Pohybové ústrojí

Pokroky ve výzkumu, diagnostice a terapii

The 20th Prague-Lublin-Sydney-St. Petersburg Symposium

Interdisciplinary approach to growing skeleton 2

12th–16th September 2018
Prague | Czech Republic

Vydává
Společnost pro pojivové tkáně ČLS J. E. Purkyně z.s.
Odborná společnost ortopedicko-protetická ČLS J. E. Purkyně z.s.
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Society For Connective Tissues CMA J.E. Purkynje & Society for Prosthetics and Orthotics CMA J.E. Purkynje & Czech Society of Biomechanics & Czech Medical Association J.E. Purkynje & Medical University of Lublin & Vincent Pol University in Lublin & Children's Rehabilitation Center of Orthopaedics and Traumatology "Ogonyok", St. Petersburg

invite you to

THE 20TH PRAGUE-LUBLIN-SYDNEY-ST. PETERSBURG SYMPOSIUM

main topic

INTERDISCIPLINARY APPROACH TO GROWING SKELETON 2

The Symposium will be held in Kromeriz, hotel "Octárna", Czech Republic in September 12–16, 2018

under the auspices of
of the chairman of the Chamber of Deputies of the Parliament of the Czech Republic
Radek Vondracek, MSc
&
the honorary president of the Czech Medical Association J.E. Purkynje
Professor Jaroslav Blahos, MD, DSc.
&
the honorary president of the Society for Connective Tissues CMA J.E. Purkynje
Professor Josef Hyanek, MD, DSc.

The Symposium belongs to education actions integrated into the life training system of physicians according to professional statute No. 16 of the General Medical Council.

SYMPOSIUM PROGRAMME

WEDNESDAY, SEPTEMBER 12, 2018

Arrival of participants to Kromeriz

19.00–21.00 WELCOME BANQUET & REGISTRATION OF PARTICIPANTS IN THE HOTEL "OCTÁRNA", KROMERIZ

THURSDAY, SEPTEMBER 13, 2018

8.30–9.00 REGISTRATION OF PARTICIPANTS IN THE HOTEL "OCTÁRNA"

9.00 OPENING OF THE SYMPOSIUM

Ivo Marik & Tomasz Karski & Mikhail Dudin

WELCOME SPEECHES

Professor Ivo Marik, MD, PhD
President of the Society for Connective Tissues, Czech Medical Association J.E. Purkynje

Professor Mikhail Dudin, MD, DSc.
Honorary member of the Society for Connective Tissues, Czech Medical Association J.E. Purkynje

Professor Tomasz Karski, MD, PhD
Honorary member of the Society for Connective Tissues, Czech Medical Association J.E. Purkynje

WELCOME SPEECHES OF GUESTS

Radek Vondracek, MSc
Chairman of the Chamber of Deputies of the Parliament of the Czech Republic

Professor Jaroslav Blahos, MD, DSc.
Honorary president of the Czech medical association J.E. Purkynje

Professor Josef Hyanek, MD, DSc.
Honorary president of the Society for Connective Tissues CMA J.E. Purkynje

9.30–12.00 **MORNING SESSIONS**

SESSION I: BIOMECHANICS – CLINICAL APPLICATION

Chairmen: PETRTYL MIROSLAV, BRAUN MARTIN, BELLEMORE MICHAEL

Petrtyl Miroslav[1], Denk Frantisek[1], Lerach Ales[3, 4], Vitek Tomas[5], Lisal Jaroslav[1], Myslivec Radek[2, 6], Marik Ivo[2, 6, 7] *(Prague, Czech Republic)*

The first electronically controlled distraction fixator stimulating the new bone formation in callus (25+5 min.)

1 Laboratory of Biomechanics and Biomaterial Engineering, Department of Mechanics, Faculty of Civil Engineering, CTU, Prague
2 Centre for Defects of Locomotor Apparatus l.l.c., Prague,
3 Faculty of Mechanical Engineering, CTU, Prague,
4 Medin Orthopaedics, a. s., Prague,
5 Faculty of Electrical Engineering, CTU, Prague
6 Orthopaedic and Traumatology Department, Hospital Pribram, Czech Republic
7 Faculty of Health Care Studies, West Bohemia University, Pilsner, Czech Republic

Braun Martin *(Prague, Czech Republic)*

Application and potential of bionanotechnologies in osteology and orthopaedics (20+5 min.)

Department of Composites and Carbon Materials, Institute of Rock Structure and Mechanics.
The Czech Academy of Sciences, Prague, Czech Republic

Tesar Karel[1,2], Sucharda Zbynek[3], Balik Karel[3] *(Prague, Czech Republic)*

Surface morphology of biodegradable magnesium wires (15+5 min.)

1 Department of Materials, Faculty of Nuclear Sciences and Physical Engineering, Czech Republic
2 Department of Dielectrics, Institute of Physics of the Czech Academy of Sciences, Czech Republic
3 Department of Composites and Carbon Materials, Institute of Rock Structure and Mechanics of the Czech Academy of Sciences, Prague, Czech Republic

11.30–12.00 COFFEE BREAK

Chairmen: MARIK IVO, PETRTYL MIROSLAV, CERNY PAVEL

KRAWCZYK PETR[1], MARIK IVO[2,5], JAKUB JOZEF[1], SYKORA ALES[1], ZEMKOVA DANIELA[2], PETRASOVA SARKA[2], UCHYTIL JAROSLAV[3], JANDACKA DANIEL[3], BUZGA MAREK[4] *(Ostrava & Prague & Pilsner, Czech Republic)*
Results of kinematic analysis of walking in patients with different weight of prosthesis (15+5 min.)
1 PROTEOR CZ l.l.c., Ostrava, Czech Republic
2 Ambulant Centre for Defects of Locomotor Apparatus l.l.c., Prague, Czech Republic
3 Diagnostic Centre of Human Movement PdF, Ostrava University, Czech Republic
4 Department of Physiology and Pathophysiology, Faculty of Medicine, University of Ostrava, Czech Republic
5 Faculty of Health Care Studies, West Bohemia University, Pilsner, Czech Republic

CERNY PAVEL[1,2,3], DRNKOVA JANA[3], STOLINSKI LUKASZ[4,5,6], CZAPROWSKI DARIUSZ[7,8], KOTWICKI TOMASZ[4], MARIK IVO[1,9] *(Prague & Pilsen, Czech Republic – Poznan & Skierniewice & Olsztyn, Poland)*
Verification of measuring method of axial pelvic rotation from photographs according to scanned 3D models (15+5 min.)
1 Faculty of Health Care Studies, University of West Bohemia, Pilsner, Czech Republic
2 Faculty of Physical Education and Sport, Charles University, Prague, Czech Republic
3 ORTOTIKA l.l.c., the complex of the Faculty Hospital at Motol, Prague, Czech Republic
4 Department of Spine Disorders and Pediatric Orthopedics, University of Medical Sciences, Poznan, Poland
5 Rehasport Clinic, Poznan, Poland
6 Rehasport Clinic Licensed Rehabilitation Center, Skierniewice, Poland
7 Department of Physiotherapy, Józef Rusiecki University College, Olsztyn, Poland
8 Center of Body Posture, Olsztyn, Poland
9 Centre for Defects of Locomotor Apparatus l.l.c., Prague, Czech Republic

CERNY PAVEL[1,2,3], CERNY MICHAL[3], DRNKOVA JANA[3], STOLINSKI LUKASZ[4,5,6], CZAPROWSKI DARIUSZ[7,8], KOTWICKI TOMASZ[4], MARIK IVO[1,9] *(Prague & Pilsen, Czech Republic – Poznan & Skierniewice & Olsztyn, Poland)*
Measurement of spinal and postural deformities from radiographs and photographs using SCODIAC software (15+5 min.)
1 Faculty of Health Care Studies, University of West Bohemia, Pilsner, Czech Republic
2 Faculty of Physical Education and Sport, Charles University, Prague, Czech Republic
3 ORTOTIKA l.l.c., the complex of the Faculty Hospital at Motol, Prague, Czech Republic
4 Department of Spine Disorders and Pediatric Orthopedics, University of Medical Sciences, Poznan, Poland
5 Rehasport Clinic, Poznan, Poland
6 Rehasport Clinic Licensed Rehabilitation Center, Skierniewice, Poland
7 Department of Physiotherapy, Józef Rusiecki University College, Olsztyn, Poland
8 Center of Body Posture, Olsztyn, Poland
9 Centre for Defects of Locomotor Apparatus l.l.c., Prague, Czech Republic

E-poster

CERNY PAVEL[1,2,3], CERNY MICHAL[3], DRNKOVA JANA[3], STOLINSKI LUKASZ[4,5,6], CZAPROWSKI DARIUSZ[7,8], KOTWICKI TOMASZ[4], MARIK IVO[1,9] *(Prague & Pilsen, Czech Republic – Poznan & Skierniewice & Olsztyn, Poland)*

Measurement of spinal and postural deformities from radiographs or photographs using dedicated software for computers and smartphones (7+3 min.)

1 Faculty of Health Care Studies, University of West Bohemia, Pilsner, Czech Republic
2 Faculty of Physical Education and Sport, Charles University, Prague, Czech Republic
3 ORTOTIKA l.l.c., the complex of the Faculty Hospital at Motol, Prague, Czech Republic
4 Department of Spine Disorders and Pediatric Orthopedics, University of Medical Sciences, Poznan, Poland
5 Rehasport Clinic, Poznan, Poland
6 Spine Disorders Center, Rehasport Clinic Licensed Rehabilitation Center, Skierniewice, Poland
7 Department of Physiotherapy, Józef Rusiecki University College, Olsztyn, Poland
8 Center of Body Posture, Olsztyn, Poland
9 Centre for Defects of Locomotor Apparatus l.l.c., Prague, Czech Republic

FAMILY PHOTO OF PARTICIPANTS IN THE HOTEL ″OCTÁRNA“

13.00–14.00 LUNCH

14.00–17.00 **AFTERNOON SESSIONS**

SESSION II: OSTEOLOGY, BONE METABOLISM

Chairmen: BAYER MILAN, LYRITIS GEORGE, MARIK IVO

LYRITIS GEORGE[1] AND STAVROULA RIZOU[2] *(Athens, Greece)*

Peak bone mass (20+5 min.)

1 Emeritus Professor of Orthopedics, Faculty of Medicine, National and Kapodistrian University of Athens, Greece
2 Hellenic Osteoporosis Foundation, Kifissia, Greece

NIKOLAOU DIMITRIOS A[1,2] *(Athens, Greece)*

The Importance of Risk of Falling Assessment alongside the "Fracture Risk", when evaluating patients with bone loss (20+5 min.)

1 Medical School, National and Kapodistrian University of Athens, Greece
2 Hellenic Osteoporosis Foundation, Kifissia, Greece

Zemkova Daniela[1,2], Marikova Alena[2], Hudakova Olga[2], Marik Ivo[2,3], *(Prague & Pilsen, Czech Republic)*
Bone density of genetic skeletal disorders – introduction (20+5 min.)
1 Dept. of Paediatrics, University Hospital Motol, Prague, Czech Republic
2 Faculty of Health Care Studies, West Bohemia University, Pilsen, Czech Republic
3 Ambulant Centre for Defects of Locomotor Apparatus l.l.c., Prague, Czech Republic

INVITED LECTURE OF PROFESSOR MILAN BAYER, MD, PHD.

Introduction: OLGA HUDAKOVA, MD, PHD

Moderator: PROFESSOR JOSEF HYANEK, MD, DSC.
Honorary president of the Society for Connective Tissues, Czech Medical Association J.E. Purkynje

Bayer Milan *(Prague, Czech Republic)*
Pubertal timing and bone health (25+5 min.)
Department of Children and Adolescents, 3rd Faculty of Medicine, Charles University, Hospital Královské Vinohrady, Prague, Czech Republic

16.00–16.30 COFFEE BREAK

Chairmen: ZWIP HANS, MARIK IVO

PROFESSOR MICHAEL BELLEMORE, MD.

Introduction: OLGA HUDAKOVA, MD, PHD

Moderator: PROFESSOR IVO MARIK, MD, PHD.
President of the Society for Connective Tissues, Czech Medical Association J.E. Purkynje

Bellemore Michael, Munns Craig *(Sydney, Australia)*
Osteogenesis imperfecta (20+5 min.)
Department of Orthopaedic Surgery, The Children's Hospital at Westmead, Sydney, Australia

Zwipp Hans *(Dresden, Germany)*
Malunited Fractures of the Foot and Ankle in Children – How to correct? (25+5 min.)
Orthopedic and Traumatology Department of the University in Dresden, Germany

17.30 – 18.30 DINNER

18.30 GUIDED TOURS IN KROMERIZ

Archbishop's cellars with wine tasting.

FRIDAY, SEPTEMBER 14, 2018

8.00–8.30 REGISTRATION OF PARTICIPANTS
in the Hotel "OCTÁRNA"

8.30–13.00 **MORNING SESSIONS**

SESSION III: SPINE DISORDERS I: PATHOGENESIS, DIAGNOSIS AND TREATMENT

Chairmen: KARSKI TOMASZ, DUDIN MIKHAIL, MARIK IVO

Lectures dedicated in memory of Milan Roth.

Hudakova Olga[1], Marik Ivo[1,2] *(Prague & Pilsen, Czech Republic)*
Memory of Associate Professor Milan Roth, DSc. (10 min.)
1 Ambulant Centre for Defects of Locomotor Apparatus l.l.c., Prague, Czech Republic
2 Faculty of Health Care Studies, West Bohemia University, Pilsen, Czech Republic

VAN LOON PIET JM[1], SOETERBROEK ANDRE M[2], GROTENHUIS ANDRE H[3] *(Deventer, Oosterbeek & Nijmegen, Netherlands)*

"A short cord can cause scoliosis": Osteoneural growth relations by Milan Roth (1923–2006) – a concise concept in morphogenesis and a useful scientific base for Orthopedics and Neuroscience. An overview of his legacy in biomedical science (25+5 min.)

1 Orthopedic surgeon, Care to Move, Centre for Orthopedics, Deventer, The Netherlands
2 Chairman Houdingnet (Posture Network Netherlands), Oosterbeek, The Netherlands
3 Professor of neurosurgery, RadboudMC, University of Nijmegen, The Netherlands

DUDIN MIKHAIL GEORGIYEVICH *(St. Petersburg, Russia)*

Reflections about the perspectives of scoliosology (25+5 min.)

Children's Rehabilitation Center for Orthopedics and Traumatology 'Ogonyok', Saint-Petersburg, Russia

ARSENEV ALEKSEY VALENTINOVICH, DUDIN MIKHAIL GEORGIYEVICH, PETROV SEMEN *(St. Petersburg, Russia)*

Idiopathic scoliosis treatment or how to 'loose spring' (20+5 min.)

Children's Rehabilitation Center for Orthopedics and Traumatology 'Ogonyok' St. Petersburg, Russia

KARSKI TOMASZ *(Lublin, Poland)*

Biomechanical etiology of the so-called idiopathic scoliosis. New classification. New therapy. Clinical material based on observation from 34 years (1984–2018) and presentation from 1995 (23 years) (25+5 min.)

Vincent Pol University in Lublin, Poland

10.30–11.00 COFFEE BREAK

SESSION III: SPINE DISORDERS II: PATHOGENESIS, DIAGNOSIS AND TREATMENT

Chairmen: VAN LOON, PIET, REPKO MARTIN, KOLESNICHENKO VERA

VAN LOON PIET JM[1], ERVE VAN RUUD HG[1], THUNNISSEN ERIK BT[2], GROTENHUIS ANDRE JM[3] *(Deventer, Amsterdam & Nijmegen, Netherlands)*

Growth of the human skeleton, a lifestyle dependant, tension based biomechanical and neurodynamic process. Connected research out of a trail in etiopathogenetic search in spinal deformities and endemic postural changes (20+5 min.)

1 Orthopedic surgeon, Care to Move, Centre for Orthopaedics, Deventer, The Netherlands
2 Pathologist, epidemiologist VUMC, Free University, Amsterdam, The Netherlands
3 Professor of neurosurgery, RadboudMC, University of Nijmegen, The Netherlands

Petrov Semen *(St. Petersburg, Russia)*
What do we know about intervertebral discs? (the short literature review) (15+5 min.)
Children's Rehabilitation Center for Orthopedics and Traumatology 'Ogonyok', St. Petersburg, Russia

Nikitina Alexandra, Komantsev Vladimir, Dudin Mikhail *(St. Petersburg, Russia)*
Electrophysiological aspects of paraspinal muscle activity in children 9–12 years old without spinal deformity (15+5 min.)
Children's Rehabilitation Center for Orthopedics and Traumatology 'Ogonyok', Saint-Petersburg, Russia

Kolesnichenko Vera[1], Golka Gregory[2], Gresko Igor[3] *(Kharkov & Lviv Ukraine)*
Structural asymmetry of lumbar vertebrae as a risk factor for the developmental of paravertebral muscle dysfunction (15+5 min.)
1 SI "Sytenko Institute of Spine and Joint Pathology National Academy of Medical Sciences of Ukraine", Kharkov, Ukraine
2 Kharkov National Medical University, Ukraine
3 Lviv National Medical University named after Danila Galitsky, Ukraine

Repko Martin[1,2], Filipovic Milan[1,2] *(Brno, Czech Republic)*
Growing scoliotic spine – limits of conservative treatment and indication of surgery (15+5 min.)
1 Orthopaedic department, Faculty Hospital of Masaryk´s University Brno
2 Centre for Spinal Surgery, Faculty Hospital Brno

Filipovic Milan[1,2], Repko Martin[1,2], Horak Jan[1,2], Leznar Milan[1,2], Prymek Martin[1,2] *(Brno, Czech Republic)*
The role of growth guidance systems in surgical treatment of early onset scoliosis (15+5 min.)
1 Orthopaedic department, Faculty Hospital of Masaryk´s University Brno
2 Centre for Spinal Surgery, Faculty Hospital Brno

FAMILY PHOTO OF PARTICIPANTS IN THE HOTEL "OCTÁRNA"

13.30–14.30 LUNCH

14.30–18.00 **AFTERNOON SESSIONS**

SESSION IV: DIAGNOSTICS AND COMPREHENSIVE TREATMENT

Chairmen: KARSKI JACEK, KRAWCZYK PETR, MARIK IVO

BELLEMORE MICHAEL *(Sydney, Australia)*
Perthes disease, irritable hip and other causes of a painful hip (20+5 min.)
Department of Orthopaedic Surgery, The Children's Hospital at Westmead, Sydney, Australia

KARSKI JACEK, WILCZYNSKI MICHAŁ, KARSKA KLAUDIA[1], OSTROWSKI JERZY, STAROBRAT GRZEGORZ[2], LATALSKI MICHAŁ[2], KAŁAKUCKI JAROSŁAW, KANDZIERSKI GRZEGORZ *(Lublin, Poland)*
Bowleg deformities in children and adolescents. Various treatment methods (15+5 min.)
Paediatric Orthopaedic and Rehabilitation Department of Medical University of Lublin
1 Paediatric Radiology Department of Medical University of Lublin
2 Paediatric Orthopaedic Department of Medical University of Lublin

KARSKI JACEK, KLAUDIA KARSKA[1], TOMASZ KARSKI[2] *(Lublin, Poland)*
Is the way of sitting important at childhood and adolescent age? (15+5 min.)
Paediatric Orthopaedic and Rehabilitation Department of Medical University of Lublin
1 Paediatric Radiology Department of Medical University of Lublin
2 Vincent Pol University in Lublin, Poland

KARSKI TOMASZ[1], KARSKI JACEK[2], BEATA SLOWINSKA[3], BARTOSZ BORYGA[3], KARSKI JANUSZ[4], ZURAKOWSKI WOJCIECH[4] *(Lublin, Poland)*
Physiotherapy correct and incorrect in patients from Sanatorium of Dr Janusz Korczak in Krasnobród in period of 1977–2018 (15+5 min.)
1 Vincent Pol University in Lublin, Poland
2 Medical University in Lublin, Poland
3 Military Hospital in Lublin, Rehabilitation Department
4 Sanatorium under the name of Dr Janusz Korczak in Krasnobród, Poland

16.00–16.30 COFFEE BREAK

Chairmen: KARSKI TOMASZ, SMRCKA VACLAV, MARIK IVO

Karski Tomasz[1], Karski Jacek[2], Domagala Marian[3], Kowalska Magdalena[3] *(Lublin, Poland)*
Problems of ankle joint, knee and in some cases of hips caused by rotation distortion in daily activity (15+5 min.)
1 Vincent Pol University in Lublin, Poland
2 Medical University in Lublin, Poland
3 Medical Centrum in Laszczów near to Tomaszów Lubelski

Karski Jacek[1], Karski Tomasz[2], Pyrc Jarosław[3] *(Lublin, Poland)*
Knee problems – instability. Causes. Symptoms. Prophylactics (15+5 min.)
1 Medical University in Lublin, Poland
2 Vincent Pol University in Lublin, Poland
3 Medical Department of Technical University in Dresden, Germany

Smrcka Vaclav[1,2], Marik Ivo[3], Kuzelka Vitezslav[4], Dick David[2], Bejvlova Jarmila[2] *(Prague, Czech Republic)*
Surgery of metacarpal aplasia (15+5 min.)
1 Institute for History of Medicine and Foreign Languages & Department of Plastic Surgery, 1st Faculty of Medicine, Charles University in Prague, Bulovka Hospital, Czech Republic
2 ESME l.l.c., Prague, Czech Republic
3 Centre for Defects of locomotor apparatus l.l.c, Prague, Czech Republic
4 Anthropological Department of National Museum, Prague, Czech Republic

Smrcka Vaclav[1,2], Rastocny Stefan[2], Marek Karel[2], Dick David[2], Bejvlova Jarmila[2] *(Prague, Czech Republic)*
Dupuytren disease in the Czech population in the 20th century (15+5 min.)
1 Institute for History of Medicine and Foreign Languages & Department of Plastic Surgery, 1st Faculty of Medicine, Charles University in Prague, Bulovka Hospital, Czech Republic
2 ESME l.l.c., Prague, Czech Republic

19.00 GALA DINNER WITH FOLKLORE MUSIC

SATURDAY, SEPTEMBER 15, 2018

8.30–9.00 REGISTRATION OF PARTICIPANTS
in the Hotel "OCTÁRNA"

9.00–13.00 **MORNING SESSIONS**

SESSION V: DISORDERS OF GROWING SKELETON – ORTHOPAEDIC ANTHROPOLOGY – PATHOBIOMECHANICS – ORTHOTICS AND PROSTHETICS – VARIA

Chairmen: ZEMKOVA DANIELA, BELLEMORE MICHAEL, MARIK IVO

Petrasova Sarka[1], Morvova Zuzana[1,4], Zemkova Daniela[1,2], Marik Ivo[1,3] *(Prague & Pilsen, Czech Republic)*
Characteristics of the tibiofemoral angle, rearfoot angle and plantar arch in healthy children aged 6 to 15 years (20+5 min.)
1 Ambulant Centre for Defects of Locomotor Apparatus l.l.c., Prague, Czech Republic
2 Dept. of Paediatrics, University Hospital Motol, Prague, Czech Republic
3 Faculty of Health Care Studies, West Bohemia University, Pilsen, Czech Republic
4 Faculty of Science, Department of anthropology and human genetics, Charles University, Prague

Zemkova Daniela[1,3], Anyzova Tereza[3,4], Marikova Alena[2], Marik Ivo[2,3] *(Prague & Pilsen, Czech Republic)*
Growth data of Czech achondroplasia patients (20+5 min.)
1 Dept. of Paediatrics, University Hospital Motol, Prague, Czech Republic
2 Faculty of Health Care Studies, West Bohemia University, Pilsen, Czech Republic
3 Ambulant Centre for Defects of Locomotor Apparatus l.l.c., Prague, Czech Republic
4 Faculty of Science, Department of anthropology and human genetics, Charles University, Prague

Shpileuski Igor, Sakalouski Aleh *(Minsk, Belarus)*
The peculiarities of surgical treatment of benign bone neoplasms in growing patients (20+5 min.)
Belarusian Research Centre of Traumatology and Orthopedics, Minsk, Belarus

Marik Ivo[1,2,4], Hudakova Olga[2], Marikova Alena[2], Zemkova Daniela[2,3], Myslivec Radek[2,4], Kozlowski Kazimierz[5]
(Prague & Pilsen, Czech Republic & Sydney, Australia)
Subtypes of enchondromatosis: case reports (20+5 min.)
1 Faculty of Health Care Studies, West Bohemia University, Pilsen, Czech Republic
2 Ambulant Centre for Defects of Locomotor Apparatus l.l.c., Prague, Czech Republic
3 Dept. of Paediatrics, University Hospital Motol, Prague, Czech Republic
4 Orthopaedic and Traumatology Department, Hospital Pribram, Czech Republic
5 Department of Medical Imaging, Children's Hospital at Westmead, Sydney, Australia

Pankratova Galina[1], Dudin Mikhail Georgievic[2] *(Ryazan & St. Petersburg, Russia)*
Anatomical and topographical peculiarities of urine flowing system organs among the children with idiopathic scoliosis (20+5 min.)
1 Orthopedics clinic, Ryazan, Russia
2 Children's Rehabilitation Center of Orthopedics and Traumatology "Ogonek", Saint-Petersburg, Russia

11.00–11.30 COFFEE BREAK

Chairmen: PARIZKOVA JANA, KRAWCZYK PETR, MARIK IVO

Bellemore Michael *(Sydney, Australia)*
Deformity correction and limb lengthening (15+5 min.)
Department of Orthopaedic Surgery, The Children's Hospital at Westmead, Sydney, Australia

Musil Michal *(Vienna, Austria)*
Indication-related strategy for orthotic aids applied to upper extremities affected by a neuromuscular disease (15+5 min.)
Pohlig Austria GmbH&CoKG, Vienna, Austria

Snytr Jan *(Zruc-Senec, Czech Republic)*
Comparison of GRAFO and reaction AFO orthoses in patient treatment (15+5 min.)
Ottobock CZ l.l.c., Zruc-Senec, Czech Republic

Popovicova Vera, Ryba Lukas, Rybova Stepanka *(Pilsner, Czech Republic)*
Monitoring the effect of fascial stretching on the range of motion in hip joint – a pilot study (15+5 min.)
Faculty of Health Care Studies, West Bohemia University, Pilsner, Czech Republic

Parizkova Jana (Prague, Czech Republic)
Predispositions for adiposity, motor abilities and muskuloskeletal development (15+5 min.)
Obesity Management Centre, Institute of Endocrinology, Prague Czech Republic

Blaha Pavel (Prague, Czech Republic)
Anthropological surveys in Czech Republic (Czechoslovakia) (15+5 min.)
Dept. of Biomedical Sciencis College of Physical Education and Sport PALESTRA

13.30–14.30 LUNCH

14.30–16.00 **AFTERNOON SESSIONS**

SESSION VI: E-POSTERS: SPINE DISORDERS III: PATHOGENESIS, DIAGNOSIS AND TREATMENT

Chairmen: KARSKI JACEK, DUDIN MIKHAIL, MARIK IVO

Presenters of E-posters: DUDIN MIKHAIL GEORGIEVIC, PETROV SEMEN, NIKITINA ALEXANDRA, PANKRATOVA GALINA

Dudin Mikhail[1], Popov Igor[2], Baloshin Yuriy[2], Lisitsa Nikita[2], Bober Stepan[1] *(St. Petersburg, Russia)*

Characteristics of linear sizes of vertebral bodies and intervertebral disks in children in the beginning of puberty (7+3 min.)

1 Children's Rehabilitation Center for Orthopedics and Traumatology 'Ogonyok', St. Petersburg, Russia

2 St. Petersburg National Research University of Information Technologies, Mechanics and Optics (ITMO University).

Bazanova Maria, Dudin Mikhail, Koloskova Lidia *(St. Petersburg, Russia)*

The value of vitamin D receptor gene polymorphism (VDR) by BSMI-B/b marker as a participant of adolescent idiopathic scoliosis (AIS) pathogenesis in children (7+3 min.)

Children's Rehabilitation Center for Orthopedics and Traumatology 'Ogonyok'& OOO "Medlab" SPb, Saint-Petersburg, Russia

Rybka Dina Olgovna[1], Dudin Mikhail[1], Sharova Lidia[2] *(St. Petersburg, Russia)*

Ultrasonic characteristics of paravertebral muscles in children with idiopathic scoliosis and without deformity of the spine (7+3 min.)

1 Children's Rehabilitation Center of Orthopaedics and Traumatology «Ogonyok»,

2 North-Western State Medical University named after I.I. Mechnikov, Sankt-Petersburg, Russia

Pankratova Galina[1], Dudin Mikhail[2] *(Ryazan & St. Petersburg, Russia)*

Anatomical and topographical peculiarities of urine flowing system organs among the children with idiopathic scoliosis (5+2 min.)

1 Orthopedics clinic, Ryazan, Russia

2 Children's Rehabilitation Center of Orthopedics and Traumatology "Ogonek", Saint-Petersburg, Russia

Vasilevich Sergej[1], Arseniev Aleksey[1], Dudin Mikhail[1], Sukhov Timofey[2] *(St. Petersburg, Russia)*

Experience diagnostics using the modern mobile technology in practice of physician orthopedist (7+3 min.)

1 Children's Rehabilitation Center for Orthopedics and Traumatology 'Ogonyok'

2 Baltic State Technical University 'VOENMECH' named after D. F. Ustinov, Saint-Petersburg, Russia

Vasilevich Sergej[1], Arseniev Aleksey[1], Dudin Mikhail[1], Khomutov Vladimir[2], Komlev Aleksey[2]
(St. Petersburg, Russia)
Prospects the possible applications of the electret effects of the bones in pediatric orthopedics- preliminary report (7+3 min.)
1 Children's Rehabilitation Center for Orthopedics and Traumatology 'Ogonyok'
2 St. Petersburg Electrotechnical University 'LETI', St. Petersburg, Russia

Afanasyeva Olga, Bober Stepan, Gyduc Tatiana *(St. Petersburg, Russia)*
Psychological peculiarities of adolescents with scoliosis of various gravity degree (5+2 min.)
Children's Rehabilitation Center for Orthopedics and Traumatology 'Ogonyok', St. Petersburg, Russia.

Zaltsman Polina *(St. Petersburg, Russia)*
The advantage of using a differential acupuncture technique in combination with traditional rehabilitation methods for stopping the pain syndrome of vertebrogenic genesis in children and adolescents (5+2 min.)
Children's Rehabilitation Center for Orthopaedics and Traumatology «Ogonyok», St. Petersburg, Russia

Ivo Marik & Petr Krawczyk, Tomasz Karski & Mikhail Dudin
Closing of the Symposium
and planning The 21st Prague-Lublin-Sydney-St. Petersburg Symposium

FAMILY PHOTO OF PARTICIPANTS IN THE HOTEL ″OCTÁRNA“

16.00 TOUR OF THE CASTLE AND GARDENS

18.00 FAREWELL DINNER

SUNDAY, SEPTEMBER 16, 2018

9.00 CELEBRATORY BREAKFAST IN THE HOTEL "OCTÁRNA"

GOOD BYE!

NOTES FOR ALL PARTICIPANTS

Lectures and text slides will be presented in English.
Time of the individual lectures and for discussion of each lecture is indicated in round brackets.
A list of lectures/posters and chairmen of sessions can be changed!

The registration conference fee 100 Euros (it includes registration, social program and refreshments throughout the symposium) will be paid by Bank Transfer.

Bank: **ČSOB, Na Pankráci 310/60, 140 00 Praha 4**
Bank account: **500617613/0300**
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Swift Code/BIC: **CEKOCZPP**
Owner of the account: **Czech Medical Association J.E. Purkynje, Prague, CZ**
Variable symbol: **2518022** (into recipient information put on your name and surname).

There is a possibility to pay during registration, too!

Hotel accommodation is paid individually.

Abstracts of lectures will be published in the Supplement 2 of the journal Locomotor System 25/2018 (electronic version, ISSN 2336-4777, http://www.pojivo.cz/cz/pohybove-ustroji/)
Participants will receive the Programme & Certificate of Attendance & Symposium materials.

NOTES TO SOCIAL PROGRAMME

Landmark protected by UNESCO:
Castle, a unique castle gardens. http://www.zamek-kromeriz.cz/en)

Social Evening at the wine Archbishop's cellars with wine tasting.
More recent information about the Symposium will be available on the websites:
www.pojivo.cz & www.ortoprotetika.cz

Do not hesitate address your questions to International Organizers of the Symposium:

Professor Ivo Marik, MD, PhD & Petr Krawczyk, MD & RNDr. Martin Braun, PhD
e-mails: ambul_centrum@volny.cz & krawczyk@proteorcz.cz & braun@irsm.cas.cz

Prof. Tomasz Karski, MD, PhD & Jacek Karski, MD, PhD
e-mail: tmkarski@gmail.com & jkarski@vp.pl

Prof. Mikhail Dudin, MD, PhD & Assist. Prof. Aleksey Arsenev, MD
E-mail: ogonek@zdrav.spb.ru & stivamat@rambler.ru

Notes:

A list of other hotels and websites where it is possible to provide accommodation:

http://www.octarna.cz/en)
http://www.hotelboucek.cz/hotel
http://www.lafresca.cz/english.html)
http://cernyorel.webnode.cz/en)
http://www.hotelpurkmistr.cz
http://www.wellness-kromeriz.cz/en)
http://www.penzionhrozen.cz/en)

Transport to Kromeriz

We ask the foreign participants to notify the organizers of the number of people and the way of transport to the symposium in order to facilitate travel no later than 14 days before the beginning of the symposium.

Transport from Prague or Ostrava (airport) to Kromeriz

Foreign participants of the symposium will report the date and time of the arrival to the airport to Prague or Ostrava no later than 14 days before the symposium begins. The organizers of the symposium will then arrange an transport from the airport to the railway station and transport to the accommodation in Kromeriz. The detailed shipping plan will be sent no later than 1 week before the symposium begins.

Partners of the symposium

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PROTEOR CZ

Vystavovatel

SANATORIA KLIMKOVICE

Speech of welcome to

The 20th Prague-Lublin-Sydney-St. Petersburg Symposium – Interdisciplinary approach to growing skeleton 2

Dear Ladies and Gentlemen, my dear colleagues!

I cordially welcome you at **The 20th Prague-Lublin-Sydney-St. Petersburg Symposium**. It is my great honour to welcome among us the chairman of the Chamber of Deputies of the Parliament of the Czech Republic Radek Vondráček, MSc. With pleasure I welcome here Professor Jaroslav Blahos, MD, DSc., honorary president of the Czech Medical Association (CMA) J.E. Purkynje (JEP). He successfully administrated this Association for 25 years. I still remember him as my teacher of internal medicine and later as my consultant in the field of Metabolic Bone Diseases. My pleasure is to welcome here the next distinguished celebrity of the Czech medicine Professor Josef Hyánek, MD, DSc., who has celebrated his 85th anniversary this year. He is our family friend and my advisor not only in medicine. He is a well known specialist in the field of biochemistry focused on diagnostics of inherited metabolic diseases and the founder of organized care for children with inherited metabolic disorders in the Czech Republic. My special reception belongs to my friend Professor Michael Bellemore, AM FRACS, well-known paediatric orthopaedic surgeon from The Children's Hospital at Westmead, Sydney, Australia.

