three groups. The first group included tests 0-III, which characterized the active bone growth. The second group consisted of test IV that pointed to a stabilization of bone growth. The third group consisted of test V, which demonstrate the completeness of the bone growth.

## Results and discussion

The data obtained showed that when IS the pelvis and spine maturation in the bone behind the 1-5 years in relation to the physiological norm. Also found that when IS the spine begins and ends his physiological growth with a certain lag compared to the bones of the pelvis for the term from 1 year to 3 years. The results indicate immaturity of bone growth of the pelvis and spine as a syndrome characteristic to IS. That is possible to regard as certain osteal growth infantilism, caused probably by general osteopeny or any other disease pathogenic specify which is not found out yet. Determined that Risser-test should be regarded as an objective, but indirect information which characterizes the activity of spinal growth plate in patients with IS. For direct evaluation of activity growth in the spine with scoliosis to use this Sadofeva test. This test allows you to objectively predict development of Pathology, as well as to determine the proper corrective treatment and optimal terms.

**Key words:** Idiopathic scoliosis, spine, bone growth

## ABSTRACT

### THE RADIOGRAPHIC METHOD FOR EVALUATION OF AXIAL VERTEBRAL ROTATION – PRESENTATION OF THE NEW METHOD

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Assessing the extent of a rotation of a spinal segment on a transversal plane is difficult. Many methods have been proposed and employed to measure vertebral rotation such as radiography, CT, MRI methods and ultrasound. However these methods do not display a close correlation nor do they reproduce the actual and known values of the thoracic or lumbar vertebral rotation.

The objective of this study is to present a new radiographic method for the assessment of vertebral rotation from an antero-posterior (AP) view of conventional X-rays which is sufficiently precise in comparison with radiographic methods presently used in clinical practice (methods of Nash-Moe and Perdriolle).

This method is based on the properties of the geometric shape of vertebrae and their shared dimensional proportions. It means that the relation between vertebral body width and height doesn't change significantly within the entire thoracic and lumbar sections of the spine. The absolute size of the angle of vertebral rotation is measured on X-ray film.

In order to verify the method, we have constructed a special device for vertebral fixation (in vitro) with the possibility to obtain X-ray films with a predefined rotation.

## Results

Subsequently, the X-ray pictures of individual human vertebrae with predefined rotation values (ranging from 0° to 45° by steps of 3°) were radio-graphically measured and then compared with their actual axial rotation on the vertebral rotation device. All arithmetic averages correlate very closely with the actual values. A published X-ray picture with defined rotational values was read utilizing both our new method and a Perdriolle torsion-meter and the acceptable accuracy of our method was verified.

The verification of axial vertebral rotation with the assistance of CT and MRI pictures of six scoliotic patients (in supine position) and the evaluation of axial vertebral rotation by both the new radiographic method and with the Perdriolle method proved the satisfactory accuracy of our method.

## Conclusion

The main advantage of the newly presented radiographic method is the uncomplicated measurement of vertebral rotation from AP projection of conventional X-ray pictures or from its printed copies. The absolute size of an X-ray picture or its copy is unimportant. The gold standard of the new radiographic method is the evaluation of axial rotation of vertebrae to 30° approximately and the shape of vertebral bodies without severe structural deformities. The new radiographic method seems to be suitable for use in clinical practice.

**Key words:** axial vertebral rotation, radiographic method, X-ray of spine, vertebral rotation device

Notes: Publication in Scoliosis Journal, 1. 8. 2014

Free software AngleSpine to download as ZIP file: http://www.anglespine.com

## ABSTRACT

### EFFECT OF BRACING ON THE QUALITY OF LIFE OF ADOLESCENTS WITH IDIOPATHIC SCOLIOSIS

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### Introduction

So-called Adolescent Idiopathic Scoliosis (AIS) is known to be associated with biomechanical-etiology concerning asymmetry of hip movement in gait and habitual standing "at ease" mostly on the right leg ( T. Karski, first publication in 1996). Bracing is so far the most effective non-operative treatment of AIS with spine curvature range between 25°-45° of Cobb angle. This method is widely accepted and its primary goal is to prevent skeletally immature patients from further progression of the spinal curve. In this study we aimed to investigate how bracing treatment impacts patients mental health and what is the compliance of very demanding treatment recommendations.

### Aim

The aim of this study was the verification of, patients compliance with prescribed brace wearing schedules, patients self-perception and physical functional health status,outcomes and problems associated with AIS during brace treatment therapy

### Material and Methods

We've researched our departments patient database records from 2006 to 2013. 51 patients aged 9 to 18 (84% girls) with AIS treated with Brace (18 months mean duration of brace treatment ), were asked to complete translated and modified by the authors survey (Quality of Life Profile for Spine Deformities Instrument). Patients Cobb angle values were compared before and after brace treatment. Statistical data analysis was performed

### Results

The mean compliance with a prescribed 23h/d regiment was 70%, 14 patients achieved over 90%, 22 patients reached 50-90%, for 11 people rate was below 50%. The vast majority of patients – 48 (94%) were satisfied with the method and final result of treatment. 6 patients (12%) reported difficulties in activities of daily living and movement limitation during brace wearing. 4 patients (8%) reported sleeping disorders while 10 (20%) were unsatisfied with the shape of their posture. Pain complaints with mean 4 pkt score (0-10 scale) were observed in 18 patients ,up to 34 (70%) declared suffering from minor abrasions and scratches of the skin. There was no significant deterioration of spinal curvature measured with Cobb angle when compared before and after brace treatment.

## Conclusions

1. Sleeping disorders and the social relationship in the study group deteriorated minimally in relation to the quality of life before brace treatment.
2. High score in faulty posture awareness in the research group is an important measure because it potentially affects the good compliance results.
3. Pain did not significantly affect the comfort of brace wearing moreover minor abrasions and scratches are quite common outcomes of brace treatment thus it is important to properly fit the brace before treatment
4. In most cases bracing did prevent patient posture from further deterioration what confirms it's value in treatment of mild and moderate adolescent idiopathic scoliosis

**Key-words:** idiopathic scoliosis, bracing, quality of life

## ABSTRACT

### BIOMECHANICS OF PROXIMAL FEMUR DUE TO PERTROCHANTERIC FRACTURE. HOW IMPORTANT ARE ACCURATE REDUCTION AND IMPLANT PLACING BY TREATMENT OF PROXIMAL FEMUR FRACTURES

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The femur is the largest and strongest bone in the body and it is capable to absorbing a huge amount of energy and resisting all but the greatest amount of trauma without damage.

But only in Germany, more than 100,000 elderly suffer a hip fracture especially pertrochanteric femur fractures every year. In this study we explain the differences between the stable and instable pertrochanteric femur fractures due to biomechanics. It is extremely important to understand biomechanics of the pertrochanteric region for the trauma surgeon. The aim of operation is to achieve the exactly reduction and optimal placement of implant, to mobilise the patient as soon as possible. The current common treatment of pertrochanteric fractures is intramedullary nail osteosynthesis. We reported about our experiences in the treatment of so called instable pertrochanteric femur fractures in comparison to international results.

**Key words:** proximal femur fracture, pertrochanteric femur fracture, instable proximal femur farcture,

## ABSTRACT

### SINUS TARSI – KEY IN THE TREATMENT OF FLAT FEET

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### Introduction

Flatfoot with valgosity of ankle is the often cause of pain in children, limits their sport activity and adversely affect the motility of the lower limbs and spine. It can lead to sinus tarsi syndrome. This syndrome is described in dancers, volleyball and basketball players associated with flatfoot and hyperpronation deformities as well. Since two years we are performing minimally invasive operating procedures, using implants. There are two methods: the first method is using the Nicky implant, placed in the sinus tarsi and the second, Lima implant - implant screwed in the calcaneus, when head of the screw stays in ST.

### Aim of the study

The aim of the study was to evaluate the effectiveness of treatment with implants placed in sinus tarsi (ST). The second aim was to compare both methods of treatment.

### Material and method

We used implants located in ST in 100 feet in 58 children: Nicky method in 60 feet and Lima method in 40 feet. Surgeries carried out in children aged 4 to 16 years (average 12.8 years old). Nicky method consists in place metal screw with plastic cover into the ST, screws with dowel an expansion when tightening the screws - plastic umbrella. The method of Lima special titanium or biodegradable screw placed it to calcaneus from the ST, so that the screw head will extinguish the ST. In both methods, the skin incision is about 1 cm. Patients begin normal loading of operated leg from 2 to 5 days after surgery.

### Analysis of the material and discussion

Children were evaluated after a period of 5 months to 2 years. Nicky and Lime increased longitudinal arch of the foot, the heel shape has improved. In one child implant Nicky stepped partly, however, the effect of the operation was maintained. In two children operated using Nicky implant there was pain observed - up to 2 months. In the case of Lime implant in one case we observed prolonged pain - up to 2 months. Other patients were satisfied, can practice sports normally. These data are consistent with the literature (the first are the observations of the Italian dates back 30 years) use of such therapies in flat-valgus feet.