I cordially welcome all colleagues, specialists of different medical branches, specialists in biomechanics, orthotics, physiotherapy and the others who are interested in disorders of neuro-musculo-skeletal system. At present, interdisciplinary approach to congenital and acquired skeletal deformities was accepted as the main line of thought how recognize the new connections regarding etiology, pathogenesis and last but not least the comprehensive and even causative (in a few diagnoses) therapy of genetic skeletal disorders.

I am very pleased that this year the topic of the Symposium attracted colleagues from Australia, Austria, Belarus, Czech Republic, Germany, Greece, the Netherlands, Poland, Russia and Ukraine (i.e. representatives of 10 nations) and we are looking forward to their outstanding lectures and fruitful discussions.

A special session is **dedicated in memory of Milan Roth** who discovered and experimentally proved the anatomical discongruenty of growth between the neural tissue and the enveloping skeleton, both under and above the foramen magnum and the other neuroskeletal relations.

I thank to all speakers for their interesting lectures and I believe that scientific lectures will amplified our knowledge which will become a profit for our disabled patients.

My great thanks belong to all International organizers – these are Professor Tomasz Karski, Assistant Professor Jacek Karski, MD, PhD from Lublin, further Prof. Mikhail Dudin, MD, DSc. and his team from St. Petersburg. My warm thanks belong mainly to my close colleague Petr Krawczyk, MD, president of the Orthotic and Prosthetic Society CMA JEP who arranged for us very interesting cultural programme. The organizers are grateful for the support of The Symposium to the Partners **ottobock.** and **Proteor s.r.o.**

I wish you to enjoy new scientific information, the beauty historical landmarks of Kromeriz that are protected by UNESCO and I wish you to make new friendships which will help us to arrange international and interdisciplinary scientific research.

It is my sad obligation to mention that honorary member of the Society for Connective Tissues, CMA, J.E. Purkynje Professor Jaromír Kolář, MD, DSc. died in November 2017. Honour to his memory!

Now, let me a short reminiscence of a few moments that we spent with most of you in beautiful Prague in September 2017. Look at photos.

At the end of my speech I would like to remember you our close colleagues and friends Professors Jacques Cheneau, Georg Neff and Kazimierz Kozlowski. They sincerely wish as I great success to The 20th Prague-Lublin-Sydney-St Petersburg Symposium.

Professor Ivo Marik, MD, PhD, FABI

Chief of the Centre for Patients with Locomotor Defects, Prague, CZ
President of the Society for Connective Tissue, CMA J.E.Purkynje
Scientific secretary of the Society for prosthetics and orthotics Czech Medical Association J. E. Purkynje
Chief-Editor of the journal Locomotor System – advances in research, diagnostics and therapy
E-mail: ambul_centrum@volny.cz

Dear friends!

In September 2018 we meet with you at the 20th Prague-Lublin-Sydney-St-Petersburg Symposium.

For the fifth time our team from the St. Petersburg Centre 'Ogonyok' will participate in the feast of science, knowledge and experience of fellow scientists, continuing the tradition of the great Jan Evangelista Purkyně. This is how the word 'symposium' (συμ + πόσιον = joint good and merry feast) is translated from the ancient Greek language.

There is another important event of this year – 95 years since the birth of the outstanding Czech scientist Milan Roth, whose scientific works were ahead of his time. Today they have become an invaluable basis for our Centre to develop practical methods of real prevention and treatment of the most frequent pathology of the musculoskeletal system – deformations of the spinal column.

The total number of meetings, that have reached twenty, speaks directly of the great foresight of the founders of the Symposium who, before all, realized that the development of modern medicine is impossible without a close union between specialists from various scientific and applied disciplines. Only in interdisciplinary cooperation unexpected and great ideas are born. Ideas that are needed on the path to one goal – to find the most optimal and effective methods of treatment for suffering people.

I would like to emphasize that for several years now the Symposium has taken the first place in the calendar of scientific-practical conferences, in which the employees of the 'Ogonyok' Centre participate. This year we want to not only share our thoughts, but also learn.

Unique benevolence is the most important characteristic of our summits. It is simply permeated with all the scientific discussions, and the events included in the cultural programs.

I sincerely wish the organizers and participants of the Symposium fruitful work, successful presentations and constructive discussions.

Be all healthy and happy!

Professor Mikhail Dudin

Director of Children's Rehabilitation Centre of Orthopedics
and Traumatology "Ogonyok" St. Petersburg, Russia
E-mail: ogonek@zdrav.spb.ru

Dear Participants of The 20th Prague-Lublin-Sydney-St. Petersburg Symposium in Kromeriz,

as many times before, now for the 20th time, we – orthopedic surgeons, rehabilitation doctors, pediatricians, general doctors, general surgeons, nurses and physiotherapists gather during this Symposium which takes place from12th to 16th September 2018. This time, after 3 years, again in Kromeriz, a beautiful town in the east of Czech Republic. Like every year, the Symposium is made possible thanks to a fascinated activity of Prof. Ivo Mařík and his co-organizers.

Here I want to recall the dates and places of last seven Symposia, and in this list also three Symposia held in Poland.

In 2011 the 13th Prague-Sydney-Lublin Symposium took place in Rhodos (Greece).

In 2012 the 14th Symposium was held in Sarbinowo, closely to the Baltic coast (Poland).

In 2013 the 15th Prague-Lublin-Sydney-St. Petersburg Symposium was held in St. Petersburg (Russia) at the Rehabilitation Center "Ogonyok"

In 2014 the 16th Symposium Prague-Lublin-Sydney-St. Petersburg took place in Military Hospital in Lublin (Poland).

In 2015 the 17th Symposium was held in Kromeriz, Czech Republic.

In 2016 the 18th Symposium took place in Guest House „Zacisze" in Zwierzyniec (Poland).

In 2017 the 19th Symposium Prague-Lublin-Sydney-St. Petersburg gathers us in beautiful Prague.

In 2018 the 20th Symposium Prague-Lublin-Sydney-St. Petersburg is again in Kromeriz.

I wish to all the participants spending a nice time in the Czech Republic, like before also a pleasant meeting of all friends as well as a fruitful and profitable discussion during the whole Symposium.

Good luck to all of you!

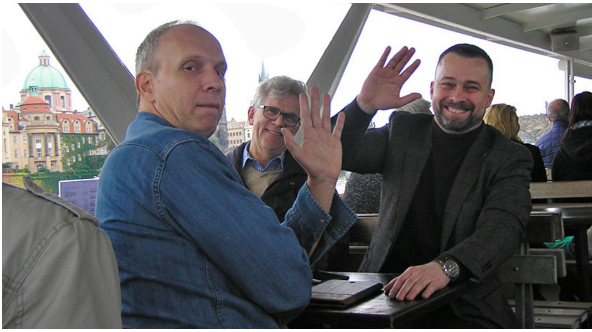
Prof. Tomasz Karski MD PhD

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

tmkarski@gmail.com
t.karski@neostrada.pl
www.ortopedia.karski.lublin.pl


BOAT TICKETS




The 19th Prague – Lublin – Sydney – St. Petersburg Symposium
Main topic:
Interdisciplinary approach to growing skeleton

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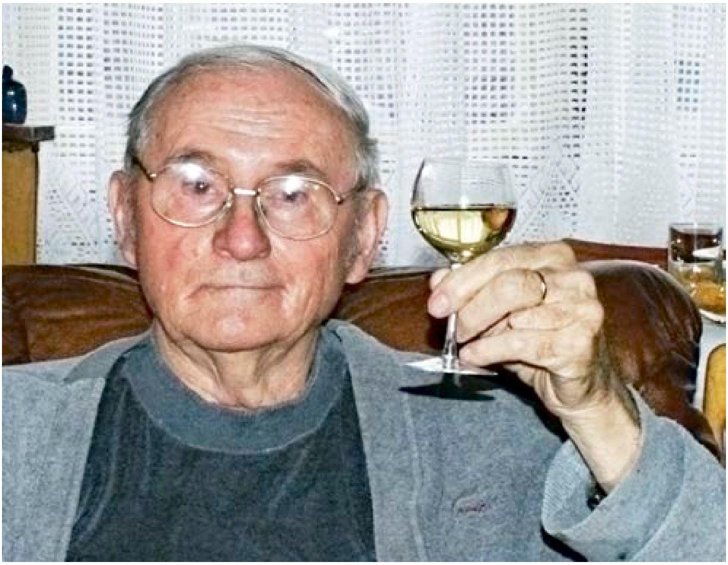
Dětský program

MEMORY TO ASSOC. PROF. MILAN ROTH, MD, DSC. (1923–2006)

Assoc. Prof. Milan Roth, MD, DSc. was born in October 6, 1923 in the village Lelekovice. He graduated at grammar school in Brno. From 1942 he attended the Institute of Languages and studied English and German language. Because of the Second World War he was totally put (he had to work) in the factory Klöckner in Kuřim from July 1943 since the end of the War. He started to study medicine at Masaryk Medical Faculty in Brno in 1945. After graduation he worked at the surgery department in Bruntal for a short time before he had to initiate the military basic service. He was sent to radiological department of Military Hospital in Pilsen. His whole life love to radiology he started just there. After termination of   military service obligation, he started to work at Radiological Institute in Olomouc. He was admitted to Radiological Department at The Faculty Hospital of Saint Anna in Brno in two years. He defended his PhD dissertation successfully in 1964. Nevertheless, his habilitation procedure was stopped from the political reasons. The title Associated Professor he reached after the Velvet Revolution in 1989 and the doctorate disertation he defended in 1991. When he was retired, he changed his work place to the Radiological Clinic of Medical Faculty of Masaryk University in Brno – Bohunice. He definitively ended employment in 1995.

Roth´s research interests had two directions – neuro-radiological (he was one of founders of European Neuroradiological Society) and orthopaedic – radiological. This unique professional combination with the interest of zoology and phylogenetics led him to the macro-projection of development and it´s macro-relation of neuronal and bone tissue, which are commonly treated, investigated and examined completely separately.

The term "osteo-neural macro-synthesis" explains generalization of cerebral-cranial development relation to „axial organ" – spinal cord and vertebral column and extremities – peripheral nerves and long bones of extremities. This approach shows substantiated and experimentally based interpretation still mysterious, above all, "dysplastic" disease states of the skeleton.

Roth´s experiences were collected in many papers with various reactions. Most of publications were in English. The overview of his publications was presented in the Locomotor System Journal (Pohybové ústrojí , 5, 1998, č. 1–2, s. 93-95) on the occasion of professor´s 75th anniversary. His fundamental cognition was published in mongraphy: "Neurovertebral and Osteoneural Growth Relations" (Brno, J.E.Purkynje University Press, 1985, 201 pp.) **figure 1**.

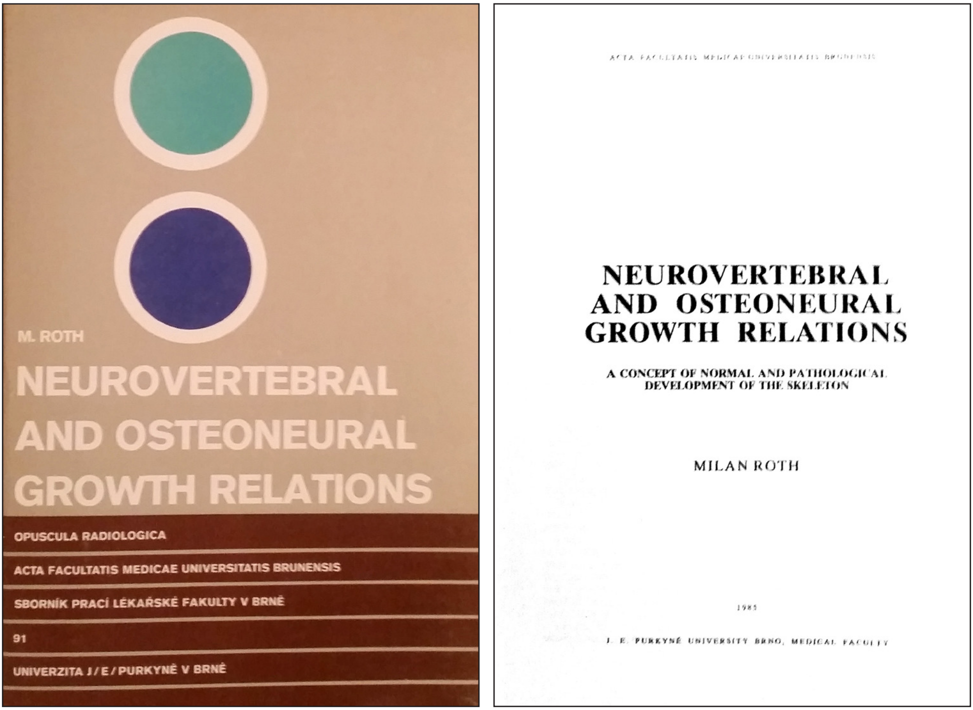


Figure 1. Cover and first page of monography "Neurovertebral and Osteoneural Growth Relations"

There is a list of some of his latest publications:

- ROTH M. Skeletal teratogenesis. Intermezzo Riv Neuroradiol 10, 1997, pp. 59–62.
- ROTH M. Cancerogenesis. Intermezzo Riv Neuroradiol 10, 1997, pp. 337–40.
- ROTH M. Morphology and development of the spine: Plea for a doubt. Intermezzo Riv Neuroradiol 11, 1998, pp. 313–20.

He was a member of the Editorial board of the journal Locomotor System from 1995. He published in this journal four very interesting experimental papers:

- ROTH M. Role of neural growth in the pathomechanism of skeletal dysplasias: an experimental study. Locomotor System, 2, 1995, No. 3, pp. 85–111.
- ROTH M. Macroneurotrophic features of growth hormone effects upon the spine and hip. Locomotor System, 3, 1996, No. 2, pp. 72–108.
- ROTH M. Rheumatoid Deformities of the Skeleton: Animal Models and Neuroadaptive Pathomechanism. Locomotor System, 5, 1998, No. 1-2, pp. 40–49.
- ROTH M. Neuroadaptive Pathomechanism of Bone Dysplasias (in Czech). Locomotor System, 5, 1998, No. 3–4, pp. 127–132.

The supporters of „macro-neuro-trophic" origin of systemic and extremities defects of locomotor system argue for the theory with the fact that bone tissue has got no nerves inside. They confess the disorders of growth of bones or genesis of osteoporosis as an impact of damaged "neuro-trophics" (for example shortening of one lower extremity after the injury interruption of nervus ischiadicus during the growing period or Sudeck algoneurodystrophy syndrome after the fracture or prolongation of the shank).

If we consider Donaldson's "nervous skeleton" (1937) to be plausible, that is to say a felt, ubiquitous net of the peripheral nerves that diffuses through the body and which is subperiostally and endostally, then it is obvious that the limb skeleton is in the most intimate relation to the nerves, more intimate than it is between the brain and its neurocranial envelope. The skeleton is literally "embedded" into the nerve skeleton and is actually a "cast" of the cavity located in the nerve tissue.

It is evident that in particular longitudinal bone growth is not possible without an adequate increase of the said surrounding skeleton and nervous stems. Thus, if the skeleton is unable to grow, then the bone "cast" can´t grow.

It should be borne in mind that the neural skeleton and the peripheral nervous system grow with a long or extensive type of growth that is energy-metabolically more demanding and therefore also more vulnerable to general teratogenic environmental factors than the commonly known cell type of growth.

Roth still maintained his enthusiastic workflow and interest in the discipline even in a gradually deteriorating state of health. He has not published any professional publications, although he has always been firmly convinced of the correctness of his opinions, hypotheses, and experimental evidence. Unfortunately, he did not finish the monographic work he had arranged in Italy.

At the end of his life, the Dutch orthopedist – doctor Piet van Loon, an admirer of his work, hoped to meet together, but the health of Roth did not allow it anymore. He died on 2nd April 2006 (in his 83 years).

In memory on Milan Roth in 2006 Professor Miroslav Kolář, MD, DSc. and Assoc. Professor Ivo Marik, MD, PhD wrote: Advances in molecular genetics, recognition of the significance of other hox genes (homeobox is a nucleotide sequence of 180 nucleotides that is part of four genes localized to chromosomes 2, 7, 12 and 17), hedgehog protein in embryo, development and its disorders, resulting in developmental abnormalities and malformations, the study of new cell adhesion molecules and receptors will certainly contribute to a more precise explanation of the etiopathogenesis of bone dysplasias, congenital limb and combined defects that we see as experiments of nature.

We are convinced that the life work of Roth will carry out further studies to test his entirely original experiments and hypotheses in clinical practice.

Conclusion

Today, scientific works of a few clinical experts proved at clinical cases that the results of experimental work of Milan Roth explains pathogenesis of some skeletal deformities such as idiopathic scoliosis, etc. Unfortunately, Milan Roth was not understood in the ninetieth years of the 20th century. In the session III of the anniversary The 20th Prague-Lublin-Sydney-St. Petersburg Symposium that is dedicated in memory of Milan Roth, we would like to draw attention to his experimental work which explains "macro-neuro-trophic" origin of some systemic and extremities defects of locomotor system.

Professor Ivo Marik, MD, PhD & **Olga Hudakova, MD, PhD**
Ambulant Centre for Defects of Locomotor Apparatus l.l.c.
Olšanská 7, 130 00 Prague 3, Czech Republic
E-mail: ambul_centrum volny.cz
o.marikova@email.cz

ABSTRACT OF PERSPECTIVE REVIEW ARTICLE

THE FIRST ELECTRONICALLY CONTROLLED DISTRACTION FIXATOR STIMULATING THE NEW BONE FORMATION IN CALLUS

Petrtyl Miroslav[1], Denk Frantisek[1], Marik Ivo[2], Lerach Ales[3,4], Vitek Tomas[5], Lisal Jaroslav[1], Myslivec Radek[2]

1 Laboratory of Biomechanics and Biomaterial Engineering, Department of Mechanics, Faculty of Civil Engineering, CTU, Prague

2 Ambulant Centre for Defects of Locomotor Apparatus l.l.c., Prague

3 Faculty of Mechanical Engineering, CTU, Prague

4 Medin Orthopaedics, a.s., Prague

5 Faculty of Electrical Engineering, CTU, Prague

E-mail: petrtylmir@seznam.cz

Key words: distraction apparatus, electronic regulation of oscillations, distraction of diaphysis, callus distraction bone lengthening

The method of physiological lengthening has been developed in the 50's years of the 20th century by G. A. Ilizarov, who performed lengthening of the long bones by the circular external fixator [**1**]. In the 70's years, Wagner H. [**2**] carried on the traditional application of lateral fixators. Current practice applies distraction jumps (once to four per 24 hours) often by a rough estimate. Among the shortcomings are included the long periods of healing. The current treatments are painful. The manual prolongations within 24 hours results in high quality of remodelling in the callus between bone fragments. The cyclic 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 fixator (**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 mechanosensors. The elongation of long bones by **EDF** is accompanied by the gradual stretching and/or oscillations of the callus between bone fragments. Loading of bone callus between the fragments regulate the degree of corticalisation in callus on these findings and according to the clinical experience are obvious advantages of using electronically controlled continuation. In the Laboratory of Biomechanics and Biomaterial Engineering, Faculty of Civil Engineering CTU with very close cooperation with specialists from the Faculty of Electrical Engineering and Faculty of Mechanical Engineering of the Czech Technical University, with the team of medicine doctors from the Centre for defects of locomotor apparatus in Prague, and with engineers of the Medin Orthopaedics ltd. have been established the basic requirements for design of the new fixator apparatus eliminating all the major drawbacks of the currently used external fixators for lengthening of long bones. Defined microoscillations 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/or viscoelastic properties of new bone tissue. **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 or symmetrically elongate shortened long bones of children/adults and to contribute to the elimination of some deformities of long bones in children/adults. **EDF** consists of two tube parts (i.e. the external pipe and internal one [**3**]). The autonomous power supply control unit regulates the oscillations of the engine – Maxon Amax – 19 toge C (GP) with gear ratio 850:1. The feedback control is realised by the three channels magnetic encoder. Automatic processes for stimulation of biomechanical effects are regulated by schedule program to create the effective quality of callus. Loading processes are programmed by variable oscillation stages having the small amplitudes of 10–1000 µm and the physiological frequences up to 4,0 Hz (or up to 10 Hz). Defined oscillatory phases are inserted between the resting periods. During the low frequency ranges, however during *the neutral fixation* must be used *higher values of amplitudes*, with an emphasis on qualitative development of tissue in callus. **EDF** devices insure to stay of patients in a domestic environment. **EDF** does not unpleasant effects on patients. These aspects are essential also for the natural physiological movement and they have the fundamental influence on the quality of new bone tissue. A new electronically controlled external fixator (**EDF**) eliminates the disadvantages still used fixators. Treatment processes are during maturation processes accelerated. Regulated microoscillations in callus stimulate the effective fibrogenesis and osteogenesis. **EDF** ensures to choose the amplitudes of oscillation frequences, unlike still used unilateral fixators or circular fixators. **EDF** thus contributes to the quality of stimulation of bone tissues. **EDF** is a tool for *effective osteogenic stimulations of bone cells*. There are important also the individual static shifts and substitutions of them by the dynamic vibration amplitudes (0,1 mm and more), which can be divided into 24 hours cycles to ensure the distraction daily, for example up to 1,5 mm. There is important to note the possibilities to regulate the „sleep phases" (i.e. the phases without the static/dynamic effects).

References

1. ILIZAROV GA, DEVIATOV AA. Operative elongation of the leg with simultaneous correction of the deformities. Ortop. Traumatol. Protez, 30, 1969, p. 32–37.
2. WAGNER H. Operative lengthening of the femur. Clin. Orthop. 136, 1978, p. 125. 15.
3. PETRTYL M, MARIK I, LERACH A, VITEK T, DENK F, LISAL J. Apparatus for lenghtening of long bones, *PATENT No. 303910* from 09.06.2013, Úřad průmyslového vlastnictví, Czech Republic.
4. PETRTYL M, DENK F, MAŘIK I, LERACH A, VITEK T, LISAL J, MYSLIVEC R. Elektronický distrakčni fixator stimuluje ve svalku novotvorbu kostni tkaně. Pohybové ústrojí, 21, 2014, 1–2, s. 53–65. ISSN 2336-4777
5. PETRTYL M, DENK F, MARIK I. Acceleration of new bone formation in callus. Abstract. Pohybové ústrojí 21, 2014, č. 3–4 Supl., p. 69. ISSN 2336-4777

ABSTRACT OF PERSPECTIVE REVIEW ARTICLE

APPLICATION AND POTENTIAL OF BIONANOTECHNOLOGIES IN OSTEOLOGY AND ORTHOPAEDICS

Martin Braun
Department of Composites and Carbon Materials, Institute of Rock Structure and Mechanics.
The Czech Academy of Sciences, Prague, Czech Republic
E-mail: braun@irsm.cas.cz

Keywords: bionanotechnology, tissue engineering, orthoapedics, bone, collagen, scaffold, composite, biomaterial

Abstract

Bone tissue is almost perfect composite material that is relatively hard, lightweight, porous and also elastic due to the high collagen content, which increases the resistance against bone fractures. Therefore, it is quite a difficult task to make artificially such a great biomaterial that suits all these aspects, and the preparation of functional bone replacements is a big challenge.

Tissue engineering and bionanotechnology represent relatively new and perspective disciplines that apply knowledge from various fields like biology, biochemistry, biophysics, biomechanics and material science to create new functional structures and controlled systems in nanoscale. The use of bionanotechnologies has currently highly considerable potential in regenerative medicine and implantology.

The natural bone tissue contains a complex extracellular matrix (ECM), an inorganic matrix (bone mineral) and bone cells (osteocytes, osteoblasts, osteoclasts, stem cells) responsible for bone formation and remodeling. In addition to the mechanical function (body support, organ protection), bone has also synthetic and metabolic functions. Human bone consists predominantly of inorganic matrix (65%) in which hydroxyapatite dominates, 25% is an organic matrix and approximately 10% belongs to water.

The organic matrix contains up to 90% of type I collagen, a small amount of collagen type III, V and also some minor collagen types, including FACIT (Fibril-associated collagens with interrupted triple helix) and moreover a number of proteoglycans, glycoproteins, glycosylated proteins, growth factors and other compounds.

Biocompatible nanocomposites, combining the best properties of the individual components, represent promising biomaterials with great potential in bone replacements, fillings and scaffolds based on biodegradable polymeric matrices are increasingly popular solution for faster and more efficient regeneration of affected bone tissues.

So far, in osteology and orthopaedics there are as substitutes often used materials based on ceramics or metal alloys (usually titanium) which are often used for the manufacture of joint replacement. Although titanium is a solid and hard material, it is unfortunately extremely stiff and inflexible when compared to the natural bone tissue, which complicates the natural transfer of the bone load and its physiological reconstruction.

Thus, newly developed advanced nanocomposite biomimetic materials that are trying to imitate the structure, chemical composition, biological and mechanical properties of the natural human tissues, are tested and can be successfully used as bone replacements, fillings and connecting elements. Frequently, they are based on collagen, as one of the most important structural proteins in mammals (it accounts for up to 30% of all proteins in the human body) whose main function is to provide mechanical support to cells and tissues.

However, nanotechnologies are also often used to functionalize and modify implant surfaces to improve the biocompatibility and bioactivity of implants, which can contribute to multiplying their lifetime in the human body. Other significant trends in modern medicine using nanotechnologies are also various polymeric systems for the controlled drug delivery, next practical applications of bionanotechnologies represent also miniaturized systems for early laboratory diagnostics.

A new generation of cell carriers made of porous biomaterials serve to bone cells as a 3D scaffold allowing them to grow through it. Subsequently, the implanted material is disintegrated and metabolically transformed into a new, fully functional bone in a controlled way and in a predefined time.

The key components for the preparation of nanocomposites can be isolated in pure form and sufficient quantities directly in the laboratory from tissues of animal origin. The inorganic component based on calcium phosphate nanoparticles (bone mineral or bioapatite respectively) can be prepared from chemically and thermally treated animal bones (e.g. porcine bones). Pure collagen, which often forms the basis of the organic component of the composite, can be isolated after special chemical treatment and vacuum freeze drying (lyophilization) from animal skin or tendon tissues (e.g. of fish, pig, calf, rat, etc.).

Then, like in case of other biodegradable polymers, it can be transformed into a solution and processed by a special device for production of nanofibers using a high-voltage electrospinning method to a matrix with a fiber diameter of approximately 100–200 nm.

The advantage of this matrix is its enormous specific surface, which can be additionally functionalized (e.g. with antibiotics) and the possibility to influence its biological and mechanical properties by choosing the right composition, the conditions of processing the initial polymer mixture and individually adjust the crucial parameters during nanofiber electrospinning.

The matrices are tested with varying component ratios, including the addition of other substances (such as additives like chitosan, hyaluronic acid and other glycosaminoglycans), which may improve the properties of the final biomaterial and its osteointegration.

Another important factor is the method of chemical crosslinking of the entire matrix, which contributes to ensuring optimum mechanical resistance and achieving the desired rate of biodegradability of the scaffolds. For use in implantology, nanocomposite biomaterials are thoroughly characterized by chemical analysis methods (FTIR, HPLC, SDS-PAGE), via microscopy (SEM), micro-CT and mechanical tests.

Selected perspective samples are also subjected to cytotoxicity and haemocompatibility assays and then tested in a long term *in vitro* and *in vivo* experiments with subsequent histological evaluation. In the final stage, biomaterials with the greatest potential for use in clinical practice of osteologists and orthopaedists are selected based on the results of successful biological experiments and in the future may be used to carry out thorough clinical trials on human patients.

Acknowledgment: The work is supported by the Ministry of Health of the Czech Republic (grant project No. NV 15-25813A) and the Institute of Rock Structure and Mechanics, The Czech Academy of Sciences, v.v.i. (Institutional projects Nos. 481, 482).

ABSTRACT OF PERSPECTIVE ORIGINAL PAPER

SURFACE MORPHOLOGY OF BIODEGRADABLE MAGNESIUM WIRES

Tesar Karel[1,2]*, Sucharda Zbynek[3], Balík Karel[3]

1 Department of Materials, Faculty of Nuclear Sciences and Physical Engineering, Trojanova 13, Prague, 120 00, Czech Republic

2 Department of Dielectrics, Institute of Physics of the Czech Academy of Sciences, Na Slovance 2, Prague, 182 21, Czech Republic

3 Department of Composites and Carbon Materials, Institute of Rock Structure and Mechanics of the Czech Academy of Sciences, V Holesovickach 94/41, Prague, 182 09, Czech Republic

* Corresponding author, Ing. Karel Tesar *, e-mail: tesarkar@fzu.cz, Tel.: +420 721 869 628, active participation

Keywords: biodegradable material, medical implant, magnesium, direct extrusion, bone support, hydroxyapatite

This work depicts the nucleation of magnesium-substituted hydroxyapatite on the surface of thin Mg and Mg-0.2Zn wires. These wires are prepared via direct extrusion and have exceptional bending properties in comparison with the conventional magnesium wires produced by cold drawing.

Magnesium is a biodegradable metal which is currently intensively researched as a possible implant material, especially for bone support applications. In order to fully understand the degradation and nucleation of corrosion products in future in-vivo tests, it is necessary to connect the morphology of nucleated surface features with their chemical composition. This is achieved by the usage of Scanning Electron Microscopy (SEM) techniques, such as Focused Ion Beam (FIB) and Energy Dispersive Spectrometry (EDS). Since EDS can precisely provide only relative ratios of elements, a micro Raman spectrometry is used to further support outputs of EDS. It is observed how the corrosion products nucleate and how they interact with the formation of hydrogen bubbles on the surface of Mg wires during degradation in Minimum Essential Medium – Alpha Modification (αMEM). A discussion of possible means to reduce the corrosion of thin Mg wires is presented, including variations of initial alloy composition and deposition of thin biodegradable copolymer layer on the wire surface. A possibility to use a rope of multiple thinner wires as a substitution of a single wire of required diameter is considered in order to lower the risk of critical failure of the wire cross-section.

ABSTRACT OF PERSPECTIVE ORIGINAL PAPER

RESULTS OF KINEMATIC ANALYSIS OF WALKING IN PATIENTS WITH DIFFERENT WEIGHT OF PROSTHESIS

Krawczyk Petr[1], Marik Ivo[2], Jakub Jozef [1], Sykora Ales[1], Zemkova Daniela[2], Petrasova Sarka[2], Marik Jan[2], Uchytil Jaroslav[3], Jandacka Daniel[3], BuzgaMarek[5]

1 PROTEOR CZ l.l.c., Ostrava, Czech Republic

2 Outpatient Centre for Defects of Locomotor Apparatus l.l.c., Prague, Czech Republic

3 Diagnostic Centre of Human Movement PdF, Ostrava University, Czech Republic

4 Department of Physiology and Pathophysiology, Faculty of Medicine, University of Ostrava, Czech Republic

5 Faculty of Health Care Studies, West Bohemia University; Pilsen, Czech Republic

Keywords: weight prosthesis, amputation, kinematic analysis, anthropometry, densitometry, oxygen consumption

Introduction

Decision on the type of prosthesis indication is based on the empirical experience of the attending doctors, physiotherapists and prosthetic technicians based on a local assessment of the extent of disability, type of performance on a limb amputation, stump shape, muscles condition, skin cover, any possible pain or tenderness of preserved limb. During the specification of the appropriate type of prosthesis, age, physical fitness, mental level of the patient and the coincidence of other diseases that can negatively influence the prosthesis must considered. From biomechanical aspects, the neglected factor is determining exactly – optimum length of the prosthesis and in particular its weight. For patients with lower extremity amputations is optimal biomechanics of walking is critical for the length and weight of the prosthesis. The authors present the results of kinematic measurements in patients with transtibial amputation who were considered to have a prosthesis in the original weight of the amputated segment of the limb.

Patients and methodology

The authors examined two groups of people. The first group consisted of 14 patients with transtibial amputation, the second control group consisted of 14 healthy people with identical anthropometric parameters. Structure of the patient group with transtibial amputation. The mean age of patients in the group is 53.8 years (aged 28 to 70). In 11 cases amputation was due to trauma, in 2 cases amputation was caused by a tumor. In one patient the cause of amputation complications was in diabetes mellitus. The average lifetime of the patient's prosthesis was 16.8 years.

Determination of the weight of the amputee part of the limb

Patients underwent detailed anthropometric measurements, based on which mass calculations of the amputee segment of the limb were performed. A total of 3 calculations were performed using Zaciorski, Osterkamp and Mozumdar methods. The results of the calculations were compared with Hologic's full-body densitometry, which was critical for determining the weight of the amputated part of the limb.

Assessing the subjective perception of the heavier prosthesis by the patient.

The subjective perception of the patient's load when using the „heavier prosthesis" was evaluated using the Borg's RPE (Rating of Perceived Exercise) scale.

Kinetic and kinematic analysis

Kinetic and kinematic analysis was performed in a biomechanical laboratory with 3 Kistler power platforms and Qualisys Oqus, Sweden with 9 cameras at Diagnostic Centre of Human Movement PdF, Ostrava University, Czech Republic. The group of patiens included patients with transtibial amputation with approximately the same length of the stump. The condition was also the absence of other comorbidities, deformity of the skeleton, and limb movement in the joints of the lower limb. All patiens had the same type of mechanics loch of socet liner. Each of the patients studied had a prosthesis - replacement of the prosthetic foot so that all patiens had exactly the same equipment with identical biomechanical parameters 3 weeks before the examination in the biomechanical laboratory. The structure of the prosthesis - bench, static, dynamic alignment was checked, depending on the used footwear when measuring all the probands.

Indirect kolorimetry – oxygen consumption

Laboratory tests determining the values of resting metabolism. Based on the measurement of inhaled oxygen consumption and exhaled carbon dioxide, the method enables to objectively and currently determine the energy output of the client in idle mode and under load. The patient is examined for the tredmilus with a prosthesis and a prosthesis where the weight is added to the weight of the limb segment.

Results

The authors present results of kinetic and kinematic analysis of walking in patients with the original lighter type of transtibial prosthesis and the prosthesis loaded to the original weight of the limb.

The results of the kinematic analysis of walking of amputated patients were compared with the kinematic analysis of walking of healthy subjects in the control group.

Walking speed

There is no significant difference between the walking and weighing speeds and the control group (**Table 1**)

	without weights	**with weights**	**control group**
Walking speed (m/s)	1,25 ± 0,07	1,24 ± 0,08	1,29 ± 0,06

Tab. 1. Walking speed

Evaluation of time-spatial characteristics

The results of time-space walking characteristics suggest that people with amputation, with a prosthesis without added weight, stay on the affected limb for a shorter time than when using weights. The shorter duration of the swinging phase and the duration of the dual support is shorter without the use of weights, especially at the stage where the limb is at the front. (**Table 2**). These results may indicate better stability of the standing phase of the affected limb when weighing.

Groups	Affected			Effect size	
Parameter	without weights	with weights	control group	without controls	with controls
Step duration (s)	0,345 ± 0,26	0,347 ± 0,26	0,368 ± 0,24	0,05	0,08
Duration of the standing phase (s)	0,404 ± 0,32	0,474 ± 0,26	0,500 ± 0,26	0,33	0,1
Duration of the swinging phase (s)	0,313 ± 0,19	0,394 ± 0,13	0,404 ± 0,12	0,57	0,08
Duration of the dual support (s)	0,255 ± 0,08	0,268 ± 0,06	0,277 ± 0,06	0,31	0,15

Tab. 2 Selected space-time characteristics

Evaluation of power parameters

Trends in force parameter curves (red curve using weights, black without weights and blue for the control group) show differences in reaction forces in all three directions, but these variations are within the standard deviations. The size of the standard deviations shows a relatively large variability in walking performance in terms of force parameters (**Figures 1–3**).

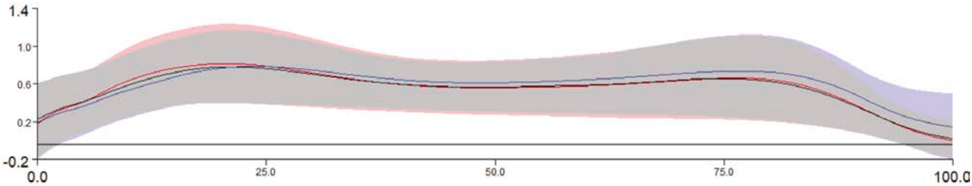


Figure 1. Strength in the vertical direction

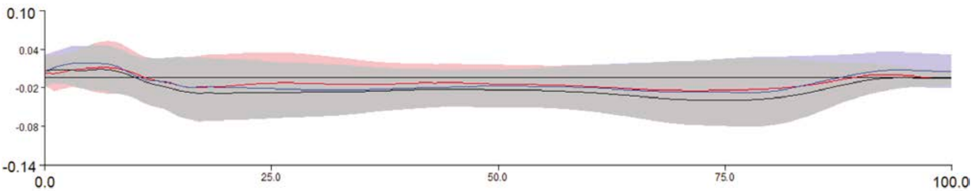


Figure 2. Strength in the mediolateral direction

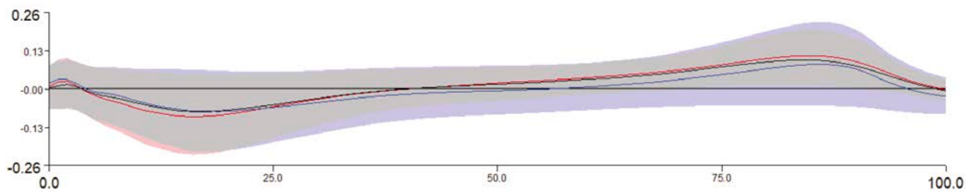


Figure 3. Force in anteroposterior direction

Black curve – affected limbs without weights
Red curve – affected limbs when using weights
Blue Curve – Control Group

When assessing individuals, greater vertical and forward forces are used as a trend when using weights versus the control group. However, further analysis is needed to confirm this trend, which does not occur in all amputated individuals.

An example of vertical and anterior-posterior force in one probanda on the affected limb to one proband from the control group.

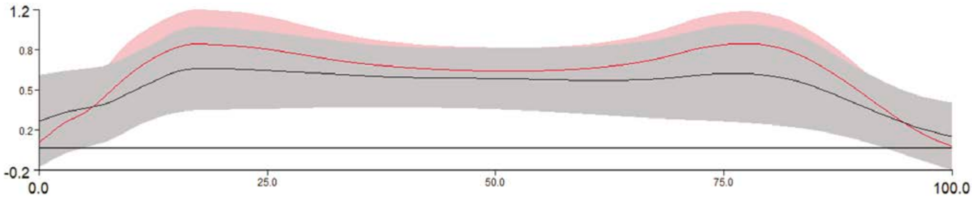


Figure 4. Strength in the vertical direction of the affected limb (red curve) and the control subject (black curve)

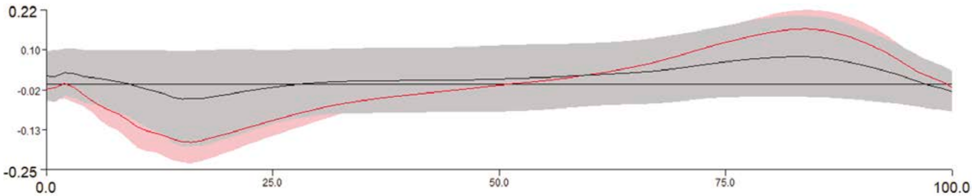


Figure 5. Strength in anteroposterior direction of the affected limb (red curve) and control subject (black curve)

Evaluation of angular parameters

Curve trends of angular parameters of ankles, knees and hips indicate differences. In walking, using weights and without weights, both on the affected and the unaffected Limb.

Subjective assessment by the patient

Questionnaire evaluation, Borg RPE scale: 70% of patients rated walking with a heavier prosthesis as a medium load, 30% as a lightweight load. All patients perceived walking with heavier prosthesis as more stable.

Evaluation of energy expenditure

Patients were also tested for oxygen consumption at constant walking speeds with the original lighter prosthesis and the prosthesis loaded to the original weight of the limb. Oxygen consumption is slightly higher when walking with weights. Measurement of a control group of healthy individuals with identical anthropometric parameters is performed, comparing their energy expendituret at walking at the same rate.

Discussion

Our findings in the biomechanical experiment confirm the conclusions of other authors' work (Lin-Chan S.-J, 2003) that there is no significant increase in energy intensity when walking with a heavier type of prosthesis.

Measuring, processing, and evaluating was based on current technical options. The method of determining the weight of the amputated part of the lower limb by means of full-body densitometry was not found in the litaratum processing anywhere. The weight of the amputated limb was calculated using anthropometric calculations in addition to the use of full-body densitometry. The most accurate calculation when compared to the result of full-body densitometry was the method of Zatsiorski and Selujanov.

References

1. LIN-CHAN S.-J., NIELSEN D.H., YACK H.J., HSU M.-J., SHURR D.G. The Effects of Added Prosthetic Mass on Physiologic Responses and Stride Frequency during Multiple Speeds of Walking in Persons with Transtibial Amputation. Archives of Physical Medicine and Rehabilitation. 84 (12) (pp 1865-1871), 2003.
2. LUSARDI, M.M.; NIELSEN, C.C. Orthotics and prosthetics in rehabilitation. 2nd ed. St. Louis : Saunders Elsevier, 2007. 904 p. ISBN-10: 0-7506-7479-2.
3. RUSAW D. RAMSTRAND N. Motion-analysis studies of transtibial prosthesis users: a systematic review. [Review] Prosthet Orthot Int. 35(1):8-19, 2011.
4. SELLES R.W., BUSSMANN J.B.J., VAN SOEST A.J.K., STAM H.J. The effect of prosthetic mass properties on the gait of transtibial amputees. A mathematical model. Disability and Rehabilitation. 26 (12) (pp 694-704), 2004.
5. SELLES R.W., KORTELAND S., VAN SOEST A.J., BUSSMANN J.B., STAM H.J. Lower-leg inertial properties in transtibial amputees and control subjects and their influence on the swing phase during gait. Archives of Physical Medicine and Rehabilitation. 84 (4) (pp 569-577), 2003.
6. SMITH, D. G.; MICHAEL J. W.; BOWKER J. H.: Atlas of Amputations and Limb Deficiencies Surgical, Prosthetic, and Rehabilitation Principles (3rd ed.). Rosemont: AAOS 2004.
7. ZHANG M., LEE W.C.C. Quantifying the regional load-bearing ability of trans-tibial stumps. Prosthetics and Orthotics International. 30 (1) (pp 25-34), 2006.

ABSTRACT OF PERSPECTIVE ORIGINAL PAPER

VERIFICATION OF MEASURING METHOD OF AXIAL PELVIC ROTATION FROM PHOTOGRAPHS ACCORDING TO SCANNED 3D MODELS

Cerny Pavel[1,2,3,*], Drnkova Jana[3], Stolinski Lukasz[4,5,6], Czaprowski Dariusz[7,8], Kotwicki Tomasz[4)] Marik Ivo[1,9] (Prague & Pilsen, Czech Republic – Poznaň & Skierniewice & Olsztyn, Poland)

1 Faculty of Health Care Studies, University of West Bohemia, Pilsner, Czech Rep.
2 Faculty of Physical Education and Sport, Charles University, Prague, Czech Rep.
3 ORTOTIKA l.l.c., the complex of the Faculty Hospital at Motol, Prague, Czech Rep.
4 Department of Spine Disorders and Pediatric Orthopedics, University of Medical Sciences, Poznan, Poland
5 Rehasport Clinic, Poznan, Poland
6 Rehasport Clinic Licensed Rehabilitation Center, Skierniewice, Poland
7 Department of Physiotherapy, Józef Rusiecki University College, Olsztyn, Poland
8 Center of Body Posture, Olsztyn, Poland
9 Centre for Defects of Locomotor Apparatus l.l.c., Prague, Czech Rep.
*) corresponding and presenting author
E-mail: pavel@ortotika.cz

Key words: measurement of axial pelvic rotation, photographs, scanned 3D model

Introduction

Clinical examination completed with frontal (AP or PA) and lateral spine X-rays, is a standard examination of scoliosis. The axial rotation of the pelvis can significantly influence the posture therefore it is useful to know its position. The pilot study of our graphic method of measuring the axial pelvic rotation from a photograph was presented in 2017.

Objective

The aim of this study is to verify the validity of the method on larger number of individuals using their scanned 3D models. The display of a 3D model on a computer screen represents the same view as a PA photograph.

Method

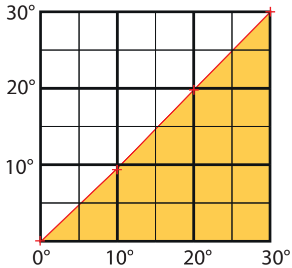
The first phase included all 3D patient models after the introduction of 3D technology (1 July – 13 December 2017) at the authors' workplace. In 4 months, 94 individuals were scanned using the Creaform HCP Scanner with the VXelements support software (Ametek). However, the scanning methodology with a visible proximal gluteal groove, which is the most important point for measuring the pelvis position, was not established until August 2017. As a result, 27 patients were excluded from the total for the illegibility of the gluteal groove position. Of the total number 67 patients, 50 girls and 15 boys in juvenile or adolescent age and 2 adult men were measured. Coordinate-oriented 3D models of the pelvis were displayed and rotated between 0°–30° in 10° steps, using

Canfit software (Vorum). The Scodiac software (www.anglespine.com) was used for measuring the axial pelvis rotation. The level of read position was above the top of gluteal groove (0–3 cm) according to visibility. The first of the authors listed measured gradual rotation to the right, the second author the gradual rotation to the left. The measured values were written into the MS Excel sheet.

Results and discussion

For each rotation step, the mean values and standard deviations of all data measured by both authors, were determined individually and globally as shown in the graph.

		0°	10°	20°	30°
1. of authors	average:	0.0	9.2	19.5	30.3
(right rotation)	SD:	0.6	1.2	1.9	2.2
2. of authors	average:	0.1	9.8	19.9	30.2
(left rotation)	SD:	0.4	0.5	0.7	0.8
both authors	**average:**	**0.1**	**9.5**	**19.7**	**30.3**
	SD:	**0.5**	**1.0**	**1.4**	**1.6**



The measurement results correlated very well with the course of defined values.

In this study, the patients were not differentiated according to age, gender, BMI, and other criteria. All scanned individuals were measured at the authors' workplace in Prague per the period mentioned above. Primarily juvenile and adolescent scoliotic patients with variety of etiology prevailed.

Conclusion and Significance

This method appears to be perspective way of obtaining the new data from a regular photograph. In the next steps it is planned to carry out further verification of the method with the cooperation of more experts at different workplaces.

Obtaining position and body symmetry parameters from a photograph could be advantageous in detecting the effects of the treatment process in the same patient before and after the procedure.

ABSTRACT OF PERSPECTIVE ORIGINAL PAPER

MEASUREMENT OF SPINAL AND POSTURAL DEFORMITIES FROM RADIOGRAPHS AND PHOTOGRAPHS USING SCODIAC SOFTWARE (10 + 5 MIN.)

Cerny Pavel[1,2,3,*]), Cerny Michal[3], Drnkova Jana[3], Stolinski Lukasz[4,5,6], Czaprowski Dariusz[7,8], Kotwicki Tomasz[4], Marik Ivo[1,9]
(Prague & Pilsen, Czech Republic – Poznaň & Skierniewice & Olsztyn, Poland)
1 Faculty of Health Care Studies, University of West Bohemia, Pilsner, Czech Rep.
2 Faculty of Physical Education and Sport, Charles University, Prague, Czech Rep.
3 ORTOTIKA l.l.c., the complex of the Faculty Hospital at Motol, Prague, Czech Rep.
4 Department of Spine Disorders and Pediatric Orthopedics, University of Medical Sciences, Poznan, Poland
5 Rehasport Clinic, Poznan, Poland
6 Rehasport Clinic Licensed Rehabilitation Center, Skierniewice, Poland
7 Department of Physiotherapy, Józef Rusiecki University College, Olsztyn, Poland
8 Center of Body Posture, Olsztyn, Poland
9 Centre for Defects of Locomotor Apparatus l.l.c., Prague, Czech Rep.
*) corresponding and presenting author
E-mail: pavel@ortotika.cz

Key words: spinal and postural deformities, measurement, radiographs, photographs, SCODIAC sofware

Introduction

A number of X-ray viewers have implemented basic functions for their evaluation. In the field of scoliosis treatment, the magnitude of scoliotic curves, the vertebral rotation is usually measured, and recently the photographs of the patient's posture are being evaluated. Most programs require finding a file in the directory and then opening it. But the practice is that the researcher scans images or videos in their favourite browsers.

Objective

The aim of the authors was to create a PC software which works with the images in a user-friendly way and contains procedures for measurements of scoliosis related parameters. Due to the fact that smartphones are increasingly used in everyday life, it was desirable to create an application for them as well. The program was named SCODIAC (SCOliotic DIAgnostiCs).

Method

The mode of using the SCODIAC software at a PC or a smartphone is described as follows.

PC: The concept has been set that the software should not disturb on the display and be immediately available. Therefore, the basic version is constantly being displayed in the foreground as a minimized window located in the upper left corner. In the measurement mode, the current screen is snapped and shown without any necessity to open an image from the directory. The evaluation of the images themselves takes place in two possible ways:

1. In the figure, the user finds and marks the points by clicking the left mouse button followed by the mark (cross). The measurement will take place automatically, after the last required left-click or right-click.

2. The predefined template for the selected measurements will be displayed on the monitor. Each template provides the lines ending with a ring. Gripping the individual rings using the mouse enables to move them to the desired positions. The result is counted and displayed immediately.

Smartphone: When opening a smartphone app, the user gets the offer to pick a picture from the gallery or to take a photo. Once the image for evaluation is chosen, the user can select the desired measurement.

Working with the smartphone comprises using predefined templates. Displayed tags reveal the form of crosses interconnected with rings. The touch screen rings are used to grip and drag the cross to the desired position. Results are counted and displayed immediately.

The program includes methods for measuring the magnitude of scoliotic curves, indirect measurement of axial vertebral or pelvic rotation and measurement of postural parameters (ATSI & POTSI, sagittal profile, lower limb profile).

Discussion and conclusion

The PC program SCODIAC has been developing for several years, with particular measurements added successively. The program is also freely available on the Web (https://www.ortotika.cz/download/SetupSCODIAC_Full.zip). Since using the software is simple and intuitive, only a small number of program queries have been raised.

The basic smartphone version was written at the end of 2017. It is downloadable in the form of a file, but it will be downloadable within Google Play apps and we hope in the Apple Store.

Not only in the workplaces of the authors, SCODIAC is used in everyday practice as well as research. Users' feedback is not only about simplicity and availability, but also the ability to work with popular browsers without having to search for and upload images from a folder.

ABSTRACT OF PERSPECTIVE REVIEW ARTICLE

PEAK BONE MASS

Lyritis George, Rizou Stavroula
Hellenic Osteoporosis Foundation, Athens, Greece
1 Emeritus Professor of Orthopedics, Faculty of Medicine, National and Kapodistrian University of Athens, Greece
2 Hellenic Osteoporosis Foundation, Kifissia, Greece

George P. Lyritis
Emeritus Professor of Orthopedics, Faculty of Medicine, National and Kapodistrian University of Athens, Greece
Address: Agias Varvaras 5, Kifissia, Greece, E-mail: glyritis@heliost.gr, Tel: +30 6999 30 7070

Stavroula Rizou
Biologist, PhD
Hellenic Osteoporosis Foundation, Greece
Address: Agias Varvaras 5, Kifissia, Greece, E-mail: st.rizou@heliost.gr, Tel: +30 6947495443

Keywords: Bone mineral density, Osteoporosis, Puberty, Adolescence

Peak bone mass is defined as the amount of bone present at the end of the skeletal maturation and its magnitude constitutes a significant predictor of osteoporosis later in life. During puberty, the gender difference in bone mass accumulation becomes more pronounced. Boys usually accomplish higher bone density and content but at a later age compared with girls. It has generally been accepted that peak bone mass at any skeletal site is attained in both sexes during the mid-thirties. Several variables affect bone mass such as genetics, sex, population ancestry, maturation, nutrition, hormonal factors, physical activity, and lifestyle behaviours. It is vital to determine the crucial years when the modifiable factors will be particularly effective on bone mass accumulation in order to set up training programs for maximizing peak bone mass during childhood and adolescence. Osteoporosis among children and adolescents is rare. When osteoporosis occurs in children, it is usually due to a medical disorder, to medications or as a result of a genetic disorder. Bone growth during childhood and puberty adapts to the fundamental laws of bone physiology. Skeletal acquisition is achieved mainly through the mechanism of bone modelling and only partially through the mechanism of bone remodelling.

ABSTRACT OF PERSPECTIVE ORIGINAL PAPER

THE IMPORTANCE OF RISK OF FALLING ASSESSMENT ALONGSIDE THE "FRACTURE RISK", WHEN EVALUATING PATIENTS WITH BONE LOSS (20 + 5 MIN.)

Nikolaou Dimitrios A[1,2]
1 Medical School, National and Kapodistrian University of Athens, Greece
2 Hellenic Osteoporosis Foundation, Kifissia, Greece
E-mail: dimitrisn91@gmail.com

Keywords: Falls, Risk of Falling Assessment, Fracture Risk, Anthropometric Evaluation, Berg Balance Scale

Objectives

Frequently, the risk of falling assessment, is overlooked in favour of other series of examinations. However, in patients with osteoporosis, the screening for possible instability is more than crucial, as most of fractures follow an incidence of falling. The objective of our study was to verify whether the risk of falling assessment, using the associated screening tools can truly predict the risk of falling in osteoporotic patients.

Methodology

Post-menopausal women of age fifty (50) and above, that submitted results of a recent bone density measurement via DXA (Dual X-ray Absorptiometry) and were screened for identification of fracture risk were included in the study. Complementary, a clinical evaluation of balance performed including a questionnaire regarding the past falls, as well examination tools such as the "Berg Balance Scale", "Timed-Up-and-Go examination", "Sit-to-Stand examination". Last but not least, the Handgrip Strength was evaluated. An advisory intervention was followed for each patient, either in the form of newsletter on how to avoid fallings and in the form of exercises mainly for the strengthening of the lower extremities. According to the status of patient (osteoporosis or osteopenia) the appropriate exercises was chosen. Patients with severe dementia, renal failure or under medication affecting the individual's balance were excluded.

Results

During our study, known factors such as polypharmacy, increased B.M.I., Kyphosis-related alterations of the spine, crucial decrease of muscle strength of lower extremities, were incriminated for the re-occurrence of fallings. Other than that, one quite interesting find was the result of the examination of balance alone couldn't predict to a certain yet efficient degree the occurrence of falling – being unable to distinguish between "fallers" and "non-fallers".

Discussion

A large number of patients, described by a low fracture risk, reported a number of falls during our study screening, which were due to several intrinsic and extrinsic factors. On the other hand, patients with increased fracture risk, led a much safer life-style with no fallings due to extreme cautious and systematic exercise. Maybe, in the future the integration of the results of the fall risk assessment with the fracture risk could give a clinical imaging of the patient.

ABSTRACT OF PERSPECTIVE ORIGINAL PAPER

BONE DENSITY OF GENETIC SKELETAL DISORDERS – INTRODUCTION

Zemkova Daniela[1,2], Marik Ivo[2,3], Mariková Alena[2], Hudakova Olga[2]
(Prague & Pilsen, Czech Republic)
1 Dept. of Paediatrics; University Hospital Motol; Prague; Czech Republic
2 Faculty of Health Care Studies, West Bohemia University; Pilsen, Czech Republic
3 Ambulant Centre for Defects of Locomotor Apparatus l.l.c.; Prague; Czech Republic
E-mail: dezem@email.cz

Key words: genetic skeletal disorders, low bone density, osteoporosis, hyperostosis

The latest version of Nosology and Classification of Genetic Skeletal Diseases (Revision 2015) includes 436 diagnoses divided into 42 groups. In only 5 groups, elevated, decreased or abnormal bone density is directly reported. Increased bone density occurs in group 22 (neonatal osteosclerotic dysplasia – e.g. Caffey disease), group 23 (osteopetrosis and related diseases – osteopetrosis, pycnodysostosis, melorheostosis, osteopoikilosis) and group 24 (other sclerosing dysplasias, e.g. craniometaphyseal dysplasia, craniodiaphyseal dysplasia, diaphyseal dysplasia Cammurati Engelmann, pachydermoperiostosis and osteoectasia with hyperphosphatasia, i.e. juvenile Paget's disease). Decreased bone density occurs in group 25 including osteogenesis imperfecta, Ehler's Danlos syndrome, idiopathic juvenile osteoporosis, X-linked osteoporosis, Bruck syndrome type I and II, osteoporosis of pseudoglioma syndrome, etc. Group 26 – abnormal mineralization – includes hypophosphatasia (from severe lethal forms to mild), hypophosphatemic rickets XLD, AD and AR, familial chondrocalcinosis etc.

In practice, however, we find reduced bone density in many diseases included in other groups. These are diseases in which endochondral ossification is impaired, especially in the proliferating zone of the growth plates, e.g. collagen II (group 2). Patients with Diastrophic dysplasia have a defect in the sulphation of proteoglycans (group 4), resulting in reduced quality of all cartilage, including growth plates. Processes on the growth plate and their organization are significantly disturbed by mutation in the TRPV4 gene, which gives instructions for making a protein that acts as a calcium channel. The TRPV4 channel transports positively charged calcium atoms (calcium ions) across cell membranes and into cells. The channel is found in many cell types and tissues and plays an important role in the formation of cartilage and bone and is also involved in osmosensation, mechanosensation and nociception, and other processes. Mutations in this gene create a broad phenotypic spectrum of overlapping diseases, the most severe being metatropic dysplasia, less severe SMD Kozlowski type and AD brachyolmia. Special issues include diseases belonging to group 28 – group of osteolysis, such as familial expansive osteolysis and Hajdu-Cheney syndrome.

Due to the fact that these are rare diseases (incidence of approximately 1:10,000–1:100,000 live births), the numbers of patients evaluated do not allow statistical processing. Reduced or low bone density and /or osteoporosis we provide in patients with Spondyloepiphyseal dysplasi congenita – SED cong. (even after correction to a small body height) and Kniest dysplasia. In the SED with short metatarsals (formerly Czech dysplasia) we found normal whole bone density as well as in the lumbar area, but in the region of hip joints the bone density was significantly reduced. The patient with spondylometaphyseal dyspla s ia, Kozlowski type was in the osteopenia range, but after correction to a small height his d e nsity was within a broader standard, similar observations were observed in two patients with m etatropic bone dysplasia. In Pseudoachondroplasia (PSACH), bone density in areas of int e rest was in standard with the exception of spinal density in some patients. Patient with Dia s trophic dysplasia was in the osteopenia range, after correction to low height, it was in the ra n ge of normal bone density. Patients with Trichorhinophalangeal dysplasia, type 1 (TRP 1) had b one density in standard, but the patient with TRP 2 (Langer-Gidion syndrome) was in the range o f osteoporosis. Patients with Hajdu-Cheney syndrome suffer from low bone density and later s ignificant osteoporosis. Patients with hypophosphatemia have bone density in adulthood normal to slightly above average. In patients with multiple exostoses, bone density is low.

Discussion

Low bone density in children and osteoporosis in adults is undoubtedly associated with disorder of metabolism, primary growth disorder (molecular genetic defect with manifestations in growth areas), and hypomobility of disabled children with progression in adulthood (as a result of osteoarthritis, spondylosis and spondylarthritis). Bone density assessment in patients with severe growth disorders can be significantly distorted by the short body height and anatomical dimensions of the dysplastic skeleton. Accurate assessment of bone density in areas of interest is possible by CT examination. However, these tests are not indicated with regard to radiation hygiene. In order to refine the interpretation of real bone density, we perform a correction to the so-called height age, knowing that even this correction is not accurate.

Conclusion

In the present study, which is a probe into problems of rare bone dysplasia, we advertise the significantly reduced bone density in patients with SED cong., Kniest dysplasia, Czech dysplasia, TRP2, Hajdu-Cheney syndrome and patients with multiple exostoses. Interesting observation is the increase of bone density with increasing age in the lumbar spine in patients with hypophosphatemic rickets. It is advisable to evaluate bone density in childhood not only in patients diagnosed with OI, but also in bone dysplasia with involvement of epiphysis, metaphysis and spine. In cases of repeatedly elevated bone turnover, i.e. elevated values of osteoformation and osteoresorption markers in patients (children and adolescents), we are individually considering the introduction of osteoporosis treatment with antiresorptive drugs in order to achieve an individual maximum bone mass in adulthood.

References

1. BONAFE L, CORMIER-DAIRE V, HALL C, LACHMAN R, MORTIER G, MUNDLOS S, NISHIMURA G, SANGIORGI L, SAVARIRAYAN R, SILLENCE D, SPRANGER J, SUPERTI-FURGA A, WARMAN M, UNGER S. 2015. Nosology and classification of genetic skeletal disorders: 2015 revision. Am J Med Genet Part A 9999A:1–24.
2. HRUŠKOVÁ L, MAŘÍK I, MAZUROVÁ S, MARTÁSEK P, MAZURA I. COL1A2 gene analysis in a Czech osteogenesis imperfecta patient: a candidate novel mutation in a patient affected by osteogenesis imperfecta type 3. Advances in Genomics and Genetics. 2015: 5, p. 175–281. ISSN 1179-9870.
3. HULEJOVÁ H, MAŘÍK I, MAŘÍKOVÁ O. Biochemické monitorování kostních onemocnění v klinické praxi: průměrné hodnoty kostní alkalické fosfatázy, osteokalcinu a 25 OH-vitaminu D u dětí v České republice – in Czech. Pohybové ústrojí, 12, 2005, č. 1+2, s. 62–76. ISSN 1212-4575
4. WARMAN ML, CORMIER-DAIRE V, HALL CH, KRAKOW D, LACHMAN R, LEMERRER M. Nosology and Classification of Genetic Skeletal Disorders – 2010 Revision &. Am J Med Genet, 155A, 2011, č. 5, s. 943–968.
5. ZEMKOVÁ D, MAŘÍK I. Osteopetróza – in Czech. Pohybové ústrojí, 22, 2015, 1–2, s. 82–101. (ISSN 2336-4777)

ABSTRACT OF PERSPECTIVE REVIEW ARTICLE

PUBERTAL TIMING AND BONE HEALTH

Bayer Milan

Department of Children and Adolescents, 3rd Faculty of Medicine, Charles University, Hospital Královské Vinohrady, Prague, Czech Republic

E-mail: milan.bayer7@gmail.com

Key words: risk of osteoporotic fractures, peak bone mass, pubertal maturation

Susceptibility to osteoporosis and low-energy trauma is determined by skeletal accrual in childhood and subsequent bone loss during adulthood and senescence. Puberty is very important period for bone maturation. At the same age, bone mass is higher for pubertal than prepubertal children. It is estrogen which is essential for bone expansion and final growth plate closure in both genders. Determination of pubertal timing is easier in females – time of the first menstruation could be exactly documented. Even later physiological menarcheal age is associated with increased risk of osteoporotic fracture. Probably it is not a result of limited estrogen exposure (from the onset of pubertal maturation until peak bone mass as primary hypothesis estimated). Low bone mineral density in these girls was documented before the onset of puberty, with no further deepening

deficit until peak bone mass. And this association persists not only in the course of fertile period but continues into early old age: pre- as well as postmenopauzal women with later menarche in their personal history have low bone mineral density and reduced bone mechanical resistence. Genetic factors, calcium and protein intake and other lifestyle choices in early infancy seems to influence pubertal timing and bone mass accrual (including bone quality – microarchitecture). Future observations are required to fully understand the exact relationships between development of peak bone mass, pubertal timing and bone mass microstructure and fracture risk.

ABSTRACT OF PERSPECTIVE REVIEW ARTICLE

OSTEOGENESIS IMPERFECTA

Bellemore Michael, Munns Craig
Department of Orthopaedic Surgery, The Children's Hospital at Westmead, Sydney, Australia
E-mail: mbellemore@michaelbellemore.com

Key words: osteogenesis imperfecta, classification, bone pathology, treatment

Osteogenesis imperfecta (OI) is a heritable disorder characterised by bone fragility and low bone mass. The effects of this disorder are sometimes apparent in utero and are certainly manifest in early childhood in most cases. Recurrent fractures and progressive limb and spine deformities impact greatly on the wellbeing of affected children and their families. Our knowledge of the clinical manifestations, underlying genetics, bone pathology, treatment modalities and prognosis has advanced greatly in the last 30 years.

Classification

The most widely used classification of osteogenesis imperfecta is that proposed by David Sillence in 1979 in which he described 4 main types. This classification is based on

- the severity of skeletal manifestations
- the presence or absence of extra skeletal manifestations
- the inheritance pattern

The majority of cases of osteogenesis imperfecta (types I – IV) are associated with mutations in the genes encoding type 1 collagen. Type 1 collagen is the main structural protein of bone, skin, tendons, dentin and sclera. The type 1 collagen in bones is defective in quantity and quality. Over 250 mutations in genes encoding type 1 collagen have been reported accounting for the great variability seen in OI. Types V–VII have been added to the classification. Types V–VII are not associated with mutations in type I collagen.

Type I

Type I OI is a relatively mild form with fractures occurring in early childhood. It has an autosomal dominant pattern of inheritance. Patients have blue sclerae, generalised ligament laxity and relatively normal stature. Dentinogenesis imperfecta is uncommon in this form. Radiological features include osteopenia, thin cortices, fractures, mild bone deformities and Wormian bones.

Type II

Type II is the most severe form with multiple fractures occurring in utero and in the neonatal period. It has an autosomal dominant pattern of inheritance. Affected babies are small, hypotonic with dark blue sclerae. Radiological features include short wide bones with cortices so thin that they tend to crumple. This form of OI is lethal in the perinatal period, usually because of respiratory failure resulting from multiple rib fractures.

Type III

Type III is the most severe form compatible with life. It has an autosomal dominant pattern of inheritance. Patients have a triangular facial appearance. They have very short stature, blue sclerae which become whiter with age and dentinogenesis imperfecta. Multiple fractures may occur in utero and in the neonatal period. The tendency to fracture persists into adulthood and is associated with progressive deformities in the upper and lower limbs and spine. Radiological features include osteopenia, thin cortices, narrow diaphyses and relatively wide metaphyses and Wormian bones.

Type IV

Type IV is the most common form. It is heterogeneous in it manifestations and is likely to be subdivided as more is learnt about the disorder. Autosomal dominant and recessive patterns of inheritance have been identified. Patients have mild to moderate bone deformities, greyish sclerae, variable short stature and dentinogenesis imperfecta. Multiple fractures occur in early childhood, but the tendency to fracture decreases with age. Radiological features include osteopenia, thin cortices, fractures and Wormian bones.

Type V

Type V is uncommon. It has an autosomal dominant pattern of inheritance. However, the gene mutation has not yet been identified. Patients have mild to moderate short stature and limb deformities are variable. Sclerae are white and dentition is normal. The distinguishing radiological features are fractures with hypertrophic callus, calcification of the forearm interosseous membrane which results in loss of forearm rotation and sometimes dislocation of the radial head. Wormian bones are also seen.

Type VI

Type VI is uncommon. The pattern of inheritance has not yet been identified. Bone deformities are moderate to severe, with significant variation in phenotype. Limb fractures and vertebral compression fractures occur frequently. Sclerae are white and dentition is normal. This type of OI is defined by histological findings on bone biopsy. Unlike the other forms of OI, type VI bone has features of osteomalacia with a marked increase in unmineralised osteoid. There is however no radiological signs of rickets and no disturbance in serum mineral homeostasis. There are no Wormian bones.

Type VII

Type VII is rare. It has been identified in a consanguineous community of native Americans in northern Quebec and the African American community. It has an autosomal pattern of inheritance and is due to mutations in cartilage associated protein on chromosome 3. It is characterised by rhizomelic short stature and coxa vara. The phenotype can vary in severity however multiple fractures are common from birth. Facial appearance is normal, sclerae are white and dentition is normal. There are no Wormian bones.

Bone Pathology

a) Bone Quality

The bone matrix is defective. There is a relative increase in woven bone and a decrease in lamellar bone.

b) Bone Quantity

The amount of cortical and trabecular bone is decreased. Bone cortices are thin, trabeculae are thin and fewer in number. Histology shows decreased osteoblastic activity on the periosteal surface and increased osteoclastic activity on the endosteal surface.

c) Bone Geometry

Normal diaphyseal bone is tubular or pipe-like. In OI the pipe walls are thin with defective lamination and the diameter is narrow causing weakness. Recurrent fractures and the abnormal nature of OI bone results in progressive deformity. Bent bones are inherently weaker and susceptible to further deformity and fracture.

Treatment

The aim of treatment in OI is to maximize mobility and other functional capacities. The optimal treatment approach involves an interdisciplinary team consisting of orthopaedic surgeons, physicians, geneticists, rehabilitation specialists, physiotherapists and occupational therapists.

Surgical Treatment

The risk of recurrent fractures and progressive deformity can be reduced by internal metal fixation. The use of intramedullary nails is the treatment of choice. Various techniques have been over the last thirty years. These include:

- stacked Kirschner wires
- solid Sofield rods
- telescopic nails

The current standard surgical practice in our institution is to use Fassier-Duval intramedullary telescopic rods in osteogenesis imperfecta children to treat recurrent fractures and correct limb deformities. The concept being that the rods will gradually increase in length with bone growth, thus avoiding rod revision. The intramedullary device has only 2 components- male and female rods – each with a thread at one end for fixation in the proximal and distal epiphysis of a long bone. The Fassier–Duval IM nails come in a range of sizes suited to the femur, tibia and humerus of short stature paediatric patients over the age of 18 months.

Medical

Treatment with Bisphosphonates

Bisphophonates are synthetic analogs of pyrophosphate that bind to the hydroxyapatite crystal found in bone. They act as specific inhibitors of osteoclastic mediated bone resorption. The use of bisphosphonates in the treatment of children with OI was pioneered by Francis Glorieux and colleagues at the Shriners Hospital for Children in Montreal, Canada. The first patient was treated in 1992.