## Conclusions

Introduction of the implant into the ST seems to be a good alternative for the treatment of Grice-Green method. Children do not require long immobilization cast, start loading in the first week after surgery.

## ABSTRACT

### ACCELERATION OF NEW BONE FORMATION IN CALLUS

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Biomechanical loading affects bone structures. The anabolic effects of cyclic biomechanical loading on bone tissue are influenced by the frequency of loading. Mechanotransduction appears to involve a complex interaction between extracellular fluid shear forces and cellular mechanics. Bone cells are activated by both the cyclic fluid shear stresses and transported ions/molecules in fluid flow. The cyclic loading stimulates new bone formation through (for example) integrin linkages and ion channels. Cyclic stress/strain changes in bone and the cyclic fluid flow in intercellular networks can be induced by the dynamic electronic fixative (EDF). The dynamic effects of EDF stimulate the distraction osteogenesis (desmogenesis). Increasing the rate or frequency by which dynamic loading is applied greatly improves bone tissue mechanosensitivity, possibly due to loading-induced extracellular fluid forces around bone cells, that serve as mechanosensors. The elongation of long bones by EDF is accompanied by the gradual stretching and/or oscillations of the callus between bone fragments. Defined microoscilations of callus between bone fragments initiated by predetermined external force effects very efficiently regulate the healing velocity, the corticalisation – the rise of load bearing tissue structures and the development of elastic and viscoelastic properties of new bone tissue. The active load cycles can be interrupted by the defined tranquillity also. The EDF regulates both strain frequencies and amplitude modulations also. EDF presents the effective clinical tool for software regulated osteogenic stimulations within the callus.

The presented distraction fixator was originally the first electronically controlled distraction fixation apparatus in the world. Its advantage is the ability to stimulate and regulate the corticalisation of the callus during distraction, to asymmetrically or symmetrically elongate shortened long bones of children/adults and to contribute to the elimination of some deformities of long bones in children or in adults.

**Key words:** bone, distraction of diaphyses, distraction apparatus, electronic regulation of oscilations, callus

## ABSTRACT

### RADIOGRAPHIC ASSESSMENT OF LENGTHENING CALLUS STRENGTH: COMPARISON OF ACHONDROPLASIA AND UNILATERAL HYPOPLASIA

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Aim of the paper is to present an experience with two radiographic methods for prediction of possible collapse of lengthening callus after external device removal in children with achondroplasia and unilateral shortening.

### Introduction

For the study we used clinical, anthropological and radiological evaluation of the depositary cases with achondroplasia and unilateral hypoplasia that were surgically treated and monitored in the Ambulant Centre for Defects of Locomotor Apparatus (ACDLA) from 1994. ACDLA is familiar with Ilizarov´s method and external fixation device using it more than 30 years. Ilizarov introduced the concept of local bone regeneration using minimally invasive surgery in 50$^{th}$ years of 20$^{th}$ century (Ilizarov 1989). Lengthening of long bones by a method of distraction osteogenesis (desmogenesis) is reached by step by step callus stretching of healing bone tissue i.e. controlled gradual distraction of bone fragments. Complete healing is a long process, which would involve remodeling of the regenerate, and its completion is difficult to define. There are obstacles and complications during and after lengthening and still the most important decision in distraction osteogenesis is the timing of device removal.

### Objectives

The paper is continuation of previous studies carried out in years 2008 – 2011. These studies were focused on assessment of the callus diameter ratio (CDR, %) measured retrospectively (Myslivec et al. 2008, 2011) at X-rays of achondroplasia and unilateral hypoplasia cases (during and after leg lengthening). We used radiographic examination of CDR according to Mamada, Nakamura et al. (1998) for evaluation and prediction of biomechanical properties of tibial and femoral distraction osteogenesis.

When the CDR was 85% or more in both planes, there were no angular deformities (bending) and fractures. But when the CDR was 80% or less, the complications called collapse of callus were observed and should be expected (Mamada, Nakamura et al. 1998, Myslivec et al. 2008, 2011).

Main objective of this paper is to compare the assessment of distraction osteogenesis in patients with achondroplasia and unilateral leg shortening according to so-called callus diame-

ter ratio – CDR (Mamada, Nakamura et al. 1988, Myslivec et al. 2011) and by classification system based on callus shapes and types of radiographic features (Li et al. 2006).

## Patients and Methods

Firstly, the authors retrospectively reviewed radiographs of 26 tibia and 11 femoral lengthening in 14 achondroplasia patients (age-range 6 – 16 years, 10 males, 4 females) and 14 tibia and 3 femoral lengthening in 12 patients with unilateral hypoplasia or hypotrophy (age-range 2 – 23 years, 4 males, 8 females). Lengthening procedures (osteotomy, rate distraction 1 mm per day after latency 7-10 days) were made using monolateral external fixation (femur) or original Ilizarov´s rings (tibia) during 1994 to 2008. The CDR (%) was calculated as the minimum callus diameter (the callus width) divided by original diaphysis diameter of the tibia/femur at the level of proximal osteotomy bone site. The minimum diameter of the callus was measured using a ruler on anteroposterior and lateral radiographs taken in the time when the lengthening was finished and/or in the time of fixator removal and 6 and 12 months after device removal.

Secondly, in years 2009 – 2013 next 8 elongated patients with achondroplasia (**2**), fibular hemimelia (**2**), femur hypoplasia (**1**), enchondromatosis Ollier (**1**) and shortening due to osteoarthritis (**2**) were reviewed from the point of clinical, anthropological and radiological evaluation – **table 1**. Radiographic assessment was carried out as by CDR method (Mamada et al. 2008) as by classification system based on 5 callus shapes and 10 types of radiographic features that occurred at different stages during limb lengthening from osteotomy through distraction and consolidation to the removal of the fixator. (Li et al. 2006).

## Results

In patients with achondroplasia the average distracted length of tibia was 72.8, femur 78.7 mm In patients with unilateral hypoplasia, the mean lengthening of tibia was 62,5 mm, femur 68 mm. In the achondroplasia group we proved CDR lesser than 85 % in 5 tibias and 2 femurs. In these cases we observed at X-rays after device removal 4 fractures and 1 bending of tibia and 1 fracture and 1 bending of femur. In the unilateral hypoplasia group we proved CDR lesser then 85 % in 6 tibias and 2 femurs. In these cases we observed at X rays soon after device removal 4 bending of tibia and 1 fracture and 1 bending of femur. The collapse of callus was in 18.9 % in the achondroplasia group and in 35.2 % in the unilateral hypoplasia group. In both groups the diameter change rates after fixation removal were significantly positive at X-rays 6 months or more both at the tibia and the femur (Myslivec et al. 2009). Results of 8 patients group are presented in tables.

## Conclusions

The CDR (< 85%) is a simple and good alarming index for preventing the complications called collapse of callus occurring in tibial and femoral lengthening after external fixation removal. The collapse of callus was more frequent in the unilateral hypoplasia group than in the achondroplasia group probably because of prolonged remodelling of callus and bone density

from hypo-activity (patients predominantly loaded unaffected leg). The CDR criterion was the same for both groups. In both groups the diameter change rates after fixation removal were significantly positive at films 6 months or more both at the tibia and the femur. We described this phenomenon as peripheral lateral drift of corticalis (Myslivec et al. 2009) and we concluded that simple axial loading is not a sufficient mechanical impulse for restoration of the physiological geometry of diaphysis and biomechanical properties. The negative influence on the distraction osteogenesis results mainly from high rigidity of the external fixation (undesirable shield effect). Bending, torsion and shear micromotions are necessary for increase of the diaphysis diameter (in the place of original callus) and full remodelling of long bones diaphysis after device removal.

On a small group of 8 patients, we verified that feature type based on four patterns and three levels of regenerate bone density can be used to predict the possible problems of healing in children and adults and it allows corrections to be made at the appropriate time to improve outcome of leg lengthening.

Combination of radiographic methods both callus diameter ratio – CDR (Mamada et al. 2008) and classification system based on callus shapes and types of radiographic features of distraction osteogenesis (Li et al. 2006) escalates reliability of the assessment of the regenerate healing and monitoring its biomechanical properties.

In the next study we plan to classify retrospectively by this classification system the whole ACDLA group of achondroplasia and unilateral hypoplasia patients. The classification will be simplified to make it more appropriate for clinical use.