The experience in our institution is that Pamidronate therapy will decrease bone pain, enhance well-being, improve mobility and muscle strength, reduce fracture incidence, increase long bone cortical thickness, increase vertebral size with vertebral reshaping, and increase bone mass and bone mineral density. In recent years we have used Zoledronate, which is a more potent bisphosphonate than Pamidronate. The indications for bisphosphonate therapy are children with moderate to severe OI as defined by: two or more long-bone fractures per year, and/or vertebral crush fractures, and/or long-bone deformities, and/or children with OI type III or IV.

Histomorphometry has shown that the major effects of pamidronate are to increase cortical thickness and trabecular number. Trabecular thickness is not increased. Bone turnover is significantly reduced with a decrease in both bone resorption and formation below that of age matched normal controls. There was also an increase in residual calcified cartilage within the bone.

Bisphosphonate infusions should be administered with caution. There is a risk of acute hypocalcaemia. Appropriate precautions should be taken. The first infusion often leads to an acute ‘flu-like acute phase reaction (fever, muscle pain, headache and vomiting). In vitamin D replete individuals receiving the recommended calcium intake, the hypocalcaemia is self remitting. The 'flu-like symptoms can be minimized by the administration of acetaminophen (paracetamol) or anti-inflammatory medication.

Bisphosphonates are contraindicated during pregnancy, and all females of reproductive age should have a negative pregnancy test before each pamidronate treatment cycle or before commencing oral bisphosphonates.

Teamwork

Optimal care of children with osteogenesis imperfecta necessities a multi-disciplinary approach.

It is imperative that there are open lines of communication between team members. This is especially important around critical events such as fracture and surgery. With this in mind, The Children's Hospital at Westmead, Australia, has established an Osteogenesis Imperfecta Clinic, which includes a paediatric endocrinologist, two orthopaedic surgeons, a geneticist, two clinical nurse practitioners, a physiotherapist, a rehabilitation physician, an orthotist, a social worker and a musculoskeletal radiologist. At one clinic visit the patient can be assessed by all the therapists involved in his/her care. The physiotherapist and rehabilitation physician play an important role in assessing gross motor development and maintaining patient mobility. They also manage rehabilitation following orthopaedic surgery. Bisphosphonate therapy is prescribed by the endocrinologist according to an internationally accepted regime but varied in each patient based on the results of XRays and bone density studies. Bisphosphonate therapy can be titrated around surgical intervention to decrease the incidence of delayed union and non-union of osteotomies.

Maintaining weight bearing activities and early postoperative mobilisation is aided by fitting orthoses. The team approach is also an excellent moral booster for families of OI patients and it means less disruption to family life with fewer visits to the hospital.

ABSTRACT OF PERSPECTIVE ORIGINAL PAPER

MALUNITED FRACTURES OF THE FOOT AND ANKLE IN CHILDREN – HOW TO CORRECT?

Hans Zwipp
Center of Orthopaedics and Traumatology at the University Hospital Carl Gustav Carus of the Technical University of Dresden, Germany
E-mail: hans.zwipp@t-online.de

Keywords: Malunion, Nonunion, Foot, Ankle, Fractures, Childhood, Compartment Syndrom, Burn Injury

In a personal 35 years period of foot & ankle surgery between 1978 to 1993 at the Trauma Department of Medical Highschool Hannover, Germany and at the Trauma Department of the University Hospital Carl Gustav Carus (Technical University of Dresden, Germany) from 1993 to 2013 a total of 5 malunions of the ankle and 8 malunions or nonunions after foot fractures were corrected in 13 patients during childhood and early adolescence up to 15 years of age.

Foot and ankle fractures in children represent 12% of all pediatric fractures [**5**]. According to an own previous analysis of a consecutive series of 128 cases of ankle and foot fractures in childhood excluding the very common and harmless toe fractures [**9**], ankle fractures occured in 54% more often than all foot fractures together in 46%. This is interesting because the ankle includes only two bones, the tibia and fibula, wheras the foot in this study included 12 bones (talus, calcaneus, navicular, cuboid, 3 cuneiforms and 5 metatarsals).

In contrast to the frequency of malunions in 7.7–50% after ankle fractures during childhood [cited in **8**] which are seen especially after Salter-Harris fractures Type 3–5 [**1,2,7,8**], malunions and non-unions after fracture of one of the 12 essential foot bones are seen seldomly [**9–12**].Therefore only little knowledge exists in literature how to correct latter ones. Because methods how to correct malunited ankle fractures are well described in literature [**1–3,7,8**] only three different types of malunions around the ankle and how to correct these are presented in this paper, but seven cases of secondary anatomic reconstructions after significant malunited or nonunited fractures of the talus, calcaneus, of the Chopart`s, Lisfrannc`s or metatarsals level are illustrated. How important a normal soft tissue envelope is in a growing foot can be shown in a case of neglected combined Chopart- and Lisfranc-fracture with a concomitant insufficiently treated burn injury. To show how essential free flap coverage in complex lower leg and foot trauma in children is, can be illustrated in a case after serial open fractures of the ankle, talus and calcaneus saving by this procedure not only the lower leg, but also allowing later reconstructions related to sequelae of a concomitant lower leg compartment syndrome. In addition a new operative technique of anatomic repair of an unstable Lisfranc ligament is presented which was created in the situation of a young, 15 years old and high level female gymnast to avoid fusion of the Lisfranc joint.

In all shown 10 cases, indicated and operated by the author himself, the main operative goal was always to restore the normal biomechanical axes by closing or opening wedge osteotomies according to Paley [**4**], by balancing with shortening or lengthening, but also, if anyhow possible, by anatomic restauration of the malunited joint itself (e.g. talus, navicular) to prevent posttraumatic arthritic pain without sacrifying joint function in a child or young adolescent.

Literature

1. Berson L, Davidson RS, Dormans JP, Drummond DS. Growth disturbance after distal tibial physeal fractures. FAI (2000) 21:54-58
2. Laer von L . Frakturen und Luxationen im Wachstumsalter. 4.Ed. Stuttgart, Thieme 2001, p.422
3. Mayr JM, Pierer GR, Linhart WE. Reconstruction of part oft he distal tibial growth plate with an autologous graft from the iliac crest.JBJS Br (2000) 82: 558-560
4. Paley D. Principles of Deformity Correction. Berlin-Heidelberg. Springer 2002, p.8
5. Petit CJ, Lee BM, Kasser JR, Kocher, MS. Operative treatment of intraarticular calcaneal fractures in the pediatric poulation.J Pediatr Orthop (2007) 27: 856-862
6. Rammelt S, Godoy-Santos AL, Schneiders W, Fitze G, Zwipp H. Foot and ankle fractures during childhood: review oft he literature and scientific evidence for appropriate treatment.Rev Bras Ortop (2016) 51: 630-639
7. Sanctis de N, Della Corte S, Pempinello C. Distal Tibial and Fibular Epiphyseal Fractures in Children: Prognostic Criteria and Long-Term Results in 158 Patients.J Pediatr Orthop (2000) 9: 40-447.
8. Schneider FJ, Linhart WE. Posttraumatische Komplikationen am kindlichen Sprunggelenk. Orthopäde (2013) 42: 665-678
9. Zwipp H, Ranft T. Fehlverheilte kindliche Frakturen im Fußbereich. Orthopäde (1991) 20: 374-380
10. Zwipp H. Chirurgie des Fußes. Wien, Springer, 1994, p.132
11. Zwipp H, Rammelt S. Posttraumatic deformity correction at the foot. Zentralbl Chir (2003) 128: 218-226
12. Zwipp H, Gavlik M, Rammelt S. Sekundäre anatomische Rekonstruktion fehlverheilter zentraler Talusfrakturen. Unfallchirurg (2014) 117: 767-775

ABSTRACT OF PERSPECTIVE REVIEW ARTICLE

“A SHORT CORD CAN CAUSE SCOLIOSIS”: OSTEONEURAL GROWTH RELATIONS BY MILAN ROTH (1923−2006) − A CONCISE CONCEPT IN MORPHOGENESIS AND A USEFUL SCIENTIFIC BASE FOR ORTHOPEDICS AND NEUROSCIENCE. AN OVERVIEW OF HIS LEGACY IN BIOMEDICAL SCIENCE

Van Loon, Piet JM[1], Soeterbroek, Andre M[2], Grotenhuis, Andre H (Deventer, Oosterbeek & Nijmegen, Netherlands)

1 Orthopedic surgeon, Care to Move, Centre for Orthopedics, Deventer, The Netherlands

2 Chairman Houdingnet (Posture Network Netherlands), Oosterbeek, The Netherlands

3 Professor of neurosurgery, RadboudMC, University of Nijmegen, The Netherlands

E-mail: pvanloon@planet.nl

Keywords: scoliosis, spinal cord, osteo-neural qrowth, sceletal morphogenesis, teratogenesis

Introduction and biography

Milan Roth was a professor of neuro-radiology of the J.Ev.Purkyně-University (now: Masarek-University) in Brno, the Czech Republic. He was one of the first worldwide experts in injecting air in the spinal canal to get contrast needed to see the neural content (Pneumencephalography and -myelography). He discovered the anatomical discongruenty of growth between the neural tissue and the enveloping skeleton, both under and above the foramen magnum.

He got an appointment in basic biomedical anatomical/ embryological research too, in the field of (patho-) anatomy and the process of growth. He produced his impressive work on this, both quantitative and without doubt also qualitative. Roth adapted the law of cephalocaudal differential growth in which growth in animals, just as in plants is found to be directed from the first existing and central parts of a living creature, in the vertebrate the central cord, in his early embryological stages. Although describing a leading role the osseous structures play as an acting part in the lengthening of the central nervous structures he put strong emphasis on the central cord and brainstem, in their initiating, architectural and controlling role of construction of their own house, the surrounding tissues that form that intriguing structure of the spine and skull.

His work remained largely unnoticed in the mainstream of the international world of orthopaedics, neurology or neurosurgery. The importance for all day clinical practice, for those dealing with children, of this biomedical knowledge on proper growth (Andry's "Orthopaedia") has to wait for disclosure in times, in which the younger generations are massively jeopardised in their normal bodily development, because of their sedentary lifestyle.

Roth's major disadvantage in exporting his knowledge was working behind the "Iron Curtain" and publishing in German and Czech language. He had a few articles in English journals in the field of Radiology. But his opus magnum, his book (1985, English) : "Osteoneural and neurovertebral growth relations" was never "exported".

His main research is about the concept of skeletal morphogenesis he developed which is based on the existence of 2 different types of growth in Nature, so also in the development of the spinal column, viz., the cellular-divisional (mitotic) growth of bone and soft tissues and the extensive (stretch) growth of the nervous structures. The neural extensive growth proceeds at a slower rate than the bone growth and will be influenced by all day movements. In a sedentary lifestyle the amount of cycles flexion (compressive force) prevail massively on cycles of extension (tensile forces).

An overview of his main topics and according research will be presented in short.

1. Analytical work

He stated: "*The traction effect of the spinal nerves is of decisive influence upon the position of the spinal cord within the spinal canal as well as upon the shaping of the vertebral foraminae, a conclusion we reached in our own radiographic studies, published in 1965 and 1966.*

2. Phylogenetic work

The hypothesis that the central nervous system should mature into the adult animal vertebrate body in a tensionless situation of was demonstrated in worms and other, more higher developed animals as well as in radiological and cadaver human studies. By applying studies to the normal state allowed an understanding of the requirements of the central nervous tissues to grow and develop, also in healthy human children.

3. Experimental teratogenic work

Roth conducted experimental studies on teratogenesis to clarify the role of the up to then neglected osteo-neural growth patterns, an area in which the interaction of growth in the nervous system interacts with other tissues. Roth was able to impair the stretching properties of the nervous system by exposing it (in-utero) to either teratogenic substances (like lathyrus) or by lowering the level of oxygen within it to hinder nervous cell growth. In these experiments, he was able to create spinal deformities as scoliosis. His experiments demonstrated that the passive role of neurogenic tissue, especially in the central cord, was transformed into a major, active role during the development and growth of the spine and the extremities. This ability of nervous tissue to grow by extension is phylogenetically determined.

4. Mechanical models of the spine, spinal growth and deformations

With the use of springmodels, dynamic spine-rib-cord models he could explain the function of neuromuscular tension in morphogenesis.

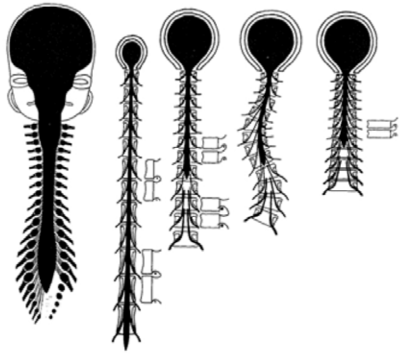
Conclusions

Biomedical science is an ongoing process with its own dynamics. Accepting and implementing Roth's concepts in different biomedical fields like orthopaedics will change its main direction in etiology related medicine. Full disclosure and understanding of the work of Roth can inspire many institutions to invest in new research. Challenges are in different fields of (medical) science and can be grouped.

1. Reproduce and clarify several of his analytical studies in spinal deformities (by pneumomyelography) by using modern technologies (MRI, f-MRI). Also, neurophysiologic studies (SSEP and surface EMG) can be performed in children with increased neuromuscular tightness against "flexible" controls. The Finger Floortest can be used as a clinical test.
2. Research related to his mechanical modelling (like springs) on direct and indirect effects of prolonged sitting in growing children with emphasis on variation of spinal forms (like curvature, disc-height, vertebral height and shape). Can the phenotype be different in children with different exposure to sitting?
3. Coordinated research efforts to find relationships between biomechanical and biochemical physiology, can clarify the mechanism behind growth (proportionate or disproportionate)

of bone and somatic tissues in relation with the stretch growth of the neural tissues. Is there a relation between neuromuscular tension (stress) and neuropsychological stress (tension)? In both the same neurotransmitters like seretonine, dopamine, adrenaline, noraderenaline play an important role in bodily and psychological functions.

4. New concepts for treating patients by conservative (exercise, bracing) or operative treatments (decompression, shortening procedures) with emphasis on the requirements for the nervous system as part of the complex "game" of compressive and tensile forces. Postural deviation will end up in degenerative processes of the skeletal system, but also on the nervous system.



A REVIEW ARTICLE

REFLECTIONS ABOUT THE PERSPECTIVES OF SCOLIOSOLOGY

Dudin Mikhail
Children's Rehabilitation Center for Orthopedics and Traumatology 'Ogonyok', Saint-Petersburg, Russia
ogonek@zdrav.spb.ru

Keywords: scoliosis, scoliosology, spinal column, osteo-neural growth, „flat back" syndrom, „round" back syndrom

Dedicated to Milan Roth.

First of all, I consider it necessary to express my gratitude to the founders of the Symposium, the main idea of which is the exchange of views on the widest spectrum of problems of the most complicated locomotor system. This is a direct continuation of the tradition of the great scientist-encyclopaedist Jan Evangelista Purkyně (1782–1869). It was he who stood (1801) at the origins of that cellular theory of the structure of the human body, which was later supplemented and developed by Matthias Jakob Schleiden (1804–1881), Theodor Schwann (1810–1882) and Rudolf

Ludwig Karl Virchow (1821–1902). The fundamental provisions of this theory have completely changed the views on the nature of numerous diseases and helped to find clues in the fight against them. Developing the findings of his predecessors, the Russian academician Georgii Nikolaevich Kryzhanovskii (1922–2013) showed that in the vast majority of cases the violation of human health is the consequence of disregulation in the activity and function of cells, organs, systems and the whole organism.

To this category we can reasonably attribute the lesions of the spinal column, manifested in the form of deformations. But, abstracting from their particular symptoms, it is necessary to admit that stable deformations, which are considered pathological, are only deviations from the normal form of the most complex segment of the skeleton. It is important to know that a violation of health only happens at critical values of curvature. Mention of such 'incurable' deformations can be found in the 16th century BC. ancient Egyptian papyri from the collection of Edwin Smith (Edwin Smith, 1822–1906). Over the next millennia these deformations have got their own name – 'scoliosis', which became the object of the most detailed study.

However, today in the world practice there are not so many scientific teams that are looking for answers to the questions 'who is to blame?' And 'what to do?'. Among the reasons for this situation not the latest role is played by the Conclusion of the American Orthopedic Association from 1941 on 'the lack of an alternative to the surgical treatment of scoliosis' (Shands, A.R., Jr., 1941). The fatality of this conclusion is that it condemns the patient and the doctor to a waiting attitude. In order to achieve a deformation of critical values and correct it in a coarse mechanical manner. The conclusion also has another unpleasant side – it reorients the resources of scoliosis to stimulate enough expensive surgical activity.

While the most negative characteristic of scoliosis is its ability to progress, however, clinical practice shows that not all scolioses progress and the number of such cases reaches 80%. In other words, the natural history of all three-plane deformations of the spinal column suggests – there are mechanisms in the body of a patient that stop the progressive development of scoliosis.

But, what are these mechanisms? After all, their understanding opens the way to an effective non-surgical fight against the most frequent failure of the locomotor system of Homo erectus.

During the interdisciplinary search for these mechanisms, four important facts were found in the development of scoliosis. First, all scolioses occur and evolve (up to critical values) only under the condition of longitudinal growth of the spinal column. The second – besides humans, they occur in fish, which combines with Homo erectus longitudinal load on the spinal column[1]. In the former, it is associated with the resistance of water, which must be overcome when moving forward, and in the latter – with a vertical (before all-sagittal) balance opposing gravity. The third fact and the paradox are the same – they are always monoform (only 3D deformation), despite the generally accepted

1 We believe that this circumstance can also be found in other vertebrates, in which the position of the vertebral column is close to the vertical, for example – in birds (penguins, young chickens).

opinion about their polyethiologic nature. The latter is indicated by numerous and quite convincingly argumented hypotheses. The fourth fact stems from the previous one – the monoformity of scoliosis, indicating a single pathomechanogenesis of their formation, opened the way for the identification of the only trigger that causes 3D deformation with the help of mathematical calculations.

During various private communication with our colleagues, the listed facts have not met any refutations and no discussions arose. Nevertheless, it is important to note the human factor. It manifests itself in the subjective adherence of physicians to one of the many etiological hypotheses and often losing sight of the fact that scoliosis is a process.

The first who named this process by name was the eminent Czech professor Milan Roth (1923–2006). He in the mid-1960s made the conclusion: **'The idiopathic scoliosis is a special type of osteo-neural growth disproportion'** (Roth M. Z. Orthop Ihre Grenzgeb., 1969. Nov., 107 (1): 37–46). Completely agreeing with the master, we specify: Scoliosis is the process of compensating for the non-alignment of the longitudinal growth of the spinal cord and its osseous-ligamentous 'sheath'. In other words, scoliosis, or 3D deformation, is a clinically significant disorder in the shape of the normal spinal column that occurs when the excess is compensated or the longitudinal dimension of the 'sheath' of the spinal cord is insufficient.

In the first case, with intensive growth of the case (sheath), the surplus is first absorbed by the reserves of physiological curves and the 'flat back' syndrome develops in the spinal column, which is the reason for enrolling the patient at risk for lordoscoliosis. Here it should be noted that 'flat back' meets the criteria of 'proud' posture, which 'develops' through numerous exhausting trainings in gymnasts, young ballerinas and models. Perhaps this is why the frequency of the so-called idiopathic scoliosis is extremely high in this category of young talents. They, these scolioses, are the result of subsequent stages of compensation for ill-fated non-conjugation, if the excess length of the 'sheath' continues its growth.

In the second case, with insufficient growth of the 'sheath', the physiological thoracic kyphosis will begin to increase, and the lumbar lordosis will decrease. As a result, the 'round back' syndrome develops in the spinal column, which, like in the previous case, is the reason for enrolling the patient at risk, but only for kyphoscoliosis.

Each of these two types of the first manifestations of the 'osteo-neural growth disproportion', while maintaining a discrepancy between the longitudinal dimensions of the spinal cord and its 'sheath', evolves into the corresponding type of scoliosis – typical, standard lordoscoliosis or atypical, non-standard kyphoscoliosis. With all the differences in their clinical patterns, the main thing is that the former have a high probability of increasing (progressing) in the frontal and horizontal planes, and the latter – only in the sagittal and never in the frontal and horizontal ones.

It follows directly from the foregoing that the main target for therapeutic procedures aimed at combating scoliosis at all stages of its evolution is **the process of longitudinal growth of a vertebral complex**.

Today the Russian pediatric orthopedics has already formed a sufficient arsenal of methods that can nonsurgically influence this key process in the evolution of the scoliosis. These methods can be divided into pathogenetic and auxiliary ones.

The first ones are:

1. Provision of a life regimen with minimization of the intake of the stimulant of osteogenesis – vitamin D (first of all due to the reduction of natural UV irradiation).
2. Correction of osteotropic hormonal profile, the purpose of which is to decrease the effectiveness of growth hormone and the activation of its antagonist – cortisol. The desired effect is achieved due to a long course of licorice root medicine, which has adeno-corticotropic activity.
3. Next to the previous, medical treatment, there is a physiotherapeutic method of high-frequency electrotherapy aimed at stimulating the synthesis of cortisol in the adrenal glands. It is based on the use of super-high-frequency electromagnetic oscillations (from 300 to 3000 MHz) with a decimeter wavelength (from 1 m to 10 cm) for therapeutic purposes to the adrenal gland region.
4. Magnetic-pulse effect with the effect of inhibition of the growth zones of the apophyses of vertebral bodies. Such an inhibition in the form of irreversible degradation occurs when the magnetic field is induced to exceed 2T. This percutaneous, painless and a traumatic method is analogous to surgical epiphiseodesis, often included in the protocol of a surgical operation to correct scoliotic deformation.
5. Method of magnetic therapy based on the effect of 'parametric magnetic resonance' ('Lednev model'). In this model, it was shown that when tuning the resonance frequency in accordance with the parameters of various ions, it is possible to obtain biological effects that are opposite in sign. Thus, tuning to the parameters of Ca^{2+} ions allows accelerating the processes of cell proliferation, and tuning to K^+ ions causes the opposite reaction. The induction of the magnetic field for this technology is measured in µT.

NB. It should be noted that the biological effects from the application of both listed methods of magnetic therapy fully correspond to the general biological law of Arndt-Schultz[2] (Hugo Paul Friedrich Schulz, 1853-1932, Rudolf Gottfried Arndt, 1835–1900).

2 **The Arndt-Schultz law**. As early as 1883, the professor (psychiatrist) of the University of Greifswald (Germany) R. Arndt, on the basis of abstract considerations, extended the provisions of the law (1859) on the dependence of the response of tissues on polarity and the force of the influencing electric current by E.F.W. Pflüger (1829–1910) on all kinds of irritation. As a result, he formulated an already general biological law (Biologisches Grundgesetz), according to which weak stimuli arouse the activity of living elements, medium ones-intensify, strong-inhibit, and very strong-paralyze. In 1887, his colleague at the university, professor of pharmacology, H. Schulz, published an article in which a similar conclusion was expressed in relation to medics.

6. Methods of electro- and magnetic local stimulation of paravertebral muscles under the control of EMG in order to counter the pathogenic rotary effect observed when unilateral contraction arises – mm. transversospinales in general and lumbar mm. multifidi in particular.
7. At present, the microstimulation method of conducting spinal cord pathways is being adapted to activate the longitudinal growth of this CNS department.

To the second, auxiliary, group of methods of conservative treatment of scoliosis we can attribute the following ones:

1. Corsetting with rigid corsets of the Chenot type (Jacques Pierre Joseph Chêneau, b. 1927).
2. 'Three-dimensional correction of scoliosis – a system of respiratory orthotics by the method of K. Schroth' (Katharina Schroth, born Bauer, 1894–1985).

The experience of using these medical technologies already yields positive results that allow not only to stop the unfavorable course of scolioses, but even to regress their symptoms, which makes conservative scoliosis treatment reasonably promising.

On the other hand, the pathogenesis model of the so-called idiopathic scoliosis, confirmed by practice, has revealed the possibilities for its prevention as a disease (NB, the prophylaxis of its occurrence, not progression!).

To what has been said, we should add that the list of the medical technologies provided is not exhausted. No way has been found to influence the hydration and dehydration of intervertebral discs, which make a considerable contribution to the longitudinal size of the 'sheath' of the spinal cord. We also made assumptions about the place in the pathogenesis of scoliosis of the female oxytocin[3] regulator, which possesses the effect of the postural asymmetry factor in high doses. The nerve growth factor (NGF), for the discovery of which Rita Levi-Montalcini (1909–2012) and Stanley Cohen (b. 1922) received in 1986 the Nobel Prize in Chemistry, has not yet received proper attention from orthopaedists. After all, it is permissible to assume that its use will allow timely elimination of the lag in the longitudinal growth of the spinal cord, the lag that causes the need to initiate compensation for the relative length of its 'sheath' in the form of 3D deformation.

It seems that we have just started reading a book called '**SCOLIOSIS'**.

3 'For the isolation, identification and synthesis of the cyclic peptide – **oxytocin**' Vincent du Vigneaud (1901–1978) received the Nobel Prize in Chemistry in 1955.

ABSTRACT OF PERSPECTIVE ORIGINAL PAPER

IDIOPATHIC SCOLIOSIS TREATMENT OR HOW TO 'LOOSE SPRING'

Arsenev Aleksey, Dudin Mikhail, Petrov Semen
Children's Rehabilitation Center for Orthopedics and Traumatology 'Ogonyok', St. Petersburg, Russia
E-mail: ogonek@zdrav.spb.ru, stivamat@rambler.ru

Keywords: idiopathic scoliosis, spring-string, spine growth, magnetotherapy.

Dedicated to Milan Roth.

Noninvasive management of spine growth zones functional activity is a promising direction at AIS treatment. This report presents experimental data about influence of weak magnetic set-up parameters field on functional activity of mice bone growth zones. It draws parallels between experimental results, M. Roth's views of AIS cause and main tasks of 3D spine deformation treatment.

Introduction

Correlation between AIS and spine growth is the most incontestable fact at AIS etiology and pathogenesis. Experimental data was received by numbers of unrelated research teams in different years. It confirms spine overgrowth at children with idiopathic scoliosis. There are classical studies of Y. Cotrel (the middle of twentieth century) [**1**] and later studies of m-me G. Duval-Beaupere [6] graphically showing the correlation between angle value of AIS getting worse and spine growth. G.G. Epstein's study was one of the first that revealed increase of spine length at children with idiopathic scoliosis [**10**]. In 1981 Epstein showed that growth of children with idiopathic scoliosis is higher than the average statistical one.

Later Chinese science team published a study with the almost the same results [**10**].

It should be especially noticed that M. Roth's AIS study direction was formed in 1968 [**9**]. He developed spring-string AIS model and supposed that idiopathic scoliosis is a result of conflict between longitudinal spine growth and spinal cord. This model demonstrates AIS forming because of linear dimension discordance of "spring and string". It was the base for many further studies.

Longstanding scientific research of our Center under Professor M.G. Dudin may be defined as continuation of M. Roth's work. Having the same view of AIS pathogenesis we found that deceleration of spine overgrowth is expedient to get a result at AIS treatment. We may expect considering AIS forming Maths model [**5**] and rules of bone growth that treatment by such methods will be the most effective on pre-clinical and subclinical AIS stages. Moreover, it is possible to talk about real AIS prevention [**5**]. Atraumatic and safety treatment technologies are priory for us. Bone growth influencing methods became possible to use for orthopedists by the end of twentieth century [**5**]. Such influence is able to cause physicotherapeutic change of osteotropic endocrine profile, in particular DMW-stimulating (decimetric magnetic waves) of adrenal cortex.

Modern knowledge about bone growth mechanism allows us to find one more target to DMW influence. It is growth zone of vertebral body. We chose such method of influence which bases on numerous basic researches of magnetic fields and its influence on biological objects. Professor V.V. Lednev (1939–2009) made his substantial contribution to development of bone growth influencing methods. Our team-works with Lednev's research group (Institute of Theoretical and Experimental Biophysics of RAS [**9**] experimentally shows that weak magnetic field is able to slow down the bone growth. It helps to develop safe and effective method using of weak magnetic field to slow down bones growth at children with idiopathic scoliosis. The final result of slowing down of spine growth may be compared with spring loosen effect at Milan Roth's spring-string model.

Material and methods

growing mice (C57BL/6 (n=50)) were used in experimental part of work. Animals undergone the influence of weak combined potassium-specific magnetic field into chronic regime (1 hour per day, 1 month duration). Alternate magnetic field with necessary parameters was generated by original device constructed at the Krylov State Research Centre. The alternate magnetic field frequency is calculated by the following formula: fres = (Bemf/2)q; (fres-resonance frequency (Hz), Bemf – Earth magnetic field, mT; q – quotient of charge of chosen ion potassium (coulomb) to its mass(kg),(2,45). Due to this reason the alternate magnetic field frequency (f res) was 19,5 Hz when the most common static magnetic field frequency of the Earth was 50 mT. Together it provided condition for ion parametric resonance of potassium ions. Control animal group undergone fake treatment when the device was switched off. Autoradiography method was used to evaluate experiment results as this method lets to evaluate DNA synthesis in growth zone chondrocytes. International rules of humane attitude to animals were observed during the experiment. Received results were statistically processed and mathematically modeled.

Results

There is tendency to slow down of bone growth and increase of mice weight during one month under the influence of weak combined potassium-specific magnetic field. Cell proliferation is inhibited as numbers of inclusions of ^{3}H-thymidine is decreasing in low differentiated cells of epiphyseal plates of long bones. At the same time, thickness of zone of high-differentiated cells is reliably increased. From our point of view, such result is explained by the following: potassium ion-specific magnetic field suppresses cambial cells (precursor of chondrocytes at epiphyseal plates) and prolongs life-time of high- differentiated chondrocytes. Cells renewal is finally decreased at growth zones. It leads to decrease of bone growth speed of experimental animals.

Discussion

All enumerated treatment technologies of spine growth control are widely used at Child Rehabilitation Orthopedic and Trauma Center "Ogonyok". We may recommend to use this technologies at children with AIS by our experience. The earlier it will be used, the better the result will be.

References

1. COTREL Y. Traitement des scolioses essentielles. Rev Chir Orthop, 1957; no. 43, pp. 331–343.
2. DUDIN M.G. Idiopathic scoliosis: prevention and conservative treatment. Saint-Petersburg, Chelovek Publ., 2017, 224 p.
3. DUDIN M.G. Mechanical-mathematical model of idiopathic scoliosis. Amsterdam, Abstracts SIROT., 1996, 221 p.
4. DUDIN M.G. Features of endocrine regulation of bone metabolic processes as etiologic and pathogenetic factors of AIS. Doct. diss. Saint-Petersburg, 1993, 195 p.
5. DUDIN M.G., PINCHUK D.Y. Idiopathic scoliosis: diagnosing and pathogenesis, Saint-Petersburg, Chelovek Publ., 2009, 336 p.
6. DUVAL-BEAUPERE G., DUBOUSSET J., QUENEAU P., GROSSIORD A. Pour une theorie unique de levolution des scoliosis. Presse Med., 1970, no. 78, pp. 1141–1146.
7. EPSHTEYN G.G. Features of child spine growth at idiopathic scoliosis/Diseases and injuries of children spine. Saint-Petersburg, 1981, pp.18–26.
8. LEDNEV V.V. Bioeffects of weak combined, stating and alternating magnetic fields. Pushchino, Biofizika Publ., 1996, vol. 41, no.1, pp. 224–232
9. ROTH M. Idiopathic scoliosis caused by a short spinal cord. Stockholm, Acta Radiol Diagn, 1968, no. 7, pp. 257–271.
10. ZHEN L., ZEZHANG Z.; JING G.; SAIHU M.; WEIJUN W.; BANGPING Q.; FENG Z.; WINNIE C.; JACK C. Y. CHENG; YONG Q. Analysis of body growth parameters in girls with adolescent idiopathic scoliosis: single thoracic idiopathic scoliosis versus single lumbar idiopathic scoliosis. Research into Spinal Deformities, 2012, vol. 176, no. 8, pp. 195–201.

ABSTRACT OF REVIEW ARTICLE

BIOMECHANICAL ETIOLOGY OF THE SO-CALLED IDIOPATHIC SCOLIOSIS. NEW CLASSIFICATION. NEW THERAPY. CLINICAL MATERIAL BASED ON OBSERVATION FROM 34 YEARS (1984–2018) AND PRESENTATION FROM 1995 (23 YEARS)

Karski Tomasz

Former Head (1995–2009) of Paediatric Orthopaedic and Rehabilitation Department of Medical University in Lublin, Poland

Actually – Professor Lecturer in Vincent Pol University in Lublin, Poland

E-mail: t.karski@neostrada.pl tmkarski@gmail.com www.ortopedia.karski.lublin.pl

Key words: So-called Idiopathic Scoliosis. Biomechanical etiology. Therapy. Prophylaxis.

Introduction

The lecture / article inform about biomechanical aetiology of the so-called idiopathic scoliosis [adolescent idiopathic scoliosis-AIS] (1995–2007). Development of scoliosis is connected with asymmetry of hips movement and secondary influence is going to the spine through "gait" and habitual permanent standing 'at ease' on the right leg.

Asymmetry o hips movements. Connections of „Syndrome of Contractures (H. Mau)" and scoliosis: The „Syndrome of Contractures" has been described primarily by Prof. H. Mau – Tübingen / Germany – as *Siebener[Kontrakturen] Syndrom*" **[1, 2]** and also by: W. Dega, Hensinger, Howorth, Green & Griffin, Vizkelety, Komprda, Karski T., Tarczyńska M., Karski J. & Frelek - Karska M. and many others authors given in inventory of Literature (see down).

Mostly we observe the "left sided syndrome of contractures" connected with the "*first foetus position*" in pregnancy (85%–90% children – gynaecologist – Prof. Jan Oleszczuk). In the "syndrome of contractures there are:

1. scull deformity (*plagiocephaly*)
2. wry neck *(torticollis muscularis)*
3. scoliosis infantilis *(infantile scoliosis – not so-called idiopathic scoliosis)*
4. contracture (shortening) of adductors of the left hip (untreated can lead to DDH) ;
5. contracture (shortening) of abductor muscles and soft tissues of the right hip (Karski), described as *Haltungsschwäche* ("weak posture") by Prof. Hans Mau;
6. pelvic bone asymmetry;
7. feet deformities
8. We also include (2006) in the "Syndrome of Contractures and Deformities" excessive shank deformity (*crura vara*) – later Blount disease "Orthopädische Praxis" [Karski T. et al.]

Children with so-called idiopathic scoliosis: Clinical material 1995 – 2017 (N) 2250 cases, 364 of the patients was control group. Three **a**etio**p**atholo**g**ical (epg) groups of scoliosis were distinguished at studied material: In cohort I epg "S" scoliosis group was 41 % of children, in group II/A epg "C" scoliosis and II/B epg group "S" scoliosis were 23 % children, in III epg group – "I" scoliosis was 9% of patients – mostly young people. Age of patients was from 3 to 70 years of life.

Additionally, in clinical material there were children with congenital scoliosis (2%), radiological symptoms of spina bifida occulta (18%), slight symptoms of Minimal Brain Dysfunction (5%) and in some children pectus infundibuliforme or signs of rickets (Harrison rib deformity) were observed. Family history of scoliosis was in 10% of patients. Mothers of 2% of examined children had been treated and operated for scoliosis.