**Key words:** lengthening, external fixation, achondroplasia, leg hypoplasia, callus diameter ratio – CDR, callus shape and feature

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## ABSTRACT

### CHANGES OF BODY COMPOSITION AND MOTOR ABILITIES OF PRESCHOOL CHILDREN DURING LAST FIVE DECADES

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Due to significant changes of lifestyle (inadequate nutrition, sedentarism) secular changes of adiposity appeared in all age categories, including early age. In preschol children (n= 2578) height, weight, body mass index (BMI), skinfold thickness (Harpenden caliper) over triceps, subscapular and suprailiac were measured along with testing motor performance (broad jump and throw a ball). repeatedly since the fifties of the last century until this millenium. During last five decades the values of skinfold thickness increased significantly until 2011, mainly on the trunk. Simultaneously, the level of motor performance significantly decreased. BMI did not change significantly and did not reflected especially body composition changes. As follows, modifications of the way of life during mentioned five decades characterized by sedentarism and inadequate food intake as related to energy output influenced negatively both adiposity and motor performance already in preschool children. Between the years 1990 and 2011, when significant social, economic, cultural etc.changes especially occurred, most marked changes were revealed. Mostly increased deposition of fat on the trunk which is considered as a marker of possible development of metabolic syndrom was apparent already in preschool age, indica-

ting the importance of early intervention concerning also physical activity and availability for exercise since early life.

**Key words:** secular trend, adipozity, motoric development, preschool children

## ABSTRACT

### RISK FACTORS OF LOW-ENERGY FRACTURES IN CHILDREN FROM MIXED RURAL AND URBAN PODLASIE REGION

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### Background

In recent years the growing number of fractures, of forearm particularly, in children is observed. Different risk factors of low-energy fracture occurrence are postulated. Those are low physical activity, obesity, lowered bone mineral density, lowered level of vitamin D concentration, consumption of carbonated drinks like coke. It is known that vitamin D deficiency is associated with increased risk of osteoporotic fractures in adults. However, unequivocal evidence for the connection between lowered concentration of vitamin D and either low- or high-energy fractures in children is still to be found. It was decided to estimate the group of children with low-energy fractures in a prospective way.

### Aim

The present study seeks to provide correlation between risk factors of low-energy fractures (such as mentioned above) and occurrence of low energy fracture. Also the relation between development period, patient origin and relationship between development period and gender of the patients was analyzed.

### Material and methods

280 children (74% boys) who experienced low-energy fracture and were hospitalized in our Department between 2010 and 2013 were qualified to the study. The comparative group consisted of 124 patients (60 %boys), without fractures hospitalized in our Department. In the questionnaire distributed among parents and patients questions concerning weekly milk and carbonated drinks consumption, physical activity, drugs taken, and previous fractures were asked. Sexual maturation was determined on the basis of modified self-assessment questi-

onnaire. Cole's indicator served the purpose of proper weight estimation. Concentration of vitamin D were determined in every patient.

## Results

In statistical analysis of collected data we found significant differences in vitamin D serum concentration levels between fracture and non-fracture group (p<0,000044). Odds ratio for the occurrence of fracture was calculated for different risk factors both separately and together. Higher vitamin D serum concentration reduces the chance of fracture by almost 6% per 1ng/ml (p<0.0001). Drinking milk reduces the chances of fracture by 7% per every glass taken per week(p<0.0001). Male sex increases the risk of fracture almost twice (Odds ratio – 1.986, p<0.003).

## Conclusions

1. Children with fractures have significantly lower vitamin D serum concentrations
2. Male sex and vitamin D deficiency is one of the major fracture risk factors in children
3. Drinking milk is protective against fractures

**Key words:** low-energy fractures in children, risk factors, serum vitamin D

## ABSTRACT

### BONE FRACTURES IN OBESE CHILDREN AND ADOLESCENTS

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**Key words:** obesity – children – adolescents – bone fractures – physical fitness – motor abilities

Trauma databases indicate most often an increased rate of fractures, especially of the extremities in growing obese subjects compared with children and adolescents of normal body weight. In obese individuals, greater visceral fat is also associated with greater marrow fat, lower bone density and impaired bone structure. Another risk factor is reduced level of physical fitness and motor abilities, causing e.g. more falls and other accidents resulting in injuries, and including also bone fractures. Femur, tibia, ankle, knee, lateral and supracondylar fractures of humerus, and also wrist fractures were found to be associated with increasing BMI and obesity. Higher risk of the fractures of pelvic bone has been also considered due to excessive deposition of body fat. Body composition and hormones secreted and regulated by body fat are, inter alia, determinants of inadequate bone density, bone structure and bone strength; body composition

is also related to serum osteocalcin in overweight and obese children. Increased risk of Blount disease especially under conditions of vitamin D deficiency was revealed in obese children. Complex studies have analyzed this bone problem along with physical activity, fitness and motor abilities development related to adiposity, as the situation concerning these characteristics revealed during last decades a negative development. Higher level of physical fitness, skill and endurance could be an efficient factor of preventing also this significant health problem.