New classification

[1] Ist etiopathological group of scoliosis ("S" – I epg / 3D) (*Karski 2001*) [double curve scoliosis] depend of "model of movements of hips" (Karski 2006). Development of spine deformity connected with gait and standing 'at ease' only on the right leg. The first – rotation deformity, confirmed by computer gait analysis. As result – "stiffness of spine". Next – curves. Some cases "lordoscoliosis". Progression.

[2a] [2b] IInd etiopathological group of scoliosis – "C" II/A epg – 1D and "S" II/B epg – 2D (*Karski 2001*). Special "model of movement of hips". On beginning physiological deviation, with the time

"C" shaped spine curve to see in age 8–12 years. Causative influence: permanent habit of standing 'at ease' on the right leg through many years. The **"C"** scoliosis was in past time "treated" as "paralytic scoliosis" or later, in older people "treated" as "degenerative scoliosis. In **"S"** II/B epg scoliosis thoracic right curve is the secondary one. In development of **"S"** II/B epg are important additionally "laxity of joints" and "harmful exercises in previous therapy". Some cases in II/B epg group are/have kyphoscoliosis.

[3] III^rd etiopathological group of scoliosis (*Karski 2004)* – it is "scoliosis with little or no curvature" – **"I"** III epg scoliosis. Main symptom – "stiffness of the spine". Clinically and radiographically only slight deformities. No rib hump or only slight. In adulthood – often "back pain".

New tests for scoliosis

In diagnosis important old tests (Adams & Meyer test) and new tests "*side bending test for scoliosis*" (Lublin test), checking of "habit of standing" (right versus left leg), Duncan Ely test (or Thom or Staheli test), *pelvis rotation* test (new test – 2006), adduction of hips test (similarly to Ober test) and others (presented in lecture).

New rehabilitations exercises

All extension exercises, all so-called strengthen exercises are wrong, are improper. In patient coming to our Department after such therapy we seen only huge iatrogenic deformity.

New exercises are: all stretching exercises removing contracture in region of right hip, of pelvis, of spine. There are flexion – rotation exercises introduced very early in age of 3–4 y. There are bending exercises towards front, towards left and to right side of body. All stretching exercises typical for karate – directed for lower extremities, for pelvis, for hips and for spine. The therapy should be continued so long as the child growth up.

Conclusions

1. The aetiology of so-called idiopathic scoliosis is strictly biomechanical (1995–2007). Type of scoliosis is connected with "model of hips movements" (2006).
2. Development of scoliosis is connected with function: "gait" and standing position 'at ease' on the right leg.
3. The restricted adduction / or abduction contracture of the right hip is connected with the "Syndrome of Contractures and Deformities" (H. Mau, T. Karski).
4. Children in age of 3–5 years old should be examined to discover "the danger of scoliosis". Important examination of adduction of both hips in straight position of joints and checking the habit of standing.
5. Radiographic asymmetry of the pelvis (*oblique position of pelvis)* of infants is a risk for spine development in children 3–4 years and scoliosis in age of 8 – 12 years.

6. In new classification there are: **"S"** I epg – 3D (some case "lordoscoliosis") scoliosis, **"C"** II/A epg – 1D, **"S"** II/B epg – 2D (some cases kyphoscoliosis), **"I"** III epg – 2D (only "spinal stiffness")
7. Proper solution of "spine problem" is early prophylactics based on "biomechanical aetiology of scoliosis" and introducing the simple therapeutic methods:
   a. standing 'at ease' on the left leg and never more on the right,
   b. stretching exercises of the right hip to receive full movements,
   c. bending exercises for spine,
   d. exercises to receive proper position of pelvis, to cure its "anterior tilt".
8. Very important is active participation in sport like karate, taekwondo, aikido, kung fu, yoga.
9. In all countries on the world should be introduced the causal prophylaxis of the so-called idiopathic scoliosis.

Literature

1. See www.ortopedia.karski.lublin.pl and next click on the link No 17 – here many of publications.
2. BARLOW TG. Early diagnosis and treatment of congenital dislocation of the hip. J.B.J.S., 1962, 44B (2), 292–301
3. BIALIK V. IN KARSKI T. Skoliozy tzw. idiopatyczne – etiologia, rozpoznawanie zagrożeń, nowe leczenie rehabilitacyjne, profilaktyka. The etiology of the so-called idiopathic scoliosis. The new rehabilitation treatment. Prophylaxis, FOLIUM, Lublin, 2003.
4. BURWELL G, DANGERFIELD PH, LOWE T, MARGULIES J. Spine. Etiology of Adolescent Idiopathic Scoliosis: Current Trends and Relevance to New Treatment Approaches, Volume 14/Number 2, Hanley & Belfus, Inc, May 2000., Philadelphia, p. 324
5. DANGERFIELD PH, DORGAN JC, SCOTT D, GIKAS G, TAYLOR JF. Stature in Adolescent Idiopathic Scoliosis (AIS).14 Meeting EPOS, Brussels, 5 April 1995, Papers and Abstracts, Page 210.
6. DEGA W. Bada ia z dziedziny etiologii wrodzonego zwichnięcia biodra. Chir. Narz. Ruchu, 1932, 144
7. Dunn P. Congenital postural deformities: further perinatal associations. Proc. R. Soc. Med 1974;67:1174–8.
8. GREEN NE, GRIFFIN PP. Hip dysplasia associated with abduction contracture of the contralateral hip. J.B.J.S.1982, 63-A, 1273–1281.
9. HEIKKILÄ E. Congenital dislocation of the hip in Finland. An epidemiologic analysis of 1035 cases, Acta Orthop. Scandinavica 1984, B.55,125–129.
10. HENSINGER RN. Congenital dislocation of the hip. Clinical Symp. 1979, 31
11. HOWORTH B. The etiology of the congenital dislocation of the hip, Clin. Orthop., 1977, 29, 164–179
12. JAMES W. OGILVIE, JOHN BROWN, VEEANN ARGYLE, LESA NELSON, MARY MEADE, KENNETH WARD: The search for Idiopathic Scoliosis Genes, Spine 2006; 31: 679 – 681. Canadian Open Medical Sciences & Medicine Journal. Vol. 1, No. 1, April 2015, pp. 1–16. Available online at http://crpub.com/Journals.php Open Access Copyright © crpub.com, all rights reserved. 10
13. KARSKI TOMASZ, MARIA FRELEK-KARSKA, JACEK KARSKI, JACEK MADEJ, JAROSLAW KALAKUCKI: "Zespół przykurczów" u noworodków i niemowląt przyczyną odległych dysfunkcji narządu ruchu w tym tzw. skolioz idiopatycznych. Wykrywanie zagrożeń nieprawidłowego rozwoju kręgosłupa i zasady nowej profilaktyki skolioz. (The syndrome of contractures' at newborns and babies as a cause of dysfunctions of skeletal system and among others of the so-called idiotaphic scoliosis. The discovery of the danger of the oncoming scoliosis. Rules of new prophylactics.) W: Międzynarodowa Konferencja Naukowa: "Uwarunkowania rozwoju sprawności i zdrowia". Częstochowa, 10–11 grudnia 2001. Progr. i streszcz, s. 11–12.

14. KARSKI JACEK, TOMASZ KARSKI, GRZEGORZ KANDZIERSKI, MARTA TARCZYŃSKA, JAROSŁAW KAŁAKUCKI, MICHAŁ LATALSKI: "Zespół przykurczów" u noworodków i niemowląt wg prof. Hansa Mau w wyjaśnieniu "geografii" i niektórych klinicznych cech skolioz tzw. idiopatycznych. ("Contracture syndrome" in newborns and infants according to Prof. Hans Mau as an explanation of the "geography" and certain clinical features of idiopathic scoliosis). Ortop. Traumatol. Rehabil. 2005 vol. 7 nr 1, s. 23–27
15. KARSKI JACEK, JAROSLAW KALAKUCKI, TOMASZ KARSKI, MARIUSZ DLUGOSZ "Syndrome of contractures" (according to Mau) with the abduction contracture of the right hip as causative factor for development of the so-called idiopathic scoliosis. ("Syndrom kontraktur" (podle Mau) s abdukční kontrakturou pravého kyčelního kloubu jako příčinného faktoru vývoje tzv. idiopatické skoliózy). Pohyb. Ustr. / Czech Republic, 2006 R. 13 č. 1/2, s. 81–88, bibliogr. poz. 21.
16. KARSKI T. in Burwell, Dangerfield – Spine. Etiology of Adolescent Idiopathic Scoliosis: Current Trends and Relevance to New Treatment Approaches, Volume 14/Number 2, Hanley & Belfus, Inc, May 2000., Philadelphia, 324
17. KOMPRDA J. in Karski T. Etiology of the so-called "idiopathic scoliosis". Biomechanical explanation of spine deformity. Two groups of development of scoliosis. New rehabilitation treatment. Possibility of prophylactics, Studies in Technology and Informatics, Research into Spinal Deformities 4, Vol. 91., IOS Press 2002, Amsterdam, Berlin, Oxford, Tokyo, Washington DC, 37–46.
18. MAU H.: Powstawanie skoliozy u małych dzieci, w: "Wczesne wykrywanie i zapobieganie progresji bocznych skrzywień kręgosłupa" Materiały z Sesji Naukowej PAN, pod red. Prof. W. Degi, Poznań,10–11.XI.1980, PZWL, Warszawa 1983, 34–42
19. MAU H.: Zur Ätiopathogenese von Skoliose, Hüftdysplasie und Schiefhals im Säuglinsalter. Zeitschrift f. Orthop.1979, 5, 601–5.
20. Mau H.: "Die Atiopatogenese der Skoliose", Bücherei des Orthopäden, Band 33, Enke Verlag Stuttgart 1982, 1–110
21. OLESZCZUK J., CHAZAN B., KAMIŃSKI K., LESZCZYŃSKA-GORZELAK B., SKRĘT A., SZYMAŃSKI W.: "Poród patologiczny" in 'Położnictwo" Klimek Rudolf, Dream Publ. Comp.Inc., Kraków, 1999, pp. 291–337
22. OLESZCZUK J., SZYMAŃSKI W., WILCZYŃSKI: "Patologia
23. POUL J, BAJEROVA J, SOMMERNITZ M, et al. Early diagnosis of congenital dislocation of the hip. J Bone Joint Surg Br 1992; 74:695.
24. RIGO J., SZEPESI K., MESZAROS T.: in Book with contents with material of „Symposium – latest achievements in orthopaedics and in paediatric orthopaedics. Prophylactic program important in 'Bones and Joint Decade 2000–2010", Lublin, 2009, 133–223 .

ABSTRACT OF PERSPECTIVE ORIGINAL PAPER

GROWTH OF THE HUMAN SKELETON, A LIFESTYLE DEPENDANT, TENSION BASED BIOMECHANICAL AND NEURODYNAMIC PROCESS. CONNECTED RESEARCH OUT OF A TRAIL IN ETIOPATHOGENETIC SEARCH IN SPINAL DEFORMITIES AND ENDEMIC POSTURAL CHANGES

Van Loon Piet JM[1]; Van Ruud Erve HG[1]; Thunnissen Erik BT[2]; Grotenhuis Andre JM[3]

1 Orthopedic surgeon, Care to Move, Centre for Orthopaedics, Deventer, The Netherlands

2 Pathologist, epidemiologist VUMC, Free University, Amsterdam, The Netherlands

3 Professor of neurosurgery, Radboud MC, University of Nijmegen, The Netherlands

E-mail: pvanloon@planet.nl

Keywords: human sceleton, postural changes, spinal deformities, scoliosis, bracing

Introduction

With a massive increase in malalignment related ailments among even the youngest children in "Western lifestyle" societies, like low back pain, neck pain, injurie- proneness and early degeneration of intervertebral discs and synovial joint cartilage, the search for understandable etiopathogenetic explanation and preventive interventions has started in the last decade into old and forgotten or neglected knowledge.

In that search, the "Form follows Function" axioma of Evolutionary Biology gets renewed attention in order to understand the unhealthy development in this era of the youth by losing or not achieving "biomechanical optimization" or overall fitness. A process of reversed engineering after the invention of a new effective brace technique (TLI, thoracolumbar Lordotic Intervention) can lead to proper preventive approaches in growing children.

Research 1

In scoliosis correction after invention (by serendipity) of an apparently effective technique of correction in kyphosis and scoliosis (dynamic realignment, TLI) a test was done to proof the interconnection of curves in different planes in scoliosis by changing the dynamic tension in the body ("Tensegrity") by hyperextension of the spine, leading to altered structural integrity (Morphology) .

Methods

Anteroposterior spine radiographs of patients with a double major curve pattern scoliosis were obtained in 2 groups of patients. In group A radiographs in 3 positions: standing, and supine with and without fulcrum (n 12), and group B radiographs in 2 positions (n 28): standing, and supine with lordotic fulcrum. Cobb angles were determined and evaluated statistically. The sagittal contour of the thoracolumbar junction in standing position was measured.

Results

In group A with the patients lying supine a correction of the Cobb angle was obtained at the thoracic level of 15.4% and the lumbar level of 27.5% (P <0.001). Adding in supine position a lordotic fulcrum on the thoracolumbar junction resulted in a coupled further correction at the thoracic level of 15.7% and lumbar 18.1% (P <0.001). Comparing in group A the thoracic and lumbar curvatures in standing position with that on a lordotic fulcrum in supine position revealed a total reduction of 31% and 45.6%, respectively. For the independent group B this reduction in 1 step is 38% and 44.4%, respectively. All TL spines were kyphotic or just neutral in the sagittal profile.

Research 2

So with true correction of scoliosis by changing the tension lines in a living spinal system, supported strongly by the concepts on Osteoneural Growth relations by Milan Roth the lack of extensile growth of the neural system by a sedentary lifestyle (overload of compression in flexion) must lead to endemic signs of increased tension and deformation of the spine.

Methods

In a cohort of schoolchildren between 14–18 years of age a relationship was investigated between the FFT and thightness of hamstrings and calf muscles. Thightness of both was done by using a goniometer. The children were photographed from lateral while performing the FFT and a questionnaire was filled in (sport-activity)

Results

Strikingly only 40,7% of the 248 children could reach the floor with the validated Finger Floor Test (FFT, bending forward with straight knees and reaching or not the floor with the fingers. FFT is a knock-out test). 78,6% of the participants has unilateral thightness of their calf muscles (59,3% bilateral). 78,2% of the children has unilateral thightness of the hamstrings (61,7% bilateral). It could be concluded, that failing the FFT showed a sensitivity of 73,2% with tightness of the hamstrings. In about 60% the contour of the flexed spine was scored as pathologic arcuate or angulate hyperkyphotic

Conclusions

Scoliosis is apparently correctable by introducing a lengthening force by reversing the present thoracolumbar kyphosis into a lordosis. Very high percentages in a cohort of children show thightness of hamstrings, calf muscle-achilles tendon and failure at the FFT. Only 40,7% could reach the floor. A high correlation was found between FFT and hamstring thightness. The tension regulated Osteoneural growthrelations as postulated by Milan Roth give great support to understand our both studies.

The direct and indirect effects of a sedentary lifestyle on a growing child are one of the most actual health issues worldwide. With better understanding of the biomechanic and neurodynamic features of proper and improper growth, or its absence, preventive interventions or guidance of postural growth (alignment) will reduce the need for corrective interventions by surgical means.

ABSTRACT O PERSPECTIVE REVIEW ARTICLE

WHAT DO WE KNOW ABOUT INTERVERTEBRAL DISCS? (THE SHORT LITERATURE REVIEW)

Petrov Semen
Children's Rehabilitation Center for Orthopedics and Traumatology 'Ogonyok', St. Petersburg, Russia
E-mail: ogonek@zdrav.spb.ru varuh@mail.ru

Keywords: vertebral column, intervertebral discs, adolescent idiopathic scoliosis

Actuality

the role of intervertebral discs (IDs) aren't studied enough at AIS pathogenesis (Dudin M.G.,2017). Although 20–25% of vertebral column consists of IDs (Sinelnikov R.D., 2010). The growth-associated AIS initiation theory is widely spread among russian and foreign orthopedists. That's why IDs, probably takes significant part at AIS pathogenesis.

But, first of all, we should study, what is the ID as single unit and as the element of vertebral column. Our short literature review doesn't pretend to whole description of ID. It is only little step to understand this one.

General

ID is fibro-cartilaginous structure including ring-shaped connective plate and jelly- shaped nucleus. It lays between two adjacent vertebras, so this is synchondrosis.

Embryogenesis

ID develops from mesoderm layer. There are paraxial, intermediate and lateral mesoderm plates. Paraxial plate forms somites (dermatome, sclerotome, myotome) (Belousov L.V.,2005) Each sclerotome has more compact caudal part and less compact cranial one by the 6th week of embryogenesis. ID begins from the cranial part. A vertebral column forms from the end of 6th to beginning of 8th weeks (Dudin M.G., 2009)

Anatomy

Intervertebral joint is connection of two vertebral body apophysis with ID (Kapandji, 2009). There is no ID between first and second vertebras. There is 23 IDs, which are included at mobile part of vertebral column. ID is fibrocartilage and consists of two units- peripheral fibrous ring and central nucleus pulposus (Sinelnikov R.D., 2010).

ID thickness changes depend on its location. Adults have ID up to 9 mm at lumbar, 5 mm at thoracic and 3 mm at cervical regions. Ratio of ID thickness and vertebral height is more important than just ID thickness on Kapanji opinion. Children have almost constant ID thickness during growth, but the ratio is getting lower because of vertebral height increasing (Stokes I.A.F., Burwell R.G., Dangerfield P.H., 2006). It believes that ID thickness increases after sleeping due to water consumption by nucleus pulposus. And it decreases by the evening because of static pressure on nucleus. At the result daily spine length varies about 2 cm.

ID thickness decreases on 1–2 mm under the pressure and increases on 3–5 mm while stretching. Hirsch showed: if an ID is under the constant pressure, it's thickness will decrease exponentially. Reduction of thickness is exponentially too. But the exact time of reduction is still unknown.

The more ratio of ID thickness and vertebral height, the more vertebral segment mobility according to Kapanji. Cervical part is the most mobile because the ratio is 2/5 (40%) (**fig. 53**[4]) lumbar ratio is 1/3 (33%) (**fig. 55**), thoracic ratio is 1/5 (20%) (**fig. 54**).

Nucleus doesn't locate at the middle of ID in all cases. If we divide ID on 10 equal parts from the front to back at sagittal profile we will see the next picture:

1. Nucleus lays from 4/10 to 7/10 at cervical part. It passes through the vertebral axis (**fig. 56**)
2. Nucleus at thoracic part has the same position but the vertebral axis passes in front of nucleus. (**fig. 57**)
3. Lumbar part nucleus lays from 4/10 to 8/10. It's size bigger because of greater axial pressure at lumbar part. The nucleus passes through the vertebral axis too (**fig. 58**) (Kapandji, 2009)

Histology and biochemistry

Nucleus pulposus is gel, including about 88% of water (Kapandji, 2009). Although, the water part differs with age. It is 90% at newborn, 86% at 11th years old teenager, 80% at adults and 60% at humans over the 70th years old. (W. Wasilev, W. Kuhnel, 1992; R. Putz, 1993). Nucleus are replaced by fibrous tissue with age. So the border erases between fibrous annulus and nucleus. (J.A. Buckwalter, 1995, Sinelnikov R.D., 2010)

4 Figure numbers of this review are corresponded to figure numbers at Kapandji A.I. 3d volume. (Kapandji A.I., Fisiología articular, Tronco y Raquis. vol. 3, 6th edicion, 2009, EKSMO Publ., 344 p, 539 figs.)

Histologically, nucleus consists of collagen fibers, chondrocyte-like cells and connective tissue. (Kapandji, 2009)

Intercellular matrix proteins are essential in cartilage strength and elasticity. The nucleus has such proteins as collagen fibers and proteoglycans. There are type I (70% of ID dry weight) and type II (20% of ID dry weight) collagen fiber there. Macromolecular proteoglycan complexes producing by chondrocytes environ collagen fibers. Proteoglycan main function is keeping water at intercellular matrix and providing water diffusion. Hyaluronic acid with polypeptide chains branching off it are the base of proteoglycan. And glycosaminoglycans are connected with polypeptide chains. There are 3 main type of glycosaminoglycans – chondroitin-6-sulfate (It is longer and mostly produced by young chondrocytes), chondroitin-4-sulfate (It is shorter and mostly produced by adult chondrocytes) and keratan sulfate. The last one part is lower relatively chondroitin sulfate, but ID has much more keratan sulfate than other hyaline cartilages (B. Johnstone et al., 1995). The longer chondroitin sulfate molecules, the more water are kept by proteoglycans (Ulumbecov E.G., 1997, Bycov V.L., 2001, Pezowicz CA et. all, 2005)Sulfate anions approach together then cartilage is under the pressure. It leads to pushing water form cartilage. But further pressure of sulfate is impossible because of their same negative charges. So this is itself stabilization. Keratan sulfate is able to form cross-links with collagen fibers and their glycoproteins. It helps to stabilize proteoglycans and provides uniform sulfate location.

Nucleus pulpous takes about 40% from ID square. And it takes over the most part of axial pressure.

Fibrous ring

Collagen fibers combines into collagen plates. There are 3 direction of collagen fibers- concentric, oblique and spiral. Fiber ends are connected with periosteum (Sinelnikov R.D., 2010). There are about 20–25 plates at fibrous ring (F. Marchand, AM. Ahmed, 1990). According to W.C. Horton they numbers from 10 to 25. Plate numbers run up 22–24 at front part of annulus and 8–10 at back part of one (A.A. Buruhin, 1983; K.L. Markolf, 1974).

Fibers lay upright at ring periphery (N.N. Sak, 1991, Kapandji, 2009). Central fibers contacting with nucleus lay almost horizontal. The elastic fibers lay radial. It helps to reduce ID form after moving (J. Yu et al., 2002).

Thickness of front plates up to 600 micrometers, and back plates up to 40 micrometers (N.N. Sak, 1991). The space between plates consists of undirected collagen and elastic fibers and intercellular matrix. So the nucleus is closed into unstretchable capsule composed of up and down vertebral laminas and fibrous ring. (Kapandji, 2009)

Vertebral lamina (terminal plate) is hyaline cartilage less 1 mm laying between vertebral body and ID. Collagen fibers lay in horizontal axis (S. Roberts et al., 1989).

ID blood supply

As said earlier, the nucleus is extremely hydrophilic. It is possible to consume water and give back it under the pressure. The cartilage over the nucleus has a lot of micro voids which provides water cycle (Kapandji, 2009). But the role of water-salt metabolism at this process is still unstudied.

Only peripheral plates of fibrous ring have blood vessels and nerves in normal (S. Roberts et al., 1995). Usually blood vessels are accompanied by nervers, but the last one may lay independent.

According to Tsivian Y.L. and Rayhinshtein V.H., ID trophism is provided by blood supply (peripheral plates of fibrous ring) and diffusion (vertebral body) till to 18–22 years old. After 23–25 years trophism is provided by only diffusion. This process reminds a pump. The water with metabolism products leave ID under compression and back there with nutrients after relaxation.

A vertebral body has blood supply from vertebral, intercostal, lumbar and iliac arteries and veins. They continue horizontal at front and lateral vertebral body surfaces (Sinelnikov R.D., 2008). There are powerful anastomosis within one vertebral segment, which connects with others (Baacke H., 1957)

Biomechanics

Nucleus pulposus approximates to spherical form under the pressure. So, it may be imagined like ball between two planes. Such type of joint has 10 gimbal freedom: 1) flexion and extension 2) lateral bending to each side 3) sagittal sliding 4) transversal sliding 5) right and left rotation.

Any applied force increases pressure inside nucleus. It leads to increasing a tension of fibrous ring. Then nucleus moving, the tension try to prevent it so the system stabilizes itself (Kapandji, 2009).

Research techniques

Ultrasound is the safest and cheapest way to study spine. It may investigate ID echogenicity, size and structure in theory. But it is almost impossible because of great number of obstacles for sound wave and subjective evaluation of data. That's why this method ineffective for the present.

Radial methods are the most accessible and informative. X-ray is the first one. But ID is not visualized on X-ray, and we can evaluate it indirectly.

Computed tomography(CT) visualizes ID structure, but it can't reveal minor changes or hydration degree. More than that, patient gets significant radiation dose when scanning, so it is not allowed to use CT often to evaluate ID condition.

Discography may be used only at special indications (oncology process etc.). Contrast medication is toxic and expensive, so we can't use this method for regular ID evaluation.

MRI is the most safe and informative because it allows visualize ID at axial, frontal and sagittal projection.

Conclusion

Although ID seems simple, it is complex structure from histological, biochemical, biomechanical points of view. And it requires further investigation to evaluate IDs role at spine morphogenesis process.

References

1. BELOUSOV L.V., Osnovy obshchej ehmbriologii [Rudiments of general embryology],Moscow, Nauka Publ.,2005, 367 p.
2. BURUHIN A.A. Morfologiya poyasnichnyh mezhpozvonkovyh diskov v period klinicheskoj manifestacii osteohondroza Kand. Diss.[lumbar intervertebral discs morphology at clinical manifestation of osteochondrosis, Ph.D. Diss], Novosibirsk, 1983, 219 p.
3. DUDIN M.G., PINCHUK D.Y. Idiopaticheskiy skolioz: diagnostika, patogenez[Idiopathic scoliosis: diagnosing and pathogenesis], Saint-Petersburg, Chelovek Publ., 2009, 336 p.
4. DUDIN M.G. Idiopaticheskiy skolioz: profilaktika, konservativnoe lechenie [Idiopathic scoliosis: prevention and conservative treatment]. Saint-Petersburg, Chelovek Publ., 2017, 224 p.
5. SAK N.N. Osobennosti i varianty stroeniya poyasnichnyh mezhpozvonochnyh diskov cheloveka [Features and anatomy types of human lumbar intervertebral discs], Arhiv anat.,gistol. i ehmbriol Publ., 1991. Vol. 100.,№4. pp. 74–85.
6. SINELNIKOV R.D, Atlas anatomii cheloveka [Atlas of human body], Moscow, Novaya Volna Pub., 2010, vol.1, 343 p.
7. BAACKE H.H. Veränderungen am venösen Gefäßsystem bei Osteochondrosis cervicalis, –1957
8. BUCKWALTER J.A. Aging and degeneration of the human intervertebral disc. Spine, 1995, vol. 20, №11, 1307 p.
9. KAPANDJI A.I., Fisiología articular, Tronco y Raquis. vol. 3, 6th edicion, 2009, EKSMO Publ., 344 p, 539 figs.)
10. MARCHAND F, AHMED AM, Investigation of the laminate structure of lumbar disc anulus fibrosus, USA, Spine, 1990, 15 p.
11. MARKOLF K.L., MORRIS J.M. The structural components of the intervertebral disc. A stady of their contributions to the ability of the disc to withstand compressive forces. J. Bone and Jt. Sugr., 1974, vol. 56A, №4, pp. 675–687.
12. ROBERTS S., MENAGE J., URBAN J. P., Biochemical and structural properties of the cartilage end-plate and its relation to the intervertebral disc. USA, Spine, 1989, 14 p.
13. STOKES I.A.F., BURWELL R.G., DANGERFIELD P.H., Biomechanical spinal growth modulation and progressive adolescent scoliosis – a test of the 'vicious cycle' pathogenetic hypothesis: Summary of an electronic focus group debate of the IBSE, Scoliosis,2006

ABSTRACT O PERSPECTIVE REVIEW ARTICLE

ELECTROPHYSIOLOGICAL ASPECTS OF PARASPINAL MUSCLE ACTIVITY IN CHILDREN 9–12 YEARS OLD WITHOUT SPINAL DEFORMITY

Nikitina Alexandra, Komantsev Vladimir, Dudin Mikhail
Children's Rehabilitation Center for Orthopedics and Traumatology 'Ogonyok', Saint-Petersburg, Russia
E-mail: ogonek@zdrav.spb.ru

Key words: EMG, Neuro-MVP-4' electromyograph, paraspinal muscle activity in children

Aim and objectives

The proper alignment of vertebral column (spine) or the formation of deformity is determined by the overall paraspinal muscle complex functioning, which, depending on a duration and level of tension in its structures is involved in the postural stereotype formation. The primary aim of this study was to investigate paraspinal muscles activities of children (9 to 12 years old) with proper spinal orientation in three axes to differentiate normal symmetrical muscle tension from abnormal muscle tension on one side of the body which is associated with a stable three-dimensional deformity of spine. Children of this age were selected in order to consider the concerning evidence of scoliotic deformation debut in this particular age group.

It has been commonly assumed that scoliotic deformity formation is caused by the inconsistency between osteal vertebral column growth and spinal cord neural tissue extension pace. It causes the osteal excess to move from the spinal cord axis. Quite naturally, spinal bone displacement requires stable paraspinal muscle tension on one side of the body. During the functional examination of muscle activities the tension was found in the deformed area. In order to interpret correctly the data obtained from the analysis we focused on the paraspinal muscles of children without postural disorders as no previous study of paraspinal muscles has given sufficient consideration of this issue.

The aim set by the study was to examine electromyogram tracing parameters, such as amplitude and frequency, with dual-channel recording of paraspinal muscles activity in lumbar region of spine (at L4–2 spinal segments levels) with symmetrical electrode placement at every recording level.

Materials and methods

The EMG of paraspinal muscles was recorded using 'Neuro-MVP-4' electromyograph with electrodes placed at a standard distance of 2 cm.

The EMG recording was carried out during the quiet standing test and the Adams's test. The recording was carried out simultaneously with two electrodes placed on both sides of osseous processes at L4 and L2 vertebrae levels, as topographically speaking, deep paraspinal muscles lie closest to the surface in this area and that allows to collect more information about muscles electric activity. Have been tested by clinical examination and computer optical topography 35 children (9 to 12 years old) with no evidence of postural disorders as tested during clinical examination and computer optical topography were included in the study.

In order to carry out a statistical analysis of paraspinal muscle activity, an asymmetry coefficient (AC) was introduced based on different parameters obtained during the EMG recording of muscles on left and right sides of the spine.

Results

Once bioelectrical data of spinal muscles activity obtained from healthy children was compared with the preliminary data of children with lumbar scoliosis, we received a verifiable asymmetry coefficient difference. As we can see from our research, paraspinal muscle activity of children without scoliotic deformity in a stable standing position resulted in asymmetry coefficient ranging considerably from 0.3–2.7 as for average amplitude and from 0.4–3.2 as for average frequency. The results were comparable with the EMG data of children with scoliotic deformity. This might be attributed to the fact that while standing, a child constantly trying to find the center of gravity to remain in a vertical position with paraspinal muscles being the key element of this function.

In addition, it is important to note that traditionally the EMG test of children with scoliosis is carried out during the «dorsal raise» exercise, which allows to register muscle activity produced by voluntary paraspinal muscle tension during spine extension with simultaneous chest and legs raise in the horizontal position. According to the results of our researches, this method also has it's drawbacks as an asymmetry in paraspinal muscle activity was registered in the bodies of children with proper body alignment on left and right sides. This can be because of the same reasons as during the test in standing position, in this test only the pubic bone of pelvis and front chest wall rest on the ground, causing voluntary tension in paraspinal muscles which acts as a key element in retaining balance. As a consequence, calculated asymmetry coefficient in this test is random and inconsistent.

What is more, we carried out the EMG test on spinal muscles in the horizontal position. The result of this non-invasive EMG test has showed that average amplitude was very low, which might not be an accurate representation of an actual functional state of muscles. In order to interpret the above mentioned test results correctly, a method was introduced to reduce the influence of background radiation, which interferes into data concerning actual state of muscles. To solve this problem, an EMG recording of non-biological objects and bone structure was carried out in order to record activity of «non-bioelectrical» origin.

As a result, it has been revealed that with average amplitude of the EMG curve reaching 7 mkV there is a high possibility of electrical noise interference, which results in «false» high average frequency (reaching 400–500 Hz), suggesting to set minimum value of average amplitude at 8 mkV to eliminate small amplitude values as background radiation.

These results have suggested to neglect small amplitude parameters in paraspinal muscle activity analysis during the EMG recording as being tested in horizontal position.

According to the results of bioelectrical paraspinal muscle activity research which was carried out in all of the above mentioned tests we got the high asymmetry coefficient or small amplitude muscle activity (not subjected to analysis), and then, we proceeded to the Adams's test, known as a major test in detecting scoliosis. The theoretical underpinning of this test was the fact that if patients with scoliotic deformity bend forward this deformity abnormally increases as a reponse to an increased tension of a "short" spinal cord connected to "long" vertebral column, which can be seen in paraspinal muscle tension on one side of the body. In other words, the Adams's test is a provocative test in assessing actual asymmetrical paraspinal tonus during the scoliotic deformity formation.

We divided the EMG parameters obtained during the Adams's test of children with scoliotic deformity (n=43) according to 2 scoliotic types: progressing scoliosis (n=14) and compensated scoliosis (n=29). **Table 1.**

Level	**Compensated type**				**Progressing type**			
	The Adams's test				**The Adams's test**			
	Amp (mkV)	AC (amp)	Freq (Hz)	AC (freq)	Amp (mkV)	AC (amp)	Freq (Hz)	AC (freq)
L2	28.1	0.9	324.8	0.8	26.3	1.3	255.2	2.5
L4	34.2	0.9	337.5	1.0	14.3	1.2	215.9	2.1

Table 1

The results seen in **Table 1** not only show difference in asymmetry coefficient between different scoliotic progression types, but also display considerably lower amplitude (up to 60%) and frequency (up to 40%) parameters as for children with progressing scoliosis compared to other participants of the same age.

In addition, during this research we compared the average EMG parameters among all the healthy children, following figures were calculated: average amplitude in the quiet standing position 20.7 mkV, average frequency in the quiet standing position 29.8 Hz, average amplitude in the Adams's test 52.9 mkV, average frequency in the Adams's test 475.5 Hz. These 2 tests showed that difference lies within 40–60% range, with the highest parameters found in the Adams's test. In other words, an extension with simultaneuos tension of paraspinal muscles as a response during the forward bending shows complete symmetry of the EMG parameters for spinal muscles activity. (**Table 2–5**).

9 years n=10	The stable standing position				The Adams's test			
Level	Amp (mkV)	AC (amp)	Freq (Hz)	AC (freq)	Amp (mkV)	AC (amp)	Freq (Hz)	AC (freq)
L2	24.5	1.1	325.1	1.1	48.7	1.0	405.3	1.0
L4	19.1	1.3	270.0	1.3	46.9	1.1	463.5	1.0

Table 2

10 years n=10	The stable standing position				The Adams's test			
Level	Amp (mkV)	AC (amp)	Freq (Hz)	AC (freq)	Amp (mkV)	AC (amp)	Freq (Hz)	AC (freq)
L2	26.5	1.1	430.6	1.1	58.6	1.0	501.2	1.0
L4	26.7	1.2	397.1	1.0	53.3	1.0	525.3	0.9

Table 3

11 years n=8	The stable standing position				The Adams's test			
Level	Amp (mkV)	AC (amp)	Freq (Hz)	AC (freq)	Amp (mkV)	AC (amp)	Freq (Hz)	AC (freq)
L2	18.7	1.0	181.1	1.0	64.7	1.0	468.6	1.0
L4	1.5	1.1	152.8	1.0	54.2	1.0	505.8	1.0

Table 4

12 years n=7	The stable standing position				The Adams's test			
Level	Amp (mkV)	AC (amp)	Freq (Hz)	AC (freq)	Amp (mkV)	AC (amp)	Freq (Hz)	AC (freq)
L2	24.9	1.0	345.1	1.1	64.0	1.0	484.6	1.0
L4	18.7	0.9	295.1	0.9	61.0	1.0	548.1	1.0

Table 5

So, these results may be taken to indicate normal muscular activity in lumbar region of the spine.

Conclusion

Considering all of the above, the Adams's test seems to be the most accurate test to record a paraspinal muscle activity as compared to other tests carried out.

Asymmetry coefficient analysis during the Adams's test in healthy children showed that normal parameters of asymmetry coefficient ranges from 0.9 to 1.1 by both parameters of the EMG curve (average amplitude and average frequency). Statistical analysis showed that the EMG data obtained from the recording of bioelectrical activity of paraspinal muscles in the lumbar region of the spine during the quiet standing test range significantly from 0.69 to 1.45 by amplitude and from 0.73 to 1.56 by frequency, which may be attributed to the retaining a vertical balance, providing a less stable factor than during the EMG recording in the Adams's test.

A non-invasive EMG method can be applied in the diagnostics of one-sided paraspinal muscle tension occurring in the process of scoliotic transformation.

ABSTRACT OF PERSPECTIVE ORIGINAL PAPER

STRUCTURAL ASYMMETRY OF LUMBAR VERTEBRAE AS A RISK FACTOR FOR THE DEVELOPMENTAL OF PARAVERTEBRAL MUSCLE DYSFUNCTION

Kolesnichenko Vera[1], Golka Gregory[2], Gresko Igor[3]

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

2 Kharkov National Medical University, Ukraine

3 Lviv National Medical University named after Danila Galitsky, Ukraine

E-mail: veakol@rambler.ru

Key words: lumbar vertebrae structural asymmetry, change in muscle interaction, motor control dysfunction.

Objective

To study the relationship between the lumbar vertebrae structural asymmetry and motor control dysfunction in patients with lumbar disc degeneration diseases.

Methods

The clinical and radiological study protocols of 30 asymptomatic volunteers (at the age of 20–30 years old, middle-age is 22.4±2.6 years) and 60 patients with lumbar degenerative disc disease (at the age of 20–40, middle-age is 33.4 years) served as the materials for this research. All the examined patients were male. 40 patients were observed in the Vertebrology Clinic of the Sytenko Institute of Spine and Joint Pathology. 20 patients were examined in the Traumatology Clinic of the Kharkov

Clinical Hospital for Emergency and First Medical Care named after professor A.I. Meshchaninov. We evaluated the mobility of the spine and hip joints, lumbar-pelvic rhythm, motor control tests for the flexor and extensor muscles of the lumbar-pelvic region.

On the lumbar spondylograms (view in the anterior-posterior and lateral projections, oblique projections in 3/4) and computer tomograms were determined on the three lower lumbar segments: (i) the R1 sign of asymmetry of the posterior support complex elements (the size asymmetry of the transverse and articular processes, the discrepancy between the size and shape of the articular facets, the anomaly of tropism, the spinous processes rotation) and (ii) the R2 sign of degeneration degree (subchondral sclerosis of the vertebral bodies and articular processes, their osteophytes, a decrease of the interbody spaces height, sagittalization of the facet joints).

Results and discussion

The trunk myofixation with predominance of flexion motion patterns was noted in patients with lumbar disc degeneration diseases in 81.7% of cases. A significant predominance of X-ray anatomical signs of R1 ($p < 0.001$) and R2 ($p < 0.001$) in patients compared with volunteers was established. In all the lumbar segments examined, was detected significantly more often the asymmetry of the articular processes ($p < 0.001$), the discongrugeness of articular facets ($p < 0.001$), the spinous processes rotation ($p < 0.01$) and the transverse processes asymmetry ($p < 0.05$) in patients with the motor control dysfunction of the muscles of the lumbar-pelvic region.

X-ray anatomical asymmetry of the posterior support complex elements (first of all, the asymmetric size of the articular and transverse processes, the spinous processes rotation – the sites of the beginning and attachment of the fibers of the multifdus muscles), accompanied by different length and tone of the right and left muscle bundles. This leads to a change in muscle interaction and potentiates the change in intersegmentary movements with a violation of functional lumbar-pelvic stability. An additional pathomechanical effect may exert asymmetry of the magnitude and tension of the spine short ligaments (capsular, inter- and supraspinous, intertransverse). This situation causes a violation of absorption of torsion loads and tensile loads, which perceives the intervertebral disc and articular capsule at vertical loads and movements of the spine.

ABSTRACT OF PERSPECTIVE REVIEW ARTICLE

GROWING SCOLIOTIC SPINE – LIMITS OF CONSERVATIVE TREATMENT AND INDICATION OF SURGICAL TREATMENT.

Martin Repko, Milan Filipovič
Orthopaedic Dpt., University Hospital Brno, Medical Faculty of Masaryk University Czech Republic
E-mail: repko@seznam.cz

Key words: scoliosis, bracing, surgery

The real scoliotic deformity is three-dimensional deformity in frontal sagittal and axial planes. Scoliotic deformity affects not only spine but it decreases functionality of respiratory, heart and digestive systems. Severity of deformity and remaining growth potential influence type of treatment.

Small deformities up to 20 degrees of Cobb angle are indicated to physiotherapy and observation. Mild deformities between 20 to 40 degrees are indicated to bracing. It is indication for surgical treatment if scoliotic deformity exceeds 40 degrees.

3D correction and spinal fusion are main principles utilized in adolescent deformities. We need to use specific surgical techniques while treated juvenile deformities with remain growth potentional. Usually we are using systems of growing rods. There are options of distractive systems or GGS (growth guided system). Both systems allow partial correction and they lead to remain of spinal growth.

Postponing of surgical treatment in serious scoliotic deformities leads to negative affection of spine itself as well as respiratory and other organ functions in adult age.

ABSTRACT OF PERSPECTIVE ORIGINAL PAPER

THE ROLE OF GROWTH GUIDANCE SYSTEMS IN SURGICAL TREATMENT OF EARLY ONSET SCOLIOSIS

Filipovic Milan[1,2], Repko Martin[1,2], Horak Jan[1,2], Leznar Milan[1,2], Prymek Martin[1,2]
1 Orthopaedic department, Faculty Hospital of Masaryk´s University Brno
2 Centre for Spinal Surgery, Faculty Hospital Brno
E-mail: Filipovic.Milan@fnbrno.cz

Key words: growth guidance system, early onset scoliosis, spinal growth, spondylodesis.

Introduction

Conservative treatment is the golden standard in treatment of iuvenile scolitic curves, but if the worsening deformity appear despite this, the surgery is necessary. Growing guidance system (GGS) represent an alternative to the traditional growing systems or anterior stapling and tethering used for the treatment of early onset scoliosis. We prefer GGS with the main aims to achieve a three-dimensional correction of the deformity with the limited continuous growth of the spine.

Methods

Our study retrospectively evaluates the results of surgical correction in a group of 45 patients treated by GGS technique. The evaluation of X-ray films with measurement of changes in cobb angle and clinical examination were the main evaluation methods. We evaluated also the growth of the spine measured in the thoracic and lumbar part separately, and the growth of the trunk as a whole in the mentioned range on X-ray pictures and advantages as well as disadvantages of this method and we refered to number and character of their specifical complications.

Results

In period between 2011–2018 the total number of 45 patients were treated with growth guidance systems. The group consisted of patients with idiopathic, neuromuscular and syndromic spine deformity with the average age of 8 years and 2 months at the time of the surgery. The average degree of deformity was 75° (45–150°) with an average correction percentage of 67%. The average range of instrumentations was 11 segments with the average fusion range 2,5 segments. The rate of number of complications was 9%.

After the first operation 11% elongation of the trunk (from 321 mm to 356 mm) was reached, the thoracic spine was elongated by 10% (from 196 to 217 mm) and the lumbar spine was elongated by 11% (from 125 to 139 mm). The elongation of the trunk by 16% (from 322 to 375 mm) was observed in the cohort of patients with two years postoperative follow-up (21 patients). The total protraction of the trunk by 21% (from 318 to 386 mm) was reached in patients treated by definitive fusion (10 patients).

Conclusions

The main advantages of guided growing systems were better correction of deformity (in comparison with growing rods), with partial three-dimensional correction, minimisation of inevitable reoperations under general anaesthesia and the possibility to quit a brace.

A negative aspect of this method is the abrasion of metal followed by metallosis.

Therefore we developed a new types of fixation screws enable more effective sliding of rods, maintenance of continuity of body grow by the shifting of rods as well as lower abrasion of the instrumentation.

ABSTRACT OF PERSPECTIVE REVIEW ARTICLE

PERTHES DISEASE, IRRITABLE HIP AND OTHER CAUSES OF A PAINFUL HIP

Michael Bellemore

Department of Orthopaedic Surgery The Children's Hospital at Westmead Sydney, Australia

Email: mbellemore@michaelbellemore.com.au

Keywords: hip joint, Perthes disease, transient sinovitis

Children often present to their primary care doctor or orthopaedic surgeon with a limp due to a hip disorder. Irritable hip or transient synovitis is the most common disorder usually occurring between 3–8 years. The etiology is unknown but it often appears 2 weeks after an upper respiratory viral infection. Because of the age range septic arthritis and Perthes disease need to be considered in the differential diagnosis. Transient synovitis is a benign self limiting disorder whereas septic arthritis is potentially destructive. Therefore, treatment of septic arthritis should be an orthopaedic emergency. Septic arthritis can usually be distinguished from transient synovitis based on history, examination and blood tests. Medical imaging in the form of x-ray, ultrasound or bone scans is not helpful in making an early diagnosis.

Perthes disease was first described by Arthur Legg, Jacque Calve and George Perthes in 1910. It is by definition idiopathic avascular necrosis of the femoral head in a child. Over the last 108 years our understanding of Perthes disease has progressed very little. The cause remains unknown. Coagulation disorders have been suggested as a cause but not substantiated. It is sporadic in most cases but there are a few reports of familial Perthes in the literature. It is bilateral in 10–20% of cases usually occurring in the 4–10 year age range. The bone age is usually delayed 2 years. Males are more commonly affected than female in ratio 5:1. It is more common in Caucasians than people of East Asian or Afro American descent.

Perthes disease usually evolves over a period of 4 to 5 years with the stages of Perthes disease well described by Waldenström.

The lateral Pillar (Herring) classification of Perthes disease is widely accepted because of inter observer reliability and prognostic value. However as a management tool its application is limited by the fact that it cannot be used until the completion of the fragmentation stage.

Treatment of Perthes may be non operative or operative. Non operative treatment includes restricted weight bearing, NSAI, bracing or bisphosphonate therapy. Operative treatment involves femoral varus osteotomy or pelvic osteotomy to improve containment.

The Stulberg classification based on residual femoral head deformity and joint congruity has clearly shown long term prognosis is based on these factors with spherical congruity leading to an excellent prognosis.

Herring's long term multicentre prospective study has shown that children with a bone age < 6 years (chronological age < 8 years) generally do well with non operative management and surgical intervention does not improve their prognosis. However the prognosis was improved by surgical intervention in some children with bone age > 6 years with lateral pillar classification: B or BC. Children with lateral pillar C tend to do poorly regardless of treatment.

In the young adolescent age range slipped capital femoral epiphysis (SCFE) should be considered as a diagnosis in patients who present with pain and a persistent limp. With the steadily increasing incidence of obesity in children in developed countries the incidence of SCFE is increasing and the age of onset is becoming earlier. The diagnosis is often delayed because 50% of children with SCFE present with knee or thigh pain.

References

1. P.C.COOK: Transient synovitis septic Hip and Legg-Calve-Perthes disease Pediatric Clin N Am 61 (2014) 1109-1118
2. MS KOCHER et al: Validation of a clinical prediction rule for the differentiation between septic arthritis and transient synovitis of the hip in children J Bone Joint Surg (AM) 2004 : 86 : 1629-35
3. J.A. HERRING et al: The Lateral pillar classification of Legg-Calve-Perthes J Pediatr Orthop 1992: 12 143–150
4. S.D. STULBERG et al: The Natural history of Legg-Calve-Perthes disease J Bone Joint Surg (AM) 1981 : 63 1095-1108

ABSTRACT OF PERSPECTIVE ORIGINAL PAPER

BOWLEG DEFORMITIES IN CHILDREN AND ADOLESCENTS. VARIOUS TREATMENT METHODS.

Karski Jacek, Wilczyński Michał, Karska Klaudia[1], Ostrowski Jerzy, Starobrat Grzegorz[2], Latalski Michał[2], Kałakucki Jarosław, Kandzierski Grzegorz

Paediatric Orthopaedic and Rehabilitation Department of Medical University of Lublin.
Head of the Department: Prof. Grzegorz Kandzierski MD PhD

1 Paediatric Radiology Department of of Medical University of Lublin
Head of the Department: Prof. Paweł Wieczorek MD PhD

2 Paediatric Orthopaedic Department of Medical University of Lublin
Head of the Department: Prof. Andrzej Gregosiewicz MD PhD

E-mail: jkarski@vp.pl

Key words: bowleg, Blount disease, varus deformation of the tibia

Introduction

The knee joint is a location of various pathologies. Some of them are related to the axis of the limb, which changes with age. In children up to the age of one the varus of the knee is physiological. In later years, the physiological valgus of the knee is dominating. At the age of 7 the axis should reach the normal value, which present in adults. Persistence of excessive valgus or varus (Blount Disease) can lead to overload changes and, with time can lead to osteoarthritis of the knee joint. It is necessary to obtain the right biomechanical axis as early as in childhood, in order to protect patients from knee pathology and the necessity of surgical procedures, especially knee replacement in the future. This paper presents various methods of non-operative and surgical correction of tibia deformity in children and adolescents.

Objective

The aim of the study is to evaluate the results of treatment of varus deformation of the tibia in children and adolescents with various non-operative and surgical methods. Indications of the appropriate method were analysed due to a number of factors, such as the age of the patient or the type of defect.

Material and methods

In the years 2014–2018 in the Paediatric Orthopaedic and Rehabilitation Department and in the Paediatric Orthopaedic Department, 90 children were treated due to a bowleg deformation. Surgical treatment was performed in 18 girls (28 operations) and 18 boys (30 operations). In 6 patients, only the right limb was operated, in the next 6 only the left; in 23 cases the defect required bilateral correction. In total 58 surgeries were performed. In 30 cases, the 8-plate method was used, in 15 – the Métaizeau method, with cannulated screws, in 10 – a palisadal osteotomy, using fibula grafts, and in 3 cases – the "Pudu" plate. The average age of patients differed depending on the performed kind of surgery.

Results

The results of the treatment were subjected to clinical and radiological evaluation including changes in the biomechanical axis of the limb and according to the American Knee Society score. In cases were the non-operative treatment was introduced too late or didn't show satisfactory results there occurred the need to perform the surgery. In those patients, 96.5% of cases good and very good results were obtained in the clinical and radiological assessment as well as in patient satisfaction. One boy, 15y, did not achieve sufficient correction due to earlier closure of the growth cartilages; later, osteotomy was performed. One patient needed peroneus nerve neurolysis.

Discussion

Varus of the tibia can cause overloading of the medial part of the knee joint, accompanied by pain and instability and is one of the causes of gonarthrosis in adults. A knee-saving treatment is the correction of the axis. At the developmental age, minimally invasive procedures are the most effective: the use of an 8-plate or a cannulated screw. After closing the growth zones, the correction of the axis can only be achieved by corrective osteotomy: tibia osteotomy with grafts or the use of Pudu plate. The advantage of Pudu method is that there is no need for immobilization in cast is necessary and there is no need to use the graft from the fibula. The results of the presented methods of surgical treatment encourage widespread use to avoid permanent damage to the knee joint in adulthood.

Conclusions

Treatment of the bowleg non-operative and surgical methods both are successful. In adolescents hemi-epiphyseodesis or osteotomy gives satisfactory results. The patient's qualification for the appropriate type of surgery depends on the age and the degree of patient's cartilage activity.

ABSTRACT OF PERSPECTIVE REVIEW ARTICLE

IS THE WAY OF SITTING IMPORTANT AT CHILDHOOD AND ADOLESCENT AGE?

Karski Jacek, Klaudia Karska[1], Tomasz Karski
Paediatric Orthopaedic and Rehabilitation Department of Medical University of Lublin
Head of the Department: Prof. Grzegorz Kandzierski MD PhD
1 Paediatric Radiology Department of Medical University of Lublin
Head of the Department: Prof. Paweł Wieczorek MD PhD
E-mail: jkarski@vp.pl

Key words: knock knee, bowleg, torsion of the tibia, pigeon walk

Introduction

Many children, adolescents and even adults habitually sit in a special way, with legs in shape of letter "W". This sitting position can be cause by various factors, like laxity, persistent DDH or others. With time, this pathological way of sitting can cause disorders of the hip, knee, shin and also foot. The way of sitting is important for development of the hips, axis of the legs and the torsion of calf and knee as well.

Objective

The aim of the study is the analysis of the way of sitting at childhood and adolescent age. Attempt to find the correlation of way of sitting with the presence of various pathologies.

Material and methods

In the years 2008–2018 in the Outpatients Clinic and in Paediatric Orthopaedic and Rehabilitation Department over 1000 Children were analysed. Clinical and radiological observations were made. We found correlations of pathological way of sitting with different abnormality due to the age, sex and body shape.

Results

The most common aetiology factor is multijoint laxity, which allows children to sit in this way. The other is too high value of antetorsion (AT) angle of the femoral neck connected with developmental dysplasia of the hips (DDH). The clinical status depending on the age, sex, presence of laxity and obesity shows different pathologic results like "pigeon" walk, valgus deformation of the knee, knee instability, hyperpressure of the patella syndrome and external torsion of the calf.

Discussion

The pathogenic impact of wrong way of siting (in "W" possition) can lead to different pathologies: in rotation of foot position at young children, knee problems and even external torsion of the calf in adolescents. Individuals with tibial torsion overload of the knee and are at an increased risk for developing of the hyperpressure of the patella syndrome and it may be predictive of anterior cruciate ligament injury. In our analysis we found similar observations. The "pigeon" walk at children and knee pain are the primary causes of visiting an orthopaedic office.

Conclusions

The way of sitting is important in development of children's bones and joints. "W" shape sitting can result in different pathologies depending on age, sex and body weight. It is important to pay attention to this problem. There are some people, even doctors who think that "W" sitting is a physiological variant of sitting and do not bring risk for abnormal further development of the children and adolescents. Our observations proved otherwise.

ABSTRACT OF PERSPECTIVE REVIEW ARTICLE

PHYSIOTHERAPY CORRECT AND INCORRECT IN PATIENTS FROM SANATORIUM OF DR JANUSZ KORCZAK IN KRASNOBRÓD IN PERIOD OF 1977–2018.

Karski Tomasz[1], Karski Jacek[2], Beata Slowinska[3], Bartosz Boryga[3], Karski Janusz[4], Żurakowski Wojciech[4]

1 Vincent Pol University in Lublin Poland

2 Medical University in Lublin, Poland

3 Military Hospital in Lublin, Rehabilitation Department

4 Sanatorium under the name of Dr Janusz Korczak in Krasnobród, Poland

E-mail: t.karski@neostrada.pl

Key words: Physiotherapy correct or incorrect. Stretching exercises. Hips. Knees. Shanks. Spine.

Introduction

The Pediatric Orthopedic and Rehabilitation Department of Medical University in Lublin cooperate with Sanatorium under the name of Dr Janusz Korczak in Krasnobród since 1977. Over a period of cooperation we could observe various kinds of illnesses and deformation of admitted children to Sanatorium and we noticed in anamnesis various methods of previous therapy – very often incorrect, giving no proper results.

Material

Ours observation are on basis of investigated group of 1330 children from the years 1977 to 2018. This group of children had the full history of the therapy stay in Sanatorium. The children were in age from 3 to 18 years. Patients were from all districts of Poland. Mostly diagnosis was: cerebral palsy, minimal brain dysfunctions cases, bad postures, femoral head necrosis (Perthes disease), dysplasia of hips, valgus deformity of knees, various deformations of feet, scoliosis, post injuries problems, general congenital disorders and others.

Methods of previous treatment

In many Medical Centres in Poland (north, south, west, east and central parts of the Poland) the therapy were often incorrect, unfortunately no leading to healing of child because it was based on wrong principles of treatment. Very often were used methods to "strengthened the muscle" instead to reduce the wrong position, shortening of soft tissues, even contracture or bad posture in region of shoulders, pelvis, hips, knees, feet, spine. Very often the main point of therapy was putting on physical therapy and not on kinesiotherapy what is in our opinion the special important.

Examples of problems of hips, knees, feet, spine

In the lecture we present examples of previous incorrect and in Sanatorium new and correct therapy. We inform about the results of Sanatorium's treatment of Perthes disease, hips dysplasia**,** slipped capital femoral epiphysis, valgus deformity of knees and feet, so-called idiopathic scoliosis and many others deformities and illnesses.

Discussion

Ours scientific program and methods of therapy stay in contrary to "educations / teaching program" in some Secondary and High Medical Schools in Lublin and Zamość (also in other towns in Poland). All teaching personal – physiotherapists and rehabilitations doctors – coming to work, to receiving the job in Sanatorium from this Schools needed the "reeducation".

Ours method of therapy we publish in USA, Canada, Czech Republic with full understanding of Teams of these Journals.

We present ours lectures for invited doctors from surroundings Medical Unites / Hospitals in Biłgoraj, Zamość, Tomaszów, Lubelski but – we see – the way to „full recognition" of new scientific knowledge is long. For example – teaching about so-called idiopathic scoliosis lasted 23 years and is not finished.

Conclusions

1. In orthopaedics, rehabilitation, physiotherapy there are important early, proper diagnosis and early, simple, understandable for patients, therapy. Surgery only in some very special and difficult cases.
2. The deformations and the wrong / incorrect function of locomotors system is mostly caused by contractures (shortenings) of muscles, tendons and capsules and not by "weak muscles".

3. In valgus, or plano – valgus feet deformities – important is to cure / delete the shortening of the muscles – triceps surae, Achilles tendon and pronators – m. peroneus longus and m. peroneus brevis.
4. In valgus deformity of the knees important is early prophylaxis – forbidden to sit in "TV position" (German – Najadensitz).
5. In hip problems – important prophylaxis of hip dysplasia in children and adults – prophylaxis of "imperfect hips".
6. For adult patients following recommendations are very important:
   a. proper standing – in abduction and in internal rotation of the hips,
   b. sitting in internal rotation of the hips,
   c. walking with the legs slight apart,
   d. sleeping in prone position with the hip in flexion and abduction.
7. In anterior tilt of pelvis and hyperlordosis of lumbar spine – important is to reduce the flexion's contracture of hips due to stretching exercises of flexors of the hips, typical for karate, taekwondo, aikido, yoga.
8. In prophylaxis of the so-called idiopathic scoliosis important is to remember never stand 'at ease' on the right leg, sitting relax, sleeping in embryo position and from 4th years of life active participate in sport – like karate, taekwondo, aikido, kung fu and yoga.

Literature

see www.ortopedia.karski.lublin.pl

ABSTRACT

PROBLEMS OF ANKLE JOINT, KNEE AND IN SOME CASES OF HIPS CAUSED BY ROTATION DISTORTION IN DAILY ACTIVITY

Karski Tomasz[1], Karski Jacek[2], Domagala Marian[3], Kowalska Magdalena[3]
1 Vincent Pol University in Lublin Poland
2 Medical University in Lublin, Poland
3 Medical Centrum in Laszczów near to Tomaszów Lubelski
E-mail: t.karski@neostrada.pl

Key words: Distortion of Ankle Joint and Knee. Prophylaxis.

Introduction

From 2012 we observed (T. Karski, J. Karski & others authors) new problem of foot – namely "the insufficiency and pain syndrome of ankle joint". In next year observations we found in these patients also the problem of the knees. We found that this "new pain syndrome" is connected with getting out from the car. It is when the patients had to use for personal transport the small cars. The going out from the car on the one leg made rotation movement of the body, distortion of the ankle joint, knee joint and hip if this hip joint is affected by arthrosis and appear limitation of movements.

Material

We treated in period of 8 years, 31 patients (n=31) with chronic insufficiency due to the distortion of the ankle joint leading to limitation of dorsal flexion of the foot and pain syndrome and many persons (circa 50). These patients suffered because of the knee pain and hips pain connected also with the using of small car.

This pathology is seen on the left knee joint, left ankle joint of car drivers or on the right knee and ankle joints of passengers. This describing "pain syndromes" is a new problem, which we published in last two years in USA and in Czech Republic.

Feet problems of adults

Since 2012 we see the problem of ankle joint insufficiency connected with improper going out from the car.

In literature we can find the descriptions of instability of the ankle joint, but not connected with the going out from the cars. We describe such syndrome among drivers using mostly small cars. In patients we noticed limited movement of dorsal flexion of the foot, pain, swelling, gait restriction. In many patients the illnesses lasted 3 or 5 years, because the diagnosis was not correct and the therapy was not proper.

Knee

The problem appears by going out from the car on one leg – left by driver – or right by passenger. The rotation movement of knee, during going out from the car is "the movement with distortion". Especially frequent these distortions are coming among the people if they drive, every day, many months or even years. Among our patients with knee insufficiency, such distortions causes were in about 30% of all cases.

Hip

In cases of coxarthrosis we notice the limitation of abduction, of extension and what is deciding – internal rotation movement. When start to be osteoarthritis of the hip joint – and there are limited movements – mostly internal rotation – the patient feels pain and difficulties to go in to the car or go out from the car. The pain appears also in many others situations.

Treatment

We precisely discussed the anamnesis and examined the joints – hips, knees and ankle joints – at all our patients with special attention for possible coxarthrosis. We informed the patients to avoid rotation movement during going out from the car or in other similar home or job activities. In therapy we recommended to get out from the car on both legs and both feet (pictures). Extension isometric exercises are important for knee as well active dorsal and plantar flexion of the foot. Additionally, very beneficial are laser, diadynamic therapy, iontophoresis, local cryotherapy.

Discussion

Patients complying of pain in one knee, on in one foot should be analyzed also in context of "using the small cars and manner of getting off the car" (figures). The authors described a group of patients with chronic pain caused by permanent distortion of knee or ankle joint. The problem more seldom appears in the hip – only in such person, who has limited rotation movement because of coxarthrosis. In the knee, in every case we find the instability because of lateral or medial loosening of ligaments, sometimes loosening of ligament cruciatum. In patients with feet problems we noticed the instability of ankle joint, swollen foot, limited dorsal flexion and pain during gait.

Conclusions

1. We described a new pathology syndrome of the ankle joint, knee and sometimes in hips – the chronic distortion caused by rotation movement made during going out from the car.
2. The problem affects the left foot and left knee of driver and right foot and right knee of passenger in countries with "right traffic rules".
3. In the therapy we advise a proper way of getting off the car – on both legs and both feet without any rotation movement of the trunk. Additionally, we advice kinesiotherapy, massage in water, laser, diadynamic.
4. With this problem should be familiarized all orthopedic surgeons, rehabilitation doctors and physiotherapists – and they should introduce the prophylaxis rules in all countries.

Literature

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ABSTRACT OF PERSPECTIVE ORIGINAL PAPER

KNEE PROBLEMS – INSTABILITY. CAUSES. SYMPTOMS. PROPHYLACTICS.

Karski Jacek[1], Karski Tomasz[2], Pyrc Jarosław[3]
1 Medical University in Lublin, Poland
2 Vincent Pol University in Lublin, Poland
3 Medical Department in Technical University in Dresden, Germany
E-mail: jkarski@vp.pl or t.karski@neostrada.pl

Key words: Permanent distortion Syndrome of Knee. Causes. Therapy.

Introduction

Hip joint, knee joint and ankle joint are common locations of dysfunctions due to congenital, post-traumatic or chronic overloading reasons. We found that in some patients with the knee problems, the cause was improper sitting position. Before our consultation these patients were in treatment but the therapy was in many cases without any success.

General description of the knee problems

The following are the reasons of knee pathology:
a. valgus deformity of the knee with following instability,
b. varus deformity of the knee with following instability,
c. flexion contracture of knee joint,
d. overextension / recurvation of knee joint,
e. pathology of patello – femoral joint – lateral position of the patella, subluxation of patella, syndrome of overstress.

In general, it is known that knee insufficiency with or without pain can be caused by common known incorrect axis of knee – varus or valgus – and next instability but also – according our present knowledge – because of permanent incorrect position of the hip and knee joint during sitting.

Patients and clinical observations

In our observations from 2012 to 2015 were 35 patients (N – 35) reporting pain of the knee. The age of our patients was from 15 years to 70 years. We found that it was connected with the manner of incorrect sitting on daily habit. This problem mainly refers to girls or women who sit in maximal internal or external rotation of the hip and maximal flexion of the knee of one a leg.

Clinical reports

The patients informed about pain appearing in many situations – at home and at job, while walking on the street, while using the stairs. The location of the pain was mostly in the lateral or medial region of the knee, or under the patella.

The patients had difficulties with standing up, standing longer time on the street, while changing the direction of gait on the street, if a twist was required, getting up from the bed in the morning and in other situations. The clinical examination showed a full extension of the knee, full flexion, no fluid in the joint. Nevertheless, they were symptoms of the lateral instability and frequent rotation instability caused by the loosening of medial or lateral ligament or loosening of ligament cruciatum of the affected knee. The deciding and important in examination was the observation that was not proper way of movement from flexion to extension of the knee. This phenomenon we have seen specially in the end phase of extension. The movement was not all the time in sagittal plane but with "rotation movement" or "valgus movement" in end phase of the extension. This phenomenon was deciding in "discovering of this new problem". A precise examination with long anamnesis found that the cause of knee problems was the improper sitting for many hours, days, months or even years (in lecture will be presented many cases of this improper sitting).

Therapy

After observations and many examinations of patients in the years 2012 – 2018 we found that, this improper sitting position can be the cause of knee instability, insufficiency and pain – so we recommended in all such cases "proper sitting position" as constant position. In therapy we advise not only to sit in proper position, but we also advice the extension exercises for knee to receive better stabilization of knee joint. We advice also the thermotherapy, laser, diadynamic, iontophoresis, cryotherapy. In all cases we received the good results – no pain, proper walking for every distance.

Conclusions

1. The pain problem of the knee can be caused by valgus or varus deformity and following instability, by knee contracture, by knee recurvation, by patello – femoral joint problems – subluxation, lateral overstress.
2. The pain syndromes of the knee can be caused also by habit of improper sitting over months or years – and subsequently instability of the knee joint.
3. The habit of improper sitting occurrence in individuals with laxity of joints, in persons with primary symptoms of Minimal Brain Dysfunction (MBD).
4. The main aim for every doctor, in early period of child's life, is the therapy of the varus deformity of shank, of the valgus deformity of knee, recurvation of knee and contracture of the knee.
5. We should inform young and older patients about proper sitting position, about standing, walking and sleeping position. Thanks to these easy recommendations we can prevent many of illnesses and deformations in locomotors system in children, adolescents and adults.

Literature

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ABSTRACT

SURGERY OF METACARPAL APLASIA

Smrcka Vaclav[1,2], Mařík Ivo[3], Kuželka Vítězslav[4], Dick David[2], Bejvlová Jarmila[2]
1 Institute for History of Medicine and Foreign Languages & Department of Plastic Surgery, 1st Faculty of Medicine, Charles University in Prague, Bulovka Hospital, Czech Republic
2 ESME l.l.c., Prague, Czech Republic
3 Centre for Defects of locomotor apparatus l.l.c, Prague, Czech Republic
4 Anthropological Department of National Museum, Prague, Czech Republic
E-mail: sedlcany1@seznam.cz

Key words: metacarpal aplasia, model of splinting, bone graft

Congenital anomalies of the hand originate during ontogenesis through defects in signalling, gene knock-outs, Hox 9–11 or 9–13, and through mutation. Metacarpal hypoplasia or aplasia may arise from teratogenic insult in the stage of finger radiation. The model, showing how metacarpals can be splinted with growth zone is presented. Splinting can be performed at any age and finger growth is not impeded.

ABSTRACT OF PERSPECTIVE ORIGINAL PAPER

DUPUYTREN DISEASE IN THE CZECH POPULATION IN THE 20TH CENTURY

Smrčka Václav[1,2], Rástočný Štefan[2], Marek Karel[2], Dick David[2], Bejvlová Jarmila[2]
1 Institute for History of Medicine and Foreign Languages & Department of Plastic Surgery, 1st Faculty of Medicine, Charles University in Prague, Bulovka Hospital, Czech Republic
2 ESME l.l.c., Prague, Czech Republic, ESME, Prague
E-mail: sedlcany1@seznam.cz

Key words: Incidence of Dupuytren's disease, disease progression, population approach

Our aim is to characterise the changes of Dupuytren's disease in the Czech population during the 20th and 21st century. Patients, operated on between 1989 and 1999 (N=75), were compared with a reference group operated on by Karfík (N=123) from 1949. Dupuytren's disease is a fibrosing condition affecting the connective tissue of the hand. Karfik's simple clinical classification divided individuals with Dupuytren's disease into three types. Fifty years later, our data shows a 4 times higher occurrence among women. The ulnar type of Dupuytren's disease remained dominant in the second half of the 20th century and the incidence of radial type remained unchanged at 3%. It is important to recognised the relationship between Dupuytren's disease, carpal compression, trigger finger, and to emphasise that Dupuytren's disease has its own development and dynamics, which must be considered to select an appropriate treatment plan.

ABSTRACT OF PERSPECTIVE ORIGINAL PAPER

CHARACTERISTICS OF THE TIBIOFEMORAL ANGLE, REARFOOT ANGLE AND PLANTAR ARCH IN HEALTHY CHILDREN AGED 6 TO 15 YEARS

Petrasova Sarka[1], Morvova Zuzana[1,4], Zemkova Daniela[1,2], Marik Ivo[1,3]
1 Ambulant Centre for Defects of Locomotor Apparatus l.l.c.; Prague; Czech Republic
2 Dept. of Paediatrics; University Hospital Motol; Prague; Czech Republic
3 Faculty of Health Care Studies, West Bohemia University; Pilsen, Czech Republic
4 Faculty of Science, Department of anthropology and human genetics, Charles University, Prague
E-mail: SarkaPetrasova@seznam.cz

Key words: tibiofemoral angle, rearfoot angle, podogram, foot arch, varosity, valgosity

Introduction

The aim of this work was to create reference data, to determine the variability of rearfoot angle for the use in orthopaedic practice and to evaluate the age variations of rearfoot angle from 6 to 15 years. We further focused on the relationship between tibiofemoral angle, rearfoot angle, and height of the foot arch. Finally, we examined the dependence of tibiofemoral angle, rearfoot angle and foot arch on BMI and body height, both in absolute values and SD score.