**Key words:** bone fractures, body composition, children obesity

## ABSTRACT

### HISTORICAL REVIEW OF CLUBFOOT TREATMENT

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It is very likely that clubfoot is as old as mankind. The first depictions about clubfoot are already visible on the walls of ancient Egyptian tombs. The basic treatment principles were already described by Hippocrates around 400 B.C.: gentle serial manipulation is needed for the correction; the foot has to be held in the achieved position; the treatment has to be started as early as possible. Throughout centuries many manipulative and fixation instruments were developed by different doctors (Paré, Cheselden, Scarpa, Thomas, Lorenz, Phelps, Schultze) and most of them applied drastic force on the foot. The first description about the serial plaster casting is available from 1838 (Guerin). The results of the first percutaneuos surgeries were also presented from the same period, but due to the high infection rate they did not spread worldwide. Denis Browne developed the abduction bar in 1934. From the 1930's Kite's casting method became popular, which in general gave good results after almost two years of serial casting. Due to the development of anaesthesia and the introduction of antiseptic principles the excessive soft tissue procedures of the foot started to prevail. With these types of surgeries also appropriate corrections could be achieved, but in many of the cases the range of motion of the foot significantly decreased and the foot became painful. Ignacio Ponseti, finding the Kite method too lengthy and the poor functioning feet after the surgeries, started to study the clubfoot more deeply and developed his own method, which provides a shorter casting period with good functioning feet and by which the excessive surgeries can also be avoided. His method and results were first published in 1963. Today Ponseti's method is the most effective method in the treatment of idiopathic clubfoot.

**Key words:** clubfoot treatment, historical review, Ponseti's method

## ABSTRACT

### SYMPTOMS OF DISEASE ON ANTIQUE FIGURES?

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## 1. Error in quantity

- Bild tiptoe
- Polydaktylie ? Incompetence of sculptor?
- Bild foot Praeneste
- The sixth (6.) toe is formed like little adnexa of the fifth (5.) We think the sculptor wanted to express pathological evidence in quantity.

## 2. But there are some pathological evidences in quality too.

- Bild Minoan statuette ca. 2000 B. C.
- This is very curious: a thickening of only one leg, the left.
- Lipoedem? Lymphoedem ? Elephanthiasis? Papillomatosis cutis lymphostatica?

Curious seems to us:

## 3. A stylistic manner of representing parts of human body

- In early sixth century B. C. in Attica/Greece the little fingers of boys were represented with four (4) phalanges instead of three (3).
- At the same time they showed the ear very great and vertical, with parallels of Helix und Anthelix and with the Tragus like a button.
- Bild Ear

Now look at the manner they represented knees. Symmetrical swellings of Quadrizeps above the Patella. Two buttons. One immediately below the Patella. This means the tuberositas tibiae, but dislocated. The other a little bit outside. This means the capitulum fibulae, wrong situated.

There is no reason to think of illness, nor of incompetence of the sculptors. It means a manner of style. The artist wanted only to show the important parts of knee from the front side.

Bild Kuros New York and the true Anatomie

In seventh century B.C. on Cyprus they produced Kentaur-Figures with male and female sex organs. This does not mean Hermaphrodit. The artist only try to express the demoniac creature.

Bild Cyprus Kentaur

At the end of archaic times it was a custom to represent the Musculus rectus abdominalis as six-pack instead of four-pack. It disappeared with the beginning of classical times.

Bild anatomic studies on abdomen

## 4. At least we are dealing with a kind of misinterpretation.

Bild Corinth, second half of the forth century B.C.

It's a votive statue from the Asklepieion of Corinth. The little boy is represented inclining the Head to his right side.

Connatal Torticollis with shortness and fibrous degeneration of Musculus sterno-cleido--mastoideus on one side only ?

Contraction of muscles as a symptom for instance of the „Siebener-Syndrom"?

Osseous defect? Klippel-Feil-Syndrom, rare congenital Synostosis, associated with other malformations?

Bild Villa Giulia

Associated with a short neck? There is an Italien archaeologist who commended to forget such a miscarried statuette at once and do not take any notice of him.

Bild Ayia Irini, Cyprus, early sixth century B. C.

In his thesis a young collegue described this statue of a Cypriote soldier with a blessed arm, put in a sling in flexion and middle position between pronation and supination.

Bild Marble. Sitting girl, Rome Capitolium, third century B. C.

He is topped from a medicine historian, who interpreted a charming young girl having blessed her arm and carrying it in a sling. But we look behind the surface and know, that this behaviour will only mean a fashionable and flirting pose.

**Key words:** symptoms of disease, antique figures

## ABSTRACT

### IDENCE BASED INTERMITTENT PNEUMATIC COMPRESSION (EBIPC) METHOD

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## Inroduction

The rehabilitation method using the EBIPC is a computer based massage, using pressure cuffs with the uniform compression of muscle tissue during massage therapy of the arms and the legs. Interactively informs on screen the massage effect in form of the muscles relaxation degree.

## Purpose of the research

Purpose of the research using the EBIPC -method is to activate important signaling molecule nitric oxide (NO), which penetrates into and activates muscle causing relaxation of smooth muscle cells (Nobel Prize 1988, Ortop. Resarch Sciety, 1997, San Francisco). On this way NO induces synthesis of cyclic GMP, by activation of enzyme guanylyl cycles (GC) leading to relaxation of myosin (muscle protein) and relaxation of the muscle in physiological way.

## The group of patients, treatment and research using EBIPC -method:

a. The treatment of postoperative swelling of the hands and arms, during 3 days at the Department of Hand Surgery, reducing swelling in a physiological manner.
b. The treatment of postoperative swelling legs after coronary bypass during 4 days at the Department of Heart Surgery, with good results.
c. The treatment of S-scoliosis, after 2 month massage of legs and arms the pain has stopped.
d. The treatment of postoperative paralyzed patient in both legs during 5 years, after 3 weeks of massage return sensibility I both big toes and after 2 month patient can get up and go.
e. The treatment of Carpal Syndrome, after 7 days massage of arm syndrome has been finished.
f. The treatment of 5 year old boy with Congenital Muscle Dystrophy, after 3 months massage of legs, the boy started crawling on the floor. The video available.

## Applications

The EBIPC-method offers an important contribution to healthcare, giving new opportunities of healing to patients suffering from acute painful conditions where conventional treatment is unsuccessful.

**Key words:** Intermittent Pneumatic Compression method, Intermittent EBIPC method

## ABSTRACT

### CHALLENGES FOR TREATING AND MANAGING DISABILITIES IN UGANDA (20 MIN.)

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Uganda is a landlocked country situated in East Africa, member of the East African Community and neighboring Southern Sudan to the north, Kenya to the east, Democratic Republic of Congo to the west and Rwanda and Tanzania to the south.

Treating and managing disabilities is still a big task ahead where infrastructure, inadequate professionals, lack of equipment are part of the big social, cultural, environmental and avoidable hardships brought about by conflicts and disasters still affecting the progress that should reduce the burden of disability in Uganda.

Uganda has population of 34,758,809, almost half of citizens are below 14 years old (48,9%), other 21,2% below 24 years old. Birth rate is 44,5 births/1000 population. This number of childrens orthopedics problems is high. In the same time number of beds are 0,5/1000 population, and number of physicians are 0,117/1000 population. This lead to late time of initiation of treatment.

The majority of disabilities seen in Uganda are mainly congenital and from effects of infections which end up being complicated and complex due to neglect with time, inappropriate treatment and management and lack of follow-up impacting on compliance and adherence.

For many generations, the social and cultural influence has dominated and controlled the health seeking behaviors and this has held an impact in society till today. It will still remain a challenge for more decades until the state and opinion leaders become committed in fully addressing these issues which have resulted to social, economic, cultural, psychological, emotional, spiritual and physical tortures that many affected families and communities are facing today.

Treatment and management of disabilities heavily lies in the hands of Non-Governmental Organizations and which services can only be got in major cities or towns far from the reach of many poor rural families.

There are few specialized hospitals, doctors and surgeons to treat and manage orthopedic problems and there is a very big shortage of Physiotherapists, Orthopedic technicians/technologists in the country.

Most hospitals lack equipped operating theatres, diagnostic equipment like X-rays to perform confirmatory diagnosis and besides lack of regular electricity supply. Usually families have to meet all the costs for treatment, appliances and reviews and this has led to relapses and complications that need a concerted and team approach to reduce the burden imposed upon the families and communities affected.

Uganda has only 28 orthopedic surgeons serving the population of over 33 million people. "Health minister Dr. RukahanaRugunda says this has made many people with different fracture complication miss out on treatment and resort to traditional medicine."