Material

We measured 120 healthy school children aged 6 to 14,99 years. Based on the chronological age the children were divided into three age categories: 6–8,99 years, 9–10,99 years and 11–14,99 years. The data were collected from March to November 2017 at three selected primary schools in Prague and Rudná, with the approval of the headquarters of those primary schools and of parents.

Methods

Methods included anthropometric measurement (height, sitting height, weight), making of static footprints of both feet on paper by a plantograph, and taking photographs of lower limbs to measure tibiofemoral angle and rearfoot angle. The foot arch height was calculated using the Chippaux-Šmiřák index. Anthropometric points for tibiofemoral angle and rearfoot angle were marked on probands with a thin marker and then measured by a protractor from photographs. Each photograph was taken under predefined, constant conditions.

Results and conclusion

The rearfoot angle did not change significantly from 6 to 15 years of age and it did not differ between boys and girls, neither in the whole file, nor in the three age cathegories. The mean rearfoot angle was 5.47°±3.44° for the right lower limb, 5.97°±3.81° for the left lower limb. We did not find clinically significant correlations between tibiofemoral angle, rearfoot angle and foot arch height. A statistically significant relationship with BMI was found only with left rearfoot angle of left foot arch height, however neither of them was clinically significant. As the body height (in SD score) increased, rearfoot angle decreased significantly.

ABSTRACT OF PERSPECTIVE ORIGINAL PAPER

GROWTH DATA OF CZECH ACHONDROPLASIA PATIENTS

Zemkova Daniela[1,3], Anyzova Tereza[3,4], Mariková Alena[2], Marik Ivo[2,3]
1 Dept. of Paediatrics; University Hospital Motol; Prague; Czech Republic
2 Faculty of Health Care Studies, West Bohemia University; Pilsen, Czech Republic
3 Ambulant Centre for Defects of Locomotor Apparatus l.l.c.; Prague; Czech Republic
4 Faculty of Science, Department of anthropology and human genetics, Charles University, Prague
E-mail: dezem@email.cz

Key words: achondroplasia, growth charts, prediction of final height

Introduction

Achondroplasia is the most common short limbed bone dysplasia affecting endochondral ossification. It is caused by gain of function mutation in the FGFR3 gene. Contemporary fast technological development led to better understanding of the processes on the epiphyseal growth plate and enabled development of new drugs for the treatment of this disorder (modified recombinant C-type natriuretic peptide, soluble FGFR3, meclizine). Nevertheless, the treatment still remains symptomatic. In this condition it is very important to know the growth pattern of children not influenced by any growth promoting treatment.

Aims, patients and methods

The aim of our study was to evaluate the growth of body height and individual body segments of Czech patients with achondroplasia, compare our data with the world-wide used growth charts by Horton et al. (1978) and recent data by Pino et al. 2018. Another goal was to verify accuracy of the multiplier method by Paley et al. 2005 in Czech patients with achondroplasia. Our group consists of 79 patients (49 boys, 30 girls) followed-up in Ambulant centre for defects of locomotor apparatus and of 3 adult men and 3 women without available anamnestic data. Unfortunately, the data of 22 patients after growth promoting therapy (12 m + 5 f lengthening of legs, 1 + 1 growth hormone, 2 + 1 both) could not be included in the study. Therefore, only 9 patients (5 male, 4 female) have complete data from childhood to adulthood. Mean values in the intervals comparable with Horton´s cohort were calculated on the basis of estimated by the model of linear regression. Comparison with Horton´s data was performed on the basis of confidence intervals.

Results

The growth curve of Czech boys with achondroplasia does not significantly differ from that of Horton (1978). In girls older than 11 years body height is significantly lower than in Horton´s study. The same trend is also noticeable in boys. Differences in adult height are not significant. On the other hand, no significant differences were found in comparison of the lower and upper body segment separately. No significant differences were found between our and Argentinian study by Del Pino (2018). We found clinically significant differences between final height and body height predicted by multiplier method by Paley et al 2005 in most patients.

Conclusions

Growth data of Czech patients with achondroplasia are comparable with the foreign more representative achondroplasia cohorts. We prefer the graphical method of prediction by means of growth charts which enables to take the whole growth curve of the patient and its trends together with clinical examination into account. Prediction of lower extremities growth by multiplier method can be used carefully with correction to bone age and sexual maturation.

References

1. HORTON, William A., Jerome I. ROTTER, David L. RIMOIN, Charles I. SCOTT a Judith G. HALL, 1978. Standard growth curves for achondroplasia. *The Journal of Pediatrics*. **93**(3).
2. PALEY, Dror, Alexander L MATZ, David B KURLAND, Bradley M LAMM a John E HERZENBERG, 2005. Multiplier Method for Prediction of Adult Height in Patients with Achondroplasia. *Journal of Pediatric Orthopaedics*. **25**(4), 539–542.
3. DEL PINO, M., R. RAMOS MEJÍA a V. FANO, 2018. Leg length, sitting height, and body proportions references for achondroplasia: New tools for monitoring growth. *American Journal of Medical Genetics, Part A* [online]. [cit. 2018-03-04].

ABSTRACT OF PERSPECTIVE ORIGINAL PAPER

THE PECULIARITIES OF SURGICAL TREATMENT OF BENIGN BONE NEOPLASMS IN GROWING PATIENTS

Shpileuski Igor, Sakalouski Aleh
Belarusian Research Centre of Traumatology and Orthopedics, Minsk, Belarus
E-mail: ihar760@gmail.com

Key words: benign bone neoplasms, surgical treatment, growing patients

The basic method of treatment of benign tumors and tumor-like lesions is surgical. Its gist is the excision of pathological tissues within the limits of unaffected ones. But in growing patients the possibilities of surgery are limited – the high risk of iatrogenic damaging of growth plate exists. And, because of this complication, shortening and/or axial deformities of the extremities may form.

Materials and Methods

We have performed a retrospective study in 383 cases of bone benign neoplasms surgery in patients aged 3–18 years: upper extremities – 120 (humerus – 83, ulna – 18, radius – 19) and lower ones – 263 (femur – 150, tibia – 113). All the patients were treated in our department in 2000–2010. The shortening and/or axial deformities were registered in 57 cases (14,9%): upper extremities – 16; 13,3% (humerus – 10; 12,0%, ulna – 3; 16,7%, radius – 3; 15,8%) and lower – 41; 17,4% (femur – 23; 15,3%, tibia – 18; 15,9%). The most frequently this complication took place in cases of Ollier disease (38,1%), multiple osteochondromas (33,3%), giant cell tumor (28,6%) and bone cysts (10,1%).

We analyzed the details of surgery tactics and technique, payed a special attention to methods of prevention of growth plate damaging and to ways of correction of bones shortening and/or their axial deformities.

Results

The analysis of pre-op and post-op status of adjacent growth plate showed, that pre-operatively there were no any shortening and/or axial deformities of the affected bone in 6 cases (all – osteochondromas), and in 10 – the value of deformities significantly increased after surgery (Ollier disease – 2, giant cell tumor – 2, bone cysts – 6). So, in these 16 patients (28,1%) the deformities were recognized as iatrogenic, and in other 41 (71,9%) – because of neoplasm influence on growth plate.

In the theory, the partial damage of growth plate must cause an axial deformity of the bone, the total and uniform one – only to the shortening, the total and irregular – to combined (shortening and axial) deformity. In all our cases there were only one type of deformity – combined one (the shortening dominated in 9 cases).

Three types of bone resection were performed: segmental, intra-lesion (extended excochleation) and marginal ones. The segmental resections were used in cases of subtotal bone involvement and high risk of neoplasm recurrent: giant cell tumor (2 cases), aneurismal bone cyst (4) and Ollier disease (7). The marginal resections were performed only in cases of osteochondromas (6); at other cases of intraosseous neoplasms (Ollier disease, bone cysts and so on) the extended excochleation was performed. The technique of all types of resections was conventional.

The registered level of bone shortening in all cases was 1–4 cm (2,7±0,4), axial deformity – 10-60° (26,8±4,2). The shortening of humerus didn't influence on its function, axial deformities decreased the level of abduction, but it didn't obstruct the possibilities of daily activities. The shortenings of ulna or radius, as well as their axial deformities, leaded to clubhand, but in the most of cases didn't obstruct the possibilities of daily activities too. So, almost all deformities of upper extremities were cosmetic. The shortening and axial deformities of lower extremities (femur and tibia) practically had no influence on the volume and range of movements in hip, knee and ankle joints, but they caused limping and compensatory scoliosis.

The indications for surgical correction of the deformities of bones of upper extremities were: shortening more than 2,5 cm, rigid clubhand more than 30° or a deviation of humerus head more than 45°. The elongations (and an axial correction, if necessary) of humerus were performed using the Ilisarov device and technology; corrections of interdependence of ulna and radius – with different combinations of shortening and extending osteotomies with AO plate osteosynthesis.

The indications for surgical correction of the deformities of bones of lower extremities were: shortening more than 1,5 cm and malalignment of biomechanical axes (according D.Paley). In cases of shortening less than 1,5 cm we recommended an orthopedic footwear; when shortening was more than 1,5 cm, we used the Ilisarov device and technology (with an axial correction, if necessary). In patients with sufficient growth potential we preferred to use temporary growth plate stapling (symmetric or asymmetric). And in patients with shortening more than 3,5-4 cm, who had sufficient growth potential, we used the combined surgery – the Ilisarov method and stapling in one step.

As a result, in 19 cases the deformities were rated as permissible, and no any surgical interventions were performed. In other 38 cases (66,7%) one of the described above methods was used.

Discussion

Thus, about 10% of benign bone neoplasms lead to disturbances of adjacent growth plate, bone shortening and axial deformation; and about 30% of them are iatrogenic. All these deformities (almost in 70% cases) require operative correction.

The negative consequences of these complications may be prevented by dint of their early diagnostics and timely correction. In several cases some well-known low-traumatic surgical techniques may be used (for example, such as intra-lesion injections of steroids or doxycycline in cases of bone cysts, such as a rejection of thermal ablation near growth plate during surgery and so on), even if they may increase the level of partial recurrence of neoplasm. Also, the temporary rejection of surgical treatment may be recommended in cases of low-symptomatic, small size and low-growing neoplasms, when the risk of surgery is significantly more, than the risks of its rejection. In all these cases patients must be observed by orthopedist not less often then 3–4 times in a year.

ABSTRACT OF A PERSPECTIVE CASE REPORT

SUBTYPES OF ENCHONDROMATOSIS: CASE REPORTS

Marik Ivo[1,2,4], Hudaková Olga[2], Marikova Alena[2], Zemkova Daniela[2,3], Myslivec Radek[2,4], Kozlowski Kazimierz[5]

1 Faculty of Health Care Studies, West Bohemia University; Pilsen, Czech Republic

2 Ambulant Centre for Defects of Locomotor Apparatus l.l.c.; Prague; Czech Republic

3 Dept. of Paediatrics; University Hospital Motol; Prague; Czech Republic

4 Orthopaedic and Traumatology Department, Hospital Pribram, Czech Republic

5 Dept. of Medical Imaging, Children's Hospital at Westmead, Sydney, Australia

E-mail: ambul_centrum@volny.cz

Key words: enchondromatosis, Ollier disease, metachondromatosis, genochondromatosis type II, severe limb deformities

The case reports demonstrate typical limb deformities and structural bone changes of patients suffering from Ollier disease, metachondromatosis and genochondromatosis, type II. Surgical treatment of biomechanically severe bone deformities is presented in case with Ollier disease and two cases with metachondromatosis.

According to Nosology and classification of genetic skeletal disorders: 2015 revision Ollier disease, metachondromatosis and genochondromatosis belong to the 29th group called "Disorganized development of skeletal components group".

Introduction

Ollier disease (enchondromatosis Spranger type I), most common subtype, first described in 1889, is defined by the presence of multiple enchondromas with asymmetric distribution. There is large clinical variability with respect to size, number, location, age of onset, and requirement of surgery. Lesions are usually distributed unilaterally and may involve the entire skeleton and cause progressive severe deformities of extremities during growth, although the skull and vertebral bodies are very rarely involved. Authors show long term comprehensive treatment with the aim to restore biomechanical axis and the length of legs.

Metachondromatosis and genochondromatosis are extremely rare, both are hereditary by autosomal dominant transmission and malignant transformation has not been reported in the literature.

Metachondromatosis (enchondromatosis Spranger type III) involves multiple, often striated enchondromatous lesions in the long bones, along the iliac crests and particularly in the short tubular bones where they are characteristically associated with exostoses pointing toward the adjacent joint causing angular deformities of hand fingers. The lesions may regress.

Genochondromatosis (enchondromatosis Spranger type IV) is characterized by small well defined symmetrical lesions – enchondromas – of the upper end of humerus, the knee region, the clavicles (these are not affected in type II), and the hands and feet. The lesions in genochondromatosis do not produce secondary deformities and may regress.

Cases

Authors show typical clinical and anthropological findings, radiographic features, additional tests (markers of bone turnover, MRI, bone scintigraphy, etc.) and treatment options of presented patients affected by these rare diseases.

The authors have also experience with comprehensive treatment of another patients suffering with Ollier disease, Maffuci syndrome and Cheirospondyloenchondromatosis. These adult patients are under follow up of orthopaedic surgeon specialized in oncology.

Conclusion

We observed typical biomechanically severe deformities of one leg in two patients with Ollier disease, typical finger deformities of two patients with metachondromatosis and obvious structural humeral and tibial changes in a female with genochondromatosis, type 2.

The deformities as well as malignant progression of enchondromas may require multiple surgical interventions in young adults.

The patients should be familiarised with features of malignant growth (unexpected enlarging of enchondromas, localized and increasing pains). Taken samples of growing tumours must be histologically investigated (atypical cells, chondrosarcoma grade I – III).

For a long time, the enchondromas have been considered to be developmental disorders caused by the failure of normal endochondral bone formation. PTHLH signaling is active in solitary enchondromas and in chondrosarcomas. PTH1R mutations have been identified in ~10% of Ollier patients. PTH1R is a receptor for parathyroid hormone and for parathyroid hormone-related peptide which acts in a negative feedback loop with Indian Hedgehog (IHH) regulating normal endochondral bone formation. One can therefore speculate that the gene(s) causing the different enchondromatosis subtypes are involved in hedgehog/PTH1R growth plate signaling. Adequate distinction within future studies will shed light on whether these subtypes are different ends of a spectrum caused by a single gene, or that they represent true different diseases.

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References

1. BONAFE L, CORMIER-DAIRE V, HALL C, LACHMAN R, MORTIER G, MUNDLOS S, NISHIMURA G, SANGIORGI L, SAVARIRAYAN R, SILLENCE D, SPRANGER J, SUPERTI-FURGA A, WARMAN M, UNGER S. 2015. Nosology and classification of genetic skeletal disorders: 2015 revision. Am J Med Genet Part A 9999A: p. 1–24.
2. COUVINEAU A, WOUTERS V, BERTRAND G, ROUYER C, GÉRARD B, BOON LM. PTHR1 mutations associated with Ollier disease result in receptor loss of function. Hum Mol Gen, 17, 2008 Jun, č. 18, p. 2766–2775.
3. IGNYS A, KRAJEWSKA-WALASEK M, MARIKOVA O, MARIK I, KOZLOWSKI K. Cheirospondyloenchondromatosis. Magyar Radiologia 77, 2003, 4: p. 162–68
4. KOWALSKA A, KOZLOWSKI K. Localised enchondromatosis. Pohybové ústrojí, 18, 2011, No. 1 – 2, p. 65 – 68.
5. KOZLOWSKI K, JARRETT J. Genochondromatosis II. Pediatr Radiol 1992; 22: 593–5.
6. MAŘÍK I, ŠORMOVÁ L, POVÝŠIL C, ZEMKOVÁ D, KUKLÍK M. Enchondromatóza a Maffuciho syndrom – diagnostika a symptomatické léčení závažných deformit DK – in Czech. Pohybové *ústrojí*, 19, 2012, č. 4–3, p. 255–239.
7. PANSURIYA TC, KROON HM, BOVÉE JVMG. Enchondromatosis: insights on the different subtypes. Int J Clin Exp Pathol, 3, 2010 Jun, č. 6, s. 557–569.
8. ROZEMAN LB, SANGIORGI L, BRUIJN IH, MAINIL-VARLET P, BERTONI F, CLETON-JANSEN AM, HOGENDOORN PC, BOVÉE JVMG. Enchondromatosis (Ollier disease, Maffucci syndrome) is not caused by the PTHR1 mutation p.R150C. Hum Mutat 2004; 24: p. 466–73.
9. Shapiro F. Ollier's Disease. An assessment of angular deformity, shortening, and pathological fracture in twenty--one patients. J Bone Joint Surg Am 1982; 64: p. 95–103.
10. SPRANGER JW, BRILL PW, POZNANSKI A. Genochondromatosis. In: Bone Dysplasias. An Atlas of Genetic Disorders of Skeletal Developement, 2nd Ed. Oxford, New York: Oxford University Press, 2002, p. 558–559.
11. WATANABE K, TSUCHIYA H, SAKURAKICHI K, YAMASHIRO T, MATSUBARA H, TOMITA K. Treatment of lower limb deformities and limb-length discrepancies with the external fixator in Ollier's disease. J Orthop Sci 2007; 12: p. 471–5.

ABSTRACT

INDICATION-RELATED STRATEGY FOR ORTHOTIC AIDS APPLIED TO UPPER EXTREMITIES AFFECTED BY A NEUROMUSCULAR DISEASE

Musil Michal
Pohlig Austria GmbH&CoKG, Vienna, Austria
E-mail: info@pohlig.at

Keywords: Indication, SimBrace, dynamics

Summary

The aim of this lecture is questioning the technical strategies currently applied on the market to upper extremities in terms of biomechanics, function and compliance. The lecturer intends to appropriately emphasise the need for a design that is related to the patient's indication.

Introduction

Unfortunately, nowadays too little attention is paid to the orthotic aids used for treating neuromuscular deformities and malpositions of the upper extremities.

Night positioning aids, which go from the fingertips to the proximal forearm or even to the proximal upper arm, are state-of-the-art when it comes to treating differential diagnostic malpositions in the palmar flexion, ulnar deviation, thumb adduction and in the flexion-related spasticity of the biceps brachii and/or pronator teres. Furthermore, they are sometimes provided with a special static extension joint. A closer consideration of the biomechanical principles reveals that these night positioning aids actually show a very narrow range of indications. Also some daily aids recommended to our patients as "functional orthoses" should be questioned and reviewed more accurately with regard to their actual indications. Some orthoses that are supposed to correct malpositions by means of a rigid or a semi-flexible palmar shell and with 3 dorsal Velcro straps can preserve the result of a postoperative medical intervention at the best, e.g. BoNT or a tendon transfer; however, these orthoses cannot improve the joint axes that show a malposition resulting from a dystonia (neuromuscular disorder).

Methods

Nevertheless, if you carry out a physiological and pathomechanical analysis by taking biomechanical principles into account, you can quickly realise that the upper extremity affected by a neuromuscular disease indicates the design of the aid needed and demands an appropriate technical strategy applying state-of-the-art manufacturing processes and materials. Even before producing a model, some markers are fixed on the patient on a 3-point-principle basis considering any incident physical forces (SimBrace). This makes it possible to ascertain the best possible correction. The design is drafted and simulated to make sure that the user, whenever possible, can put on the brace by themselves in the maximum corrective position. As a result, the SimBrace procedure enables us to functionally simulate the aid.

Only once the patient's compliance has been ensured having regard to the best possible correction and function, as well as to aspects such as aesthetics and comfort, a corrected scanning is performed immediately by means of the SimBrace and production begins.

Results

This procedure enables us to involve the patient in the determination of a functional result at the best. Thus, doctors, physiotherapists and occupational therapists have the opportunity to apply their expertise to the aids required. As a consequence, practically no change in position has to be made to the aid because of pressure marks and a loss of correction or of function. By including dynamic extension or flexion elements, an additional increase in quality is ensured. So, not only can we keep the best possible correction achieved on the day the model was made, but also the therapeutic results until the next therapy session; this is possible by a constant stretching depending on how the patient feels that day. Therefore, the ROM is also improved.

Conclusion

A suitable indication as well as the structured deficit-oriented methodology needed for this purpose should be discussed in this lecture by presenting several cases and different types of orthotic aids, thus leading to some constructive further progress.

If patients, parents or the nursing personnel are involved in the technical strategy, they will know from the very beginning how and especially why the aids look in a certain way. The device will then assume an essential role in its daily use.

ABSTRACT

COMPARISON OF GRAFO AND REACTION AFO ORTHOSES IN PATIENT TREATMENT.

Šnytr Jan
Ottobock ČR s.r.o.
E-mail: snytr@ottobock.cz

Keywords: GRAFO, ground reaction force, orthotic treatment

Summary

Presentation describes the basic principle of standard GRAFO orthoses in comparison to new possibilities in reaction modular systems. Video and visual documentation shows the advantages and disadvantages of such orthoses, possible errors and problems. Finally the cooperation of a multidisciplinary team in the diagnosis and treatment of the patient is emphasized.

ABSTRACT OF PERSPECTIVE ORIGINAL PAPER

MONITORING THE EFFECT OF FASCIAL STRETCHING ON THE RANGE OF MOTION IN HIP JOINT – A PILOT STUDY

Vera Popovicová, Lukas Ryba, Štepanka Rybova
Faculty of Health Care Studies, West Bohemia University, Pilsner, Czech Republic
E-mail: popovicovavera80@gmail.com

Key words: fascia, range of motion, hip joint, fascial stretching, yoga, foam rolling

Introduction

Fascial tissue due to embryonic development is based on mesenchymal tissue, which is the starting tissue for all connective tissue (**4**). At the first international fascial congress in Boston in 2007 it was stated that the term „fascia" would include not only the connective tissue of the musculoskeletal system but also the fibrous tissue surrounding the internal organs. At the International Fascial Congress in 2015 it was then stated that the term fascia is a specialized organ that intertwines the whole body and has both complex and specific functions, and can be considered synonymous with connective tissue (**11**). Fascial tissue also contains telocytes, mechanosensitive cells found in the stroma of a number of organs. According to Vang, these cells form a kind of 3D network of interstitial space and, together with fascicular networks, create a complex, sophisticated and integrated „net in net" system (**2, 13**).

The biomechanical properties of fascial tissue determine the presence of elastic, collagen or reticular fibers and their orientation within the fascia.5,10Fascial restraints due to an injury, illness, overload or inactivity result in a decrease in elasticity of this tissue and its dehydration and subsequent adhesion of the connective tissue in the traumatized area. Bond adhesions are painful, obstruct normal muscle mechanics, muscle contraction and hypertonia on the neuromuscular basis. They reduce strength, endurance, motor coordination, stretching of soft tissues, which consequently reduces the extent of movement of the affected joint. The research conducted by the Canadian University of Newfoundland in 2012, which examined the effect of self-myofascial release by means of a foam roller, suggests that it is possible by this method to increase the extent of flexion movement in the hip joint in just 5 to 10 seconds under a 13 kg pressurization significant decrease in muscle performance (**3,7,8**). In 2014, Mohr et al. measured the effect of foam rolling in combination with static stretching on the range of motion of hip joint flexion. The authors found that the combination of these two methods had a significant effect on increasing the extent of hip joint flexion in probands whose range of motion was less than 90 degrees (**9**) Since fascial stretching, unlike static stretching, is also supported by breathing and targeting entire myofascial chains, it can be assumed that it plays a significant role in the neuromuscular involvement of individual muscle groups and the gradual release of fascial tissue throughout the myofascial chains. Moreover, unlike a static stretching which uses linear motion patterns, fascial stretching also uses diagonal and rotating motion patterns.

Aims

There is a number of studies demonstrating the effect of the self – myofascial release technique on increasing the range of motion in the hip joint, but there is paucity of evidence on the effect of fascial stretching on increase of the range of motion in the hip joint. The aim of this study is to investigate the effect of this method in combination with the fascial stretching method on the range of motion in hip joint.

Methodology

The participants in the present study were 15 healthy individuals (8 men, 7 women), aged 22 to 46, with an average age of 29.8 years, mainly the visitors of the gym and leisure time sportsmen.

The exercise consisted of seven main exercises, three of which consisted of yoga asanas(**1, 6**), and the remaining four were focused on self – myofascial release of the hip joint with the use of foam rollerv (**12**). The whole exercise was enriched with diaphragmatic and vibrational breathing and lasted approximately for one hour to be done properly. As part of the instruction, it was shown how the exercises were to be performed and feedback was given to whether the participants performed the exercises correctly. Also, preparatory exercises were presented to help probands achieve a better realization of the resulting yoga asanas, explaining that they will also serve to measure progress. Participants also had the opportunity to practice these exercises regularly every day in the gym under the supervision of instructed fitness trainer who was professionally trained in the fascial stretching. Measurements took place three times, at the beginning, in the middle of the three-month exercise and at the end. Patrick's test was used to measure the potentialintra-articular hip joint pathology and Thomas or Ober's test to detect possible restrictions of myofascial tissue in the area of hip joint. The progress of the participants in the research was monitored by goniometric measurements and personally designed measurements in yoga asanas. Furthermore, tests normally used for spinal mobility were also applied for testing the fascial tissue extensibility in whole myofascial chains, namely lateroflexion and Thomayer test.

During the first measurement, the probands were submitted to the input questionnaire and the output questionnaire at the end of the exercise. At each measurement, proband progress was also recorded by photos in asana positions.

Discussion and conclusions

The results of research show that fascial stretching, which includes elements of foam rolling and yoga, can extend the range of motion in the hip joint in all directions. The range of motion in all probands improved with 100% success, unless the cases where the range of motion in certain direction did not show any signs of restriction at the beginning of the research. However, in order to determine the exact values of the depth of effect of fascial stretching on the hip joint, this method requires a further research solution that will be performed with a higher number of probands and the results can be objectively evaluated based on available imaging methods.

References

1. AVISON J. YOGA Fascia, Anatomy and Movement [Book]. – Edinburgh : Handspring Publishing Ltd., 2015
2. CHAUDHRY H, SCHLEIP R, JI Z, BUKIET B, MANEY M, FINDLEY T. Three-Dimensional Mathematical Model for Deformation of Human Fasciae in Manual Therapy. J Am Osteopath Assoc 2008;108(8):379–390

3. CHEATHAM S. W. The effects of self-myofascial release using a foam roll or roller massager on joint range of motion, and perfo [Article] // International Journal pf Sports and Physical Therapy. – 2013. – 3 : Vol. 8. – pages 228–236
4. DYLEVSKÝ I. Obecná kineziologie [Book]– Praha : Grada, 2007
5. KNUTZEN H. J a Kathleen Biomechanical Basis of Human Movement [Book]. – Philadelphia : Wolters Kluwer Health/Lippincott Williams and Wilkins, 2009
6. IYENGAR, B. K. S. Light on yoga: yoga dipika : [the classic guide to yoga from the world's foremost authority with a new introduction from B.K.S. Iyengar]. London: Thorsons, 2001. ISBN 0-00-710700-5
7. KATHLEEN M. Sullivan Dustin B.J. Silvey, and Behm, David G. Roller Massager application to the hamstrings increases sit-and-reach range of motion within five to ten seconds without performance impairments [Article] // International Journal of Sports Physical Therapy. – 2013. – 3 : Vol. 8. – pages 228–236
8. MACDONALD, GZ.,PENNEY, M.D.H. et al. n Acute Bout of Self-Myofascial Release Increases Range of Motion Without a Subsequent Decrease in Muscle Activation or Force [Article] // The Journal of Strength & Conditioning Research. – 2013. – 27 : Vol. 3. – pages 812–821
9. MOHR, A.R., LONG B.C. A GOAD C.L. Effect of Foam Rolling and Static Stretching on Passive Hip-Flexion Range of Motion. Journal of Sport Rehabilitation [online]. 2014, 23(4), 296–299.DOI: 10.1123/JSR.2013–0025. ISSN 1056–6716
10. PAOLETTI, S. The fasciae: anatomy, dysfunction and treatment. [Book]. Englished. Seattle: Eastland Press, c2006. ISBN 093961653x
11. SCHLEIP ROBERT. Fascial Fitness: How To Be Resilient, Elegant, Dynamic in Everyday Life and Sport [Book]. – Chichester : Lotus Publishing, 2017
12. THÖMMES, F. Uvolňování fascií: fyziologické podklady a tréninkové principy, využití v týmových a vytrvalostních sportech a uplatnění v rámci prevence a rehabilitace [Book]. – Olomouc : Poznání, 2016
13. VANG CRETOIU TELOCYTES: connecting cells [Book]. – New York : Springer Berlin Heidelberg, 2016

ABSTRACT

PREDISPOSITIONS FOR ADIPOSITY, MOTOR ABILITIES AND MUSKULOSKELETAL DEVELOPMENT

Jana Parizkova
Obesity Management Centre, Institute of Endocrinology, Prague Czech Republic
E-mail: jparizkova@endo.cz

The abstract was not delivered.

ABSTRACT

ANTHROPOLOGICAL SURVEYS IN CZECH REPUBLIC (CZECHOSLOVAKIA)
ANTROPOLOGICKÉ VÝZKUMY PROVÁDĚNÉ V ČESKÉ REPUBLICE (ČESKOSLOVENSKU)

Pavel Bláha

Dept. of Biomedical Sciencis, College of Physical Education and Sport PALESTRA

Key words: Nationwide anthropological surveyses in children and adolescents; anthropological surveyes with Czechoslovak Spartakiade

Monitoring of body composition development in child, adolescent and adult population has a long tradition in Czech Republic (Czechoslovakia). First wide research focused on body height and body weight development in children aged 6 to 16 was realized by prof. Matiegka in cooperation with biology teachers in 1895. After World war II prof. Fetter organized 1st nationwide anthropological survey in children and adolescents in 1951. Body height and body weight in population from birth to 18 years of age and also body height and weight of their parents were recorded. Consecutive surveys were organized in 10 years periods (1961, 1971, 1981, 1991 and 2001). Monitoring of secular trend was the main target. Unfortunately, following survey in 2011 was not realized. In connection with Czechoslovak Spartakiad (mass gymnastic festival in Communist ruled Czechoslovakia) were made several surveys targeted on adult population (1955, 1960, 1965, 1970, 1975, 1980 and 1985). Most of the data was published as monographs or papers in scientific journals.

Československo (Česká republika) je jedna z mála zemí, kde byl monitorován vývoj tělesné stavby jak dětí a mládeže, tak dospělé populace. První rozsáhlý výzkum zaměřený na vývoj tělesné výšky a hmotnosti dětí ve věku 6 až 16 let provedl za spolupráce učitelů biologie prof. Matiegka v roce 1895. Po druhé světové válce, v roce 1951 prof. Fetter zorganizoval I. celostátní výzkum dětí a mládeže (měřena byla tělesná výška a hmotnost populace ve věku od narození do 18 let a rovněž byla zaznamenávána tělesná výška a hmotnost rodičů). V desetiletých intervalech se prováděly další výzkumy (1961, 1971, 1981, 1991, 2001) a byl monitorován především vývoj sekulárního trendu. Výzkum v roce 2011 již nebyl proveden. Kromě toho od roku 1955 byly prováděny výzkumy v souvislostí s konáním československých spartakiád dospěle populace (1955, 1960, 1965, 1970, 1975, 1980, 1985). Většina dat byla publikována monograficky, nebo jako původní práce v odborných časopisech.

ABSTRACT OF PERSPECTIVE ORIGINAL PAPER

CHARACTERISTICS OF LINEAR SIZES OF VERTEBRAL BODIES AND INTERVERTEBRAL DISKS IN CHILDREN IN THE BEGINNING OF PUBERTY

Dudin Mikhail[1], Popov Igor[2], Baloshin Yuriy[2], Lisitsa Nikita[2], Bober Stepan[1]

1 Children's Rehabilitation Center for Orthopedics and Traumatology 'Ogonyok', St. Petersburg, Russia.

E-mail: ogonek@zdrav.spb.ru, http://center-ogonek.ru

2 St. Petersburg National Research University of Information Technologies, Mechanics and Optics (ITMO University), St. Petersburg, Russia.

E-mail: od@mail.ifmo.ru

Keywords: vertebral column, proces of growth, pathological deformities, scoliosis

Summary

In order to provide a comprehensive understanding of lesions of the vertebral column and ensure curation measures, there is a high demand for the so-called 'norm' of linear sizes of vertebral bodies and intervertebral discs, being the essential elements of the 'carrying' column of the most important part of the skeleton. Unfortunately, this question is almost not reflected In the literature. Here we present the found patterns in the development of these objects in children aged 9 to 14 years. These patterns may serve as normative parameters during the first half of puberty. This period was chosen because it is the time when the pathological deformations of the vertebral column are usually initiated, and there is only one indisputable fact in the deformations theory and practice – they are connected with the process of growth. The chosen parameters can objectively reflect this process. On the other hand, the obtained data are quite useful in the construction of correct mathematical models of both healthy and deformed vertebral complex.

Introduction

Surprisingly, the pathological deformation of the most complex anatomic-physiological vertebral complex can only be regarded as sustainable deviation of the form thereof from the norm. As with any disease, such deviation starts with slight changes in the homeostasis in the human body. This stage is called 'symptomless'. On the one hand, this stage is the most difficult in terms of the diagnosis, and on the other hand, it is the most favorable stage for prevention and treatment. This statement is also true for idiopathic scoliosis.

Based on a wide range of information in regard to the anatomical functional condition of the vertebral complex, which was repeatedly confirmed in clinical and instrumental studies thereof, a task for mathematical modeling was formulated. A number of equations were obtained during solving thereof. These equations described the mechanism of gradual formation of three-plane deformation from a normal two-column vertebral column from the point of view of theoretical mechanics. Interestingly, the calculations first found a certain pattern in the sequence of stages of development of deformation in the model which is absolutely identical to the real scoliosis pattern.

However, the developed models and equations thereto have a significant drawback – they lack real linear sizes of the vertebral complex as a whole and parts thereof. This fact does not allow to calculate the conditions of changing the status of the vertebral column from 'healthy' to 'scoliotic'.

In order to address this gap, we have analyzed data obtained by radiography of the vertebral column in children of various age groups to identify the real linear sizes of parts of the vertebral complex and determine the rate of normal longitudinal growth of the vertebral column in the above age range.

Material and Methods

Due to complex structure and anatomy peculiarities of the vertebral complex, the most accessible and informative method of obtaining data on linear sizes of the vertebrae of a specific person is to process radiographs of two groups of patients of the Rehabilitation Center of Pediatric Traumatology and Orthopedics 'Ogonyok' (St. Petersburg). The first group was diagnosed with the following: stable compression fractures of the vertebral bodies. The second group included children with posture disorder of the 'flat back' type and with first-degree idiopathic lordoscoliosis with a deformation of up to 5°–7° (Cobb's degrees).

Compressed vertebrae were not measured and were not considered when building the model and small deformation value in the second group when measuring in an axillary projection did not significantly influence the obtained linear sizes of the vertebral bodies. In total 497 radiographs were examined.

The search parameters of vertebrae with clearly visible sizes were measured in each radiograph. Typically, these are vertebrae C_7–L_5[5]. Examinated parameters: width, height and anteroposterior size of the vertebral bodies, and height of the intervertebral discs.