There are currently two Physiotherapy schools in the country. Mulago School of Physiotherapy, state owned and Mbarara University of Technology and Sciences, private.

Admission to these schools is limited and for example, not more than 3 students graduate each year from Mulago School of Physiotherapy.

## Current challenges

- Very few orthopedic surgeons in the country
- Very few Physiotherapists and Orthopedic Technologists
- Lack of equipment, electricity supply
- Services are concentrated within the capital city far from the reach of the most affected population
- No collaborative approaches to deal with issues and services for people who need orthopedic services

## Remedies

- Need for more trainings and education for Orthopedic surgeons, Physiotherapists, orthopedic Technologists and other allied staff
- Develop team approach and collaboration with all the key Non-Governmental Organizations and hospitals treating patients with orthopedic and disability related conditions
- Build a team approach with international expatriates and hospitals who have extensive experience

**Key words:** disabilities in Uganda, treating and managing

## ABSTRACT

### ORTHOPAEDICS, PROSTHETICS AND ORTHOTICS IN THE THIRD WORLD COUNTRIES (45 MIN.)

Neff Georg (Berlin, Germany)
Berlin, Germany
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Despite a century long period of western influence – along with moderate medical care – sequels of poliomyelitis, trauma, scald, sickle cell anemia, tumors, limb deficiencies present at birth, punishment etc. are still common in Third World Countries or those under development.

Due to more than 40 years of cooperation mainly with gtz training centers for Orthopedic Technologists in Africa, Near and Far East and Asia, follow-up programs, evaluation of P&O projects, and local assistance – including diagnosis, conservative and surgical interventions – teaching and examining as a Visiting Professor and researcher is the background for an overview on

various deformities present at birth or acquired by disease or trauma and their treatment under nonstandard conditions including P&O solutions.

The shortcomings in infrastructure, equipment, materials and lack of qualified manpower are a challenge for improvisation and modified solutions to assist those in need.

**Key words:** orthopaedics, prosthetics, orthotics, 3rd world countries

## Workshop Hand surgery

**Lecturer:** Smrcka Vaclav (Prague, Czech Republic)
ESME l.l.c. & Department of Plastic Surgery, 1st Medical Faculty of Charles University in Prague, Hospital Na Bulovce, Prague, Czech Republic

## Titles of lectures

1. Flexor Tendon Repair
2. Extensor Tendon Repair (with Mallet Finger, Swan-neck Defomity and Boutonniére Deformity)
3. Skin Loss Defects and Replantation
4. Carpal Tunnel Syndrome/Release,
5. Tendinitis
6. Dupuytren´s Disease.

## ABSTRACT

### REHABILITATION PROCEDURE AFTER INTERRUPTION OF TENDONS AND NERVE STRUCTURES IN THE WRIST OF AN ENTERTAINER – VIDEO FILM

Bejvlova Jarmila[1), 2)], SmrckaVaclav[1), 2)], Molitor Martin[2)]

[1)] ESME l.l.c.

[2)] Department of Plastic Surgery, 1st Medical Faculty of Charles University in Prague, Hospital Na Bulovce, Prague, Czech Republic

Description of a complete post-traumatic interruption of the n. medianus and nearly of all tendinous structures within the zone IV in the wrist of an entertainer, world master in jugglery, recorded in the Guinness Book of Records 2010 in Moulin Rouge, Paris for the speed and use of as much as seven clubs.

Rehabilitation was started 3 weeks after the operation done with a 4-strand suture acc. to Kessler. It was aimed to cure the oedema and maintain the joint range by means of passive mobilization. After 2 weeks of the beginning of the rehabilitation phase the oedema receded, after 2 months there is 60 -70 deg. range in the MP joints. After 4 months the fingers have the full range of the motion, nevertheless EMG shows no signs of regeneration.

Co-operation with the patient during the rehabilitation phase is excellent, he is even over--motivated, he himself completes the manual therapy by ergotherapeutic incorporation of the exercises with the clubs on the principle of limbering up.

Thus for one month he makes exercises with one club imitated by a plastic bottle and every other month he adds one more club.

So thanks to motivation, after 9 months he gets, as he says, up to the level of 98 percent of his performance he had before the injury.

After 13 months he normally does even his top performance with 7 clubs.

**Key words:** interruption n. medianus, inteerruptioon tendinous structures zone IV, rehabilitation after surgery

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**provozní doba:**
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