Results

In order to determine average (normal) values of longitudinal sizes of the vertebrae by children's age, the polynomial regression method was applied. As a result, the average linear dependences of height and anteroposterior sizes as well as the quadratic dependences of width and thickness of the intervertebral discs on the vertebra number were obtained. (it should be noted that disk #6 corresponded to vertebra Th1, and vertebra L5 corresponded to disc #23).

5 The following designations are common in anatomy: C – cervical vertebrae (Lat. Pars Cervicalis), Th – thoracic vertebrae (Lat. Pars Thoracalis), L – lumbar vertebrae (Lat. Pars Lumbalis), S – the sacrum (Lat. Os Sacrum) and Co – the coccyx (Lat. Os Coccygis).

Results and Discussion

As a result of the study, both linear (height and anteroposterior size of the vertebral bodies) and nonlinear (width of the vertebral body and height of the intervertebral discs) nature of increase in the actual sizes of the major elements of the vertebral column were identified.

Overall, the reliable values and dependences obtained in the study can already be used as the source (normative) data when building dynamic physical and mathematical models of normal vertebral complex in children and modeling the development of various deformations of the vertebral column.

ABSTRACT OF PERSPECTIVE ORIGINAL PAPER

OF THE VALUE OF VITAMIN D RECEPTOR GENE POLYMORPHISM (VDR) BY BSMI-B/B MARKER AS A PARTICIPANT OF ADOLESCENT IDIOPATHIC SCOLIOSIS (AIS) PATHOGENESIS IN CHILDREN.

Bazanova Maria, Dudin Mikhail, Koloskova Lidia
Children's Rehabilitation Center for Orthopedics and Traumatology 'Ogonyok', Saint-Petersburg, Russia
E-mail: ogonek@zdrav.spb.ru
OOO "Medlab" SPb, Saint-Petersburg, Russia
E-mail: son@mail.ru

Keywords: Vitamin D, Vitamin D receptor, polymorphism (VDR) by BSMI-b/B marker, children population with AIS

Introduction

Since its discovery, vitamin D (1913) has been considered only from the point of view as an essential participant in calcium – phosphorus homeostasis, but as a result of numerous studies, the study of vitamin D as a hormone that binds to its specific receptors (VDR) and has a biological effect on the body (endocrine, paracrine and autocrine). Vitamin D also plays a direct role in bone metabolism, directly affecting it through the presence of its cellular elements (osteoblasts, osteoclasts and osteocytes) VDR receptors. Given that the indisputable fact in the theory and practice of AIS is the connection of its origin and its further development with the process of growth of the child, it can not be excluded that the polymorphism of the VDR gene may be an additional factor in this connection due to its direct participation in bone metabolism.

Purpose of research

In order to answer this question, the 'Ogoniok' ECDC carries out a longitudinal study to assess genetic polymorphism using the BsmI-b/B marker of the VDR gene receptor in children with AIS.

Materials and methods (technologies)

The results of laboratory diagnostics of 80 children aged from 9 to 13 years, without apparent verified chronic pathology, were used as the material for this work and the established diagnoses; 40 children with compression fractures of the vertebral bodies without idiopathic scoliotic deformation of the spine and 40 children with AIS (20°–35° and more Cobb).

Object of research

The object of the study was selected polymorphism of the VDR gene by the BSMI-b/B marker (when G63980A is replaced in the non-coding regulatory region of the gene).

It is known that the vitamin d receptor is encoded by the VDR gene located on the short arm of the chromosome 12 (12q12–q14). its most important feature is the genetic polymorphism, i.e. the existence of different allele variants of this gene in the population. However, according to modern ideas, the most promising in the study of the VDR gene in the pathology of osteogenesis is the polymorphism of the VDR gene by the BSMI-b/B marker (when g63980a is replaced in the non-coding regulatory region of the gene). With the 'mutant' allele B, the level of receptor production is increased, which leads to a decrease in the level of parathyroid hormone in the blood and an increase in the risk of fractures, regardless of bone density, and changes in sensitivity to the effects of vitamin D.

Technologies. The technology of polymerase chain reaction (PCR) was used as a research technology to study the polymorphism of the VDR gene. In addition to this task, the patients were assessed the state of the osteotropic hormone profile and the state of calcium – phosphorus metabolism of the bone system by determining cortisol, calcitonin, somatotropic, parathyroid, adrenocorticotropic hormones and evaluating total calcium, inorganic phosphorus and total alkaline phosphatase in the blood serum.

Results

In the group of children diagnosed with AIS there was a high frequency of mutant allele b carrier, compared with the control group of children diagnosed with compression fracture.

Also, in the group of children diagnosed with AIS, the level of serum vitamin D concentration was optimal or close to the upper limit of normal.

Therefore, the allele carriage In the handle BsmI b/B gene receptor VDR but with a normal or close to the high end of normal concentrations of serum vitamin D in children with a diagnosis of AIS gives reason to conclude; that with the increased level of production of the receptor, there is a change in the sensitivity of cells to the effects of serum vitamin D and, as a consequence, the increase of its concentration in serum.

Conclusion

These processes of the VDR receptor gene acting through changes in cellular homeostasis and increase in serum vitamin D can contribute to the growth of the skeleton. Polymorphism of the VDR gene by BsmI-b/b marker may be one of the additional factors explaining the relationship of the occurrence and development of AIS with the processes of child growth.

References

1. POVOROZNYUK BB, PLUDOVSKY P, BALATSKAYA N. H "deficiency and deficiency of vitamin D. Epidemiology, diagnosis, prevention and treatment" Kyiv, 2015. –262c.
2. DUDIN M. G., PINCHUK D. Y. Idiopathic scoliosis: prevention. conservative treatment. Pub "Man", Saint Petersburg, 2017, p. 132–133.
3. MAILYAN E. A. effect of genetic polymorphisms of genes of vitamin D system on serum level 25(OH) D // Bulletin of Smolensk state medical Academy.- 2017.-№1-p. 19–24.
4. BIKLE D. D Vitamin D and bone // Current Osteoporosis Reports-2012.– V. 10.-№2-P. 151–159.
5. ZAZERSKIY I. E., ASEEV M. V., KUZNETSOVA L. V. the Analysis of the Association of VDR3, and COL1A1 with postmenopausal osteoporosis. Osteoporosis and osteopathy. 2002; 2: 2–6.
6. M. A. BUCHALKA, N. IN. SKRIPCHENKO, E. YU., SKRIPCHENKO, E. N. IMYANITOV. The value of vitamin D receptor gene polymorphism in human pathology. //The Russian Bulletin of Perinatology and Pediatrics ,2017 ; 62:(6) Pp. 23–26.
7. MORRISON N. A. Vitamin D receptor gene variations and osteoporosis: a contributor to the polygenic control of bone density. In: Vitamin D. Eds. D. Feldman, FN. Glorieux, JW. Pike. San Diego: Academic Press, 1997: 713–731.
8. DUDIN M. G., ASEEV M. V., BILONOG O. L. the Use of modern achievements of molecular genetics in orthopedic practice // Optima - silovanie technologies of diagnostics and treatment in pediatric traumatology and orthopedics. Errors and complications: proceedings of the Symposium of children's traumatologists and orthopedists of Russia. – Volgograd, 2003. – P. 194–196.

ABSTRACT OF PERSPECTIVE ORIGINAL PAPER

ULTRASONIC CHARACTERISTICS OF PARAVERTEBRAL MUSCLES IN CHILDREN WITH IDIOPATHIC SCOLIOSIS AND WITHOUT DEFORMITY OF THE SPINE.

Rybka Dina[1], Dudin Mikhail[1], Sharova Lidia[2]

1 Children's Rehabilitation Center of Orthopaedics and Traumatology «Ogonyok»,

2 North-Western State Medical University named after I.I. Mechnikov, Sankt-Petersburg, Russia

E-mail: ogonek@zdrav.spb.ru, dolspb@mail.ru

Keywords: method of ultrasonic diagnostics, scoliosis, mm.transversospinales.

Paravertebral muscles have a special role in both maintaining the vertical position of the human body and in the pathogenesis of spinal deformity. This makes their study in patients with scoliosis extremely topical. In the literature available to us, research work in this direction is extremely meager.

Idiopathic scoliosis, three-plane deformation of the spine, is a process that develops over time, the clinical symptomatology of which is growing. It is the most common pathology of the musculoskeletal system in children, ranging from 1% to 36% in the population. In the pathogenesis of the development of the disease, one of the main factors is the discrepancy between the growth of the spinal cord and its osteo-musculoskeletal apparatus, which results in a medulla-vertebral conflict requiring compensation (Dudin M.G, Pinchuk D.Y., 2009).

The functional state of the paravertebral muscles plays a main role both in maintaining the normal shape of the spinal column and in the process of its pathological twisting.

To date, the main way to assess the functional state of the muscular system is electromyography. However, this method does not allow to evaluate the structure of muscles. In this case the method of ultrasonic diagnostics is optimal. It is non-invasive, economical and does not require special preparation of the patient.

Embryologically paravertebral muscles belong to the autochthonous (own) musculature of the spine, which is divided into two muscular tracts – a more superficial lateral and a deep medial one. For our study, the most interesting were the muscles of the medial tract (mm.transversospinales), subdivided in depth and length. This is mm. semispinalis, mm.multifidi, mm.rotatores. It should be noted that mm. transversospinales are lateral flexors and contralateral rotators of vertebra.

Among the muscles of the medial tract of the lumbar spine are more superficially located mm. multifidi, so they are more accessible for ultrasound. In the thoracic region, mm. semispinalis are more superficially located, but they are covered by m.trapesius, which makes their monodiagnostics more complex, whereas the aponeurosis of m. latissimus dorsi over the lumbar mm. multifidi does not prevent this. Thus, the level of the fourth lumbar vertebra was optimally reliable and convenient for the study.

Aim

To give a comparative analysis of paravertebral muscles with the help of ultrasound diagnosis in children with idiopathic scoliosis and without deformity of the spine

Materials and methods

30 children aged 9 to 11 years old without clinical signs of deformity of the spinal column and 30 children from 9 to 11 years old with scoliosis 10–25° Cobb was examined. In addition.

All patients assessed the state of paravertebral muscles in a prone and standing position, with the right and left side of the spine.

A linear sensor with a frequency of 5–10 MHz of the Aloka SSD–1100 scanner was used. It was placed at the level of fourth lumbar spine at a distance of 1–2 cm from the line of spinous processes.

In the ultrasound range of the transverse position of the sensor, a group of mm. multifidi, was measured, the cross-sectional area of these muscles (cm^2) was estimated.

To assess the density of paravertebral muscles, the function of the apparatus "histogram changes" was used, which evaluated the average level of intensity in a given muscle region (MN).

All children were electromyography examination. A multifunctional computer complex "Neuro-MVP-4" with a magnetic stimulator 'Neuro-MS' ('Neurosoft') was used. The amplitude and frequency of muscle contraction were registered.

Result

As a result of ultrasonic diagnostics of paravertebral muscles of healthy children, the presence of symmetry of characteristics of the right and left groups of paravertebral muscles was revealed, which can be interpreted as a norm. This phenomenon persisted both in the standing and lying position (**Table 1**).

		Mm. multifidi			
	Level	**left**	**left**	**right**	**right**
		Cross-sectional area (sm^2)	Echo-density (%)	Cross-sectional area (sm^2)	Echo-density (%)
lying	L4	2,552 $\pm$3	17,96 $\pm$4	2,482 $\pm$0,4	16,88 $\pm$4
standing	L4	2,679 $\pm$3,5	17,36 $\pm$3	2,617 $\pm$0,4	19,45 $\pm$4

Table 1. US- characteristics of paravertebral muscles normal

In children with idiopathic scoliosis 10–25° Cobb the density of paravertebral muscles was elevated in the projection of the base of the scoliotic arch from the convex side (**Table 2**).

Patients	**Level L4**	**Mm. multifidi**			
		left		**right**	
		Cross-sectional area (sm^2)	Echo-density (%)	Cross-sectional area (sm^2)	Echo-density (%)
9 years n=10	**lying**	2,552 $\pm$3	17,9 $\pm$4	2,482 $\pm$0,4	16,8 $\pm$4
	standing	2,679 $\pm$3,5	17,3 $\pm$3	2,617 $\pm$0,4	19,4 $\pm$4
10 years n=10	**lying**	2,432 $\pm$3,5	16,2 $\pm$3	2,391 $\pm$0,4	16,6 $\pm$4
	standing	2,541 $\pm$3,5	16,7 $\pm$3	2,981 $\pm$0,4	17,4 $\pm$4
11 years n=10	**lying**	2,543 $\pm$3,5	17,1 $\pm$3	2,634 $\pm$0,4	18,1 $\pm$4
	standing	2,154 $\pm$3,5	17,8 $\pm$3	2,989 $\pm$0,4	17,1 $\pm$4

Table 2. US- characteristics of paravertebral muscles with AIS

Conclusion

1. Normally, the ultrasound parameters of the paravertebral muscles are symmetrical.
2. In scoliosis, the muscle density on the side of the scoliotic arch is increased, and the degree of change in echogenicity depends on the severity of the deformation.

Thus, our study showed that the ultrasound characteristics of paravertebral muscles in children with scoliosis differ from those in healthy individuals, which allows them to be considered as a guide for predicting the progression of scoliotic deformity of the spine in children and to include an ultrasound method in the diagnostic complex with such patients.

ABSTRACT OF PERSPECTIVE ORIGINAL PAPER

ANATOMICAL AND TOPOGRAPHICAL PECULIARITIES OF URINE FLOWING SYSTEM ORGANS AMONG THE CHILDREN WITH IDIOPATHIC SCOLIOSIS

Pankratova Galina[1], Dudin Mikhail[2]
[1] Orthopedics clinic, Ryazan, Russia
[2] Children's Rehabilitation Center of Orthopedics and Traumatology "Ogonek", Saint-Petersburg, Russia
E-mail: ogonek@zdrav.spb.ru

Keywords: adolescent idiopathic scoliosis, urine flowing systheme, pathology of kidneys

Introduction

Adolescent idiopathic scoliosis (AIS) is a three-dimensional deformity of the spine that may cause pulmonary restriction, heart abnormities and change of other systems and organs. But we know about kidneys condition very little. However, the kidneys and the spine have common mesodermal origin. The results of conservative scoliosis treatment depends on the condition internal organs in many cases.

Objective

To study the anatomical and topographical peculiarities of urine flowing system organs among the children with idiopathic scoliosis.

Materials and methods

This work was based on the results of the kidneys ultrasound research carried out among 425 children with idiopathic scoliosis with Cobb's angle from 5 to 60 degrees. Children from 4 to 17 years old were under the research. We are used standard ultrasound imaging method with additional definition of kidneys agilities.

Results

The results of the research revealed the kidneys pathologies (abnormal kidneys topography and their anomalies) in 187 children or 44%.

The most frequent was the congenital kidneys dislocation (38 children or 8,9%), such as lumbar, iliac and pelvic dystopia (population index is 500-800 cases on 1000). The abnormal kidneys agilities and its extreme version – kidneys prolapse or nephroptosis were discovered in 22%. We revealed the other kidneys anomalies of development (double kidneys) in 7,8% (33 patients). Population index is 1:145. In case of "horseshoe" kidney our results (4 cases from 425) twice exceeded population index (1:400–500). Anomalies of structure (hydronephrosis and his stages) is 6,3% of our patients with AIS.

Besides we revealed such rare anomalies as multilocular cyst in 1 (population index 1:9859), unicameral cyst in 1 case and 1 single local calcinosis. The rarest anomaly of bladder as its extrophy (population index 1:40000–50000) we found out in 1 case. This patient received operative treatment after born.

The most of discovered pathologies (80%) had no symptoms and were reveled for the first time in our research.

Anatomical and topographical abnormities of urine flowing system organs more often were discovered from severe deformities III-IV stages AIS.

Conclusion

The anomalies of urine flowing system organs exceed population indexes many times. Ultrasound research of kidneys should be included in the obligatory diagnostic investigation of children with idiopathic scoliosis.

ABSTRACT OF PERSPECTIVE ORIGINAL PAPER

AN EXPERIENCE DIAGNOSTIC USING OF MODERN MOBILE TECHNOLOGY IN THE PRACTICE OF A PHYSICIAN ORTHOPEDIST

Vasilevich Sergej[1], Arseniev Aleksey[1], Dudin Mikhail[1], Sukhov Timofey[2]

1 Children's Rehabilitation Center for Orthopedics and Traumatology 'Ogonyok', Saint-Petersburg, Russia

E-mail: ogonek@zdrav.spb.ru

2 Baltic State Technical University 'VOENMECH' named after D. F. Ustinov, Saint-Petersburg, Russia

E-mail: tsuhov@mail.ru

Keywords: posture, scoliosis, kyphosis, diagnosis, angle, mobile equipment.

Mobile home portable telecommunication devices have become firmly established in our daily life and are increasingly used in highly specialized areas, in particular in the practice of medical specialists. We present the experience of using smartphones / tablets for diagnostic evaluation of static and dynamic indicators of the human musculoskeletal system.

Introduction

The portable 'Smart-Orto 2D' system, which was presented at the Symposium-2017, was intended for static evaluation of a number of parameters of orthopedic status in children and adults.

Meanwhile, the experience of this application in its original version has made it possible to see a number of promising directions in the diagnosis of the dynamic characteristics of other segments and components of the musculoskeletal system.

Material and methods

The main software application of 'Smart Orto 2D' was developed by our team for both Android and Windows devices. The application made it possible to create a database of patients with their photos, from which it is possible to evaluate the frontal, sagittal, and horizontal profiles of a person to measure the linear dimensions and angular dimensions of the patient's torso and limbs.

In addition, the program made it possible to conduct repeated examinations and evaluate the dynamics of the observed changes. The peculiarity of the application was that for the patient's pictures to be taken with maximum accuracy, the device's camera must be aligned in space using the internal accelerometer of the device.

Also, 'Smart Orto 2D' provided for the possibility of remote data transmission through communication channels and telemedicine consultations of patients. However, for a full assessment of the state of the locomotor system – its dynamic characteristics, reflecting the volume of movement in the joints and individual segments of the skeleton, as well as the most important integral function of 'Homo Erectus' – its walking – were lacking. For this purpose, we used action cameras – in particular Hero4 GoPro. Walking of the patient on the treadmill was recorded with the help of a camera installed at the level being examined (e.g., knee, ankle joints). Video shooting was carried out from two positions: lateral and back. The speed of the shooting was 120 frames per second. The cameras were connected to a tablet or a desktop computer via a Wi-Fi channel.

After receiving the data, the video image was examined using a video editor (GoPro Studio or similar) in slow motion mode. The technique we used makes it possible to identify abnormalities of the gait, including hidden ones (revealed after a normal walking period). In addition, it allows us to evaluate the biomechanics of walking, including the biomechanics of moving the lower limb from the pelvic level to the level of the foot.

For more detailed visualization, contrast marks can be placed on the skin above the evaluated limb sites. The analysis of the obtained results was carried out visually by a specialist and had an aim of an applied orientation. For practical implementation of the method proposed above, any high-speed video camera of smartphone with a shooting speed higher than 120 frames per second or a separate action camera is applicable.

To assess the amplitude of movements of limb segments and the human body, we used mobile systems with built-in hardware devices for measuring the position of the device in space (they are available on almost all modern devices). Currently, for practical use on the PlayMarket and AppStore, there are many applications designed for measuring angles in technical areas, but no analogues intended for measurement for medical purposes have been found. Nevertheless, it is possible to use available technical software solutions for work (e.g., 'Angle Counter' in version 1.0). With the help of the 'Angle Counter' installed on a mobile device, the amplitude of movements in segments of limbs and trunk (tilt in the frontal and sagittal plane) can be estimated.

In addition, it is possible to assess the angular asymmetry of segments in the statics (e.g., the lateral slope of the pelvis, the forelegs, etc.) and when performing functional tests. The advantage of such measurements is high accuracy at any level and any measurement step; the ability to measure in one or two planes simultaneously; the ability to measure single or relative measurements; the difference between two angles; and the visibility of the information provided.

Results

The application of the above methods showed high accuracy of the measurements comparable with the data obtained from other diagnostic systems. The doctor, using mobile systems with software applications installed on them, can quickly measure the indicators of interest with high accuracy and significantly save the time of examination.

Discussion

The above evaluation methods are inherently analogous to expensive diagnostic complexes (e.g., 'Diers Formetrics 4D'), and can be used by any specialist with basic computer skills.

In conclusion, objective evaluation of the patient's orthopedic status allows for more effective preventive and curative measures. Of particular diagnostic value are the publicly available imaging techniques that allow one to document the initial assessment of the orthopedic status and its changes with subsequent analysis of qualitative and quantitative characteristics and clinical symptoms. The wide possibilities offered by the mobile diagnostic system 'Smart Orto 2D' allow for better orthopedic diagnostics embracing ever larger areas of application, including telemedicine ones. Another important aspect of the use of mobile devices is significant time saving by the physician when examining the patient and increasing the level of objectivity of the observed changes.

ABSTRACT OF PERSPECTIVE ORIGINAL PAPER

PROSPECTS THE POSSIBLE APPLICATIONS OF THE ELECTRET EFFECTS OF THE BONES IN PEDIATRIC ORTHOPEDICS (preliminary report)

Vasilevich Sergej[1], Arseniev Aleksey[1], Dudin Mikhail[1], Khomutov Vladimir[2], Komlev Aleksey[2]

1 Children's Rehabilitation Center for Orthopedics and Traumatology 'Ogonyok', Saint-Petersburg, Russia

E-mail: ogonek@zdrav.spb.ru

2 St. Petersburg Electrotechnical University 'LETI', Saint-Petersburg, Russia

E-mail: a.komlev@mail.ru

Keywords: electret, piezoelectric, growth bone, osteogenesis, healing, regeneration.

The work was performed to study the prospects of using electret (piezoelectric) properties of bone to control the processes of osteogenesis that bases the growth of the lower extremities.

The material for this work is the analysis of scientific literature, as well as the relative own experimental work and the results of initial experience of the clinical application.

Introduction

The activity of the growth zones of the child's skeleton primarily depends on the activity of the endocrine system, but local factors play an equally important role in the regulation of bone growth rates.

Local 'regulators' include the Hueter-Volkmann Law (1861–1862) (compressive loads lead to slowing skeletal growth, and stretching, on the contrary, to its acceleration), the law of Wolf (Julius Wolff Law 1892) (if the load on any bone increases, the bone will rebuild itself in such a way that it becomes stronger in relation to this type of load, it becomes more dense and thin. These laws have the opposite effect: if the load on any bone decreases, the bone becomes weaker as a result of reverse adaptive change). Thus, the manifestation of the law of Hueter-Volkmann can be seen in the development of idiopathic scoliosis, valgization of the lower extremities in children or lengthening of the lower extremity with a unilateral fracture, and the law of Wolf is usually accompanied by compaction and strengthening of the bone in places of the biggest load.

Bone restructuring in accordance with the load is carried out by means of mechanotransduction, the effector link of which are osteoprogenitor cells (osteoblasts and osteoclasts, which can replace each other depending on the state of load, and osteocytes have these both properties at once) [**1–3**].

Meanwhile, the mechanisms of implementation of these physiological laws of bone metabolism remain not fully disclosed. The piezoelectric effect, first described for the living bone tissue I. Yasuda (1955), is of great interest here. It can be added that the presence of the electrical state and the associated piezoelectric potentials is observed in many organs and tissues, but these effects are most pronounced in bone tissue. Therefore, new information about these effects may well expand the possibilities of new medical and diagnostic technologies [**4–6**].

The electret state of the bone and the associated piezoelectric effects of the bone are considered to be the main source of potentials caused by mechanical stress in the bone. At the moment, it is generally accepted that the electret/piezoelectric potentials of bone are due to the presence of collagen and bone hydroxyapatite, and are associated with a compression/tension load that strongly correlates with bone growth [**7–9**].

It is likely that the piezoelectricity of osteogenic tissue is the factor through which bone cells detect areas of great effort or tension and is an alternative mechanism of regulation.

Material and methods

Experiments were carried out and the influence of the electrostatic field of electret coatings of tantalum pentoxide obtained by the method of magnetron reactive sputtering, on the regeneration of tissue by mechanical, toxic and radiation injuries:

1. on tendon regeneration after isolated mechanical damage;
2. on the regeneration of bone tissue in combined radiation and mechanical lesions and isolated mechanical trauma;
3. on the regeneration of the nerve with medication nephropathy;
4. skin regeneration in case of chemical and radiation damage.

Results

Experience our own use of the electret films as a skin wound-healing coatings and submerged implants (with applied electret coatings) on different experimental models of lesions of the skin and bone damage have shown unequivocal influence of introduced electret field on reparative processes in tissues with direct contact with the electret surface.

The experience of clinical application of electret coatings based on tantalum pentoxide shows their full safety and effectiveness both in submerged osteosynthesis and upper cutaneous installation.

Discussion

From the practical point of view of the application of electrostatic fields, the important question remains about the depth of their penetration into biological tissues. Experiments by a number of researchers (Jiang Qian and co-authors, 2012) show that the external electrostatic field of the electret penetrates through all skin samples with good stability. In addition, the electrostatic field of the electret can also form a stable potential difference between the two sides of the skin [**10**].

It turned out that the electrets can not only affect the skin, changing its microstructure, but also affect the subcutaneous tissue and the underlying microvessels due to changing their local metabolism.

The presence of piezoelectric effects in the bone can serve as a point of practical application, including the study and creation of external sources of constant or dynamic static stress to affect the bone growth zone, the optimization of a complex of physical rehabilitation for children with this pathology (exercises can include a large intensive axial load on the "long leg", less intense load on the "short leg" in combination with traction or similar unloading effects).

References

1. ALAN J. GRODZINSKY, MARC E. LEVENSTON4, MOONSOO JIN, AND ELIOT H. FRANK. Cartilage tissue remodeling in response to mechanical forces. Annual review of biomedical engineering Vol. 2:691-713 (volume publication date august 2000) https://doi.org/10.1146/annurev.bioeng.2.1.691
2. S.A.M. TOFAIL, Y. ZHANG AND A.A. GANDHI. Piezoelectricity of Bone from a new Perspective 978-1-4577-1025-4/11/ 2011
3. AC. AHN, AND AJ., GRODZINSKY. Relevance of collagen piezoelectricity to Wolff's law: A critical review, Med. Eng. Phys., vol. 3 1, pp733- 74 1, September2009.
4. HUEY DJ. HU JC, ATHANASIOU KA: Unlike bone, cartilage regeneration remains elusive. Science. 2012;338(6109):917–21.
5. TUZLAKOGLU K, BOLGEN N, SALGADO A, GOMES ME, PISKIN E, REIS R. Nano-and micro-fiber combined scaffolds: a new architecture for bone tissue engineering. J Mater Sci Mater Med. 2005;16(12):1099–104.
6. GRODZINSKY AJ, LEVENSTON ME, JIN M, FRANK EH. Cartilage tissue remodeling in response to mechanical forces. Annu Rev Biomed Eng. 2000;2(1):691–713.
7. M. MINARY-JOLANDAN and M-F.YU, Uncovering nanoscale electromechanical heterogeneity in the subfibrillar structure of collagen fibrils responsible for the piezoelectricity of bone, ACS Nano, vol. 3, pp.l859-1863,2009.
8. RUMI HIRATAI, MIHO NAKAMURA and KIMIHIRO YAMASHITA. Role of Collagen and Inorganic Components in Electrical Polarizability of Bone Received 9 May 2013/Accepted 4 October 2013/Published online in J-STAGE 18 October 2013 doi: 10.1292/jvms.13-0229; J. Vet. Med. Sci. 76(2): 205–210, 2014
9. S. BAUER. Electrets for Biomedical Applications. 978-1-4577-1025-4/11/ 2011 IEEE
10. JIANG JIAN, LIANG YUANYUAN, DONG FAJIE, MA LIN. Penetration and Stability of External Electrostatic Field of PP Electret through Rat Skin. IEEE Transactions on Dielectrics and Electrical Insulation Vol. 19, No. 4; August 2012 1137.

ABSTRACT OF PERSPECTIVE ORIGINAL PAPER

PSYCHOLOGICAL PECULIARITIES OF ADOLESCENTS WITH SCOLIOSIS OF VARIOUS GRAVITY DEGREE

Afanasyeva Olga, Bober Stepan, Gyduc Tatiana
Children's Rehabilitation Center for Orthopedics and Traumatology 'Ogonyok', St. Petersburg, Russia.
E-mail: ogonek@zdrav.spb.ru
af.olga@bk.ru

Keywords: adolescent scoliosis, psychical changes

Aim and objectives

Scoliosis is, in fact, a chronic disease that has a significant impact on the human psyche, forms deficit development conditions, narrows the space of opportunities, changes the perception of the world, internal life, the nature of activity. Under the influence of a chronic disease, a special social situation develops, the biological conditions of activity change as well as the image of the future. The reactions of adolescents to the disease differ in their specifics. Typically, adolescents are burdened by the limitations imposed by the disease, respond sensitively to hospitalization and medical procedures. Chronic diseases in adolescents often lead to asthenization, neuroticism, the development of anxiety, stress, a decrease of self-esteem, behavioral disorders, problems in communication, and a decline in academic performance.

The most important sign of the adolescent period is a fundamental change in the sphere of self-awareness, which contributes to the development of the individual. Teenagers often ask themselves, 'What kind of self?', This forces them to look for the resources of their abilities, thereby contributing to the emergence of the 'I – image' with a set of ideas about themselves, their external and internal qualities. The study of the psychological characteristics of adolescents with scoliosis of varying severity, ideas about themselves, as a whole the 'I – image' of myself is relevant.

The purpose of the study

To determine the characteristics of the 'I – image' of adolescents with different degrees of scoliosis.

The study used extensive (observation, conversation, analysis of medical records), and intensive methods, including the following methods of psychological testing:

1. investigation of the state of emotional instability according to LI Vasserman;
2. the study of the level of self-relation according to VV Stolin and SR Panteleev;
3. studying the properties of the personality and its interpersonal relations according to C. Osgood;
4. a study of self-esteem by T. Dembo and S. Ya. Rubinshtein in the modification of A.M. Prikhozhan.

Materials и methods. The sample of the study was a group of adolescents aged 14–15 in the number of 40 people (20 of them have 10–25° Cobb's degree and 20–30° and more Cobb's degree of scoliosis). The study was conducted on the basis of the Children's Rehabilitation Center for Orthopedics and Traumatology 'Ogonyok'.

Results

These studies allow us to conclude that adolescents with scoliosis have the following specific features:

1. in adolescents with 30° and more Cobb's degree of scoliosis the strong-willed sides of the personality are more developed, they are self-confident, they tend to rely on their own forces in difficult situations, are less dependent on external circumstances and assessments, less anxious than peers with 10–25° Cobb's degree of scoliosis. This result indicates that despite the degree of the disease, adolescents are motivated to a positive outcome of the disease and believe only in their own strength on the way to recovery, are inclined to realize themselves as bearers of positive characteristics, are satisfied with themselves;
2. in adolescents with scoliosis of 30° and more Cobb's degree, the harmonious type of attitude to the disease dominates, for which a sober assessment of one's condition is characteristic, without the tendency to exaggerate its severity and without reason to see everything in a gloomy light, but without underestimating the severity of the disease, the desire to actively promote success of treatment;
3. the level of claims in the research group corresponds to an adequate representation of their capabilities in a realistic assessment of themselves;
4. low level of neuroticism testifies to emotional stability, positive background of experiences (calmness, optimism), initiative, self-esteem, independence, social courage, ease of communication;
5. adolescents with scoliosis respect themselves enough (high score on the 'succession', 'self-understanding', 'self-confidence' scales), believe in their own strengths, abilities, energy, independence, control their own life, are interested in themselves ('Self-interest' scale, 'The expected relationship from others'), which indicates the presence of an internal, undifferentiated sense of self-accepting.

The obtained data is of importance for the development of differentiated and complex programs of psychocorrection, the organization of psychological support of adolescents in the conditions of a health institution.

ABSTRACT OF PERSPECTIVE ORIGINAL PAPER

THE ADVANTAGE OF USING A DIFFERENTIAL ACUPUNCTURE TECHNIQUE IN COMBINATION WITH TRADITIONAL REHABILITATION METHODS FOR STOPPING THE PAIN SYNDROME OF VERTEBROGENIC GENESIS IN CHILDREN AND ADOLESCENTS

Zaltsman Polina
Children's Rehabilitation Center for Orthopedics and Traumatology 'Ogonyok', Saint-Petersburg, Russia
E-mail: ogonek@zdrav.spb.ru

Keywords: Vertebrogenic pain syndrome, differential acupuncture technique, acupuncture treatment.

Introduction

This research aims at analysing the effects of usage of the differential acupuncture technique on the pain syndrome of lumbosacral localization of vertebrogenic genesis in children and adolescents.

The advantage of its application in combination with traditional methods of rehabilitation in this pathology has been investigated.

Comparative analysis of the treatment results demonstrates that the most effective treatment proved to be exploiting the differentiated acupuncture technique which makes the pain syndrome stopped or significantly reduced in shorter terms.

Material and methods

One hundred twenty-seven patients aged from 8 to 18 years were observed and treated. All patients were divided into 2 groups – the main (87 children) and control (40 children). Patients of the main group were treated using the differential acupuncture technique in addition to generally accepted treatment (remedial gymnastics, massage, physiotherapy, medication). Acupuncture was not provided for patients of the control group. All patients were comparable in clinical manifestations of the disease.

The group of 87 children that were treated with the differential technique, was divided into two groups. Seventy-two were treated using only corporal acupuncture for the other 15 a combined method of corporal and auricular reflexology was applied. During the treatment, the age of the patient, the clinical manifestations of the disease (in particular, the pain syndrome) and the degree of their severity were taken into account as a matter of priority.

For the patients undergoing the treatment, the following orthopedic pathologies were diagnosed: degenerative-dystrophic changes in the lumbar spine, lumbosacral spine dysplasia, instability of the sacral spine, scoliosis of the spine.

For the statistic evaluation, the following detailed anamnestic data were used: date of lumbar spine degenerative-dystrophic changes detection, the age when the pain syndrome sprang up for the first time, the probable cause of it origination, the character of neural disorders history from their origination to date, dynamics of their manifestations and remissions.

To define the qualitative symptoms and their quantitative evaluation with graduation the clinical neurologic examinations of the patients were done twice in both groups (before and after the treatment). In addition, electroneuromyography examination (H – reflex, M – response), computer optical topography (COT) and thermal imaging diagnostics with analysis of thermograms of the spine and lower extremities were conducted. To improve the objectivity of the pain evaluation, apart from the verbal characteristic of pain, the patients' algesia was measured using the Visual Analog Scale (VAS).

The following principles of acupuncture points selection were applied:

1. the local points in lumbar region at the level of maximum pain, including those that located in close proximity to changed intervertebral disks, in other words, the points located in a projection of nidus or area of the clinical manifestation;
2. the points nearby the nidus (at the level of over- and underlying segments);
3. the segmental and remote points at lower extremities (with point selection options): along the tract extending above nidus; selected by "tract" dependence, that is, acupuncture points of the "tract" system which requires correction because its dysfunction is the core of the leading clinical syndrome; the acupuncture points of contralateral side.
4. the points of pain (out of the "tracts")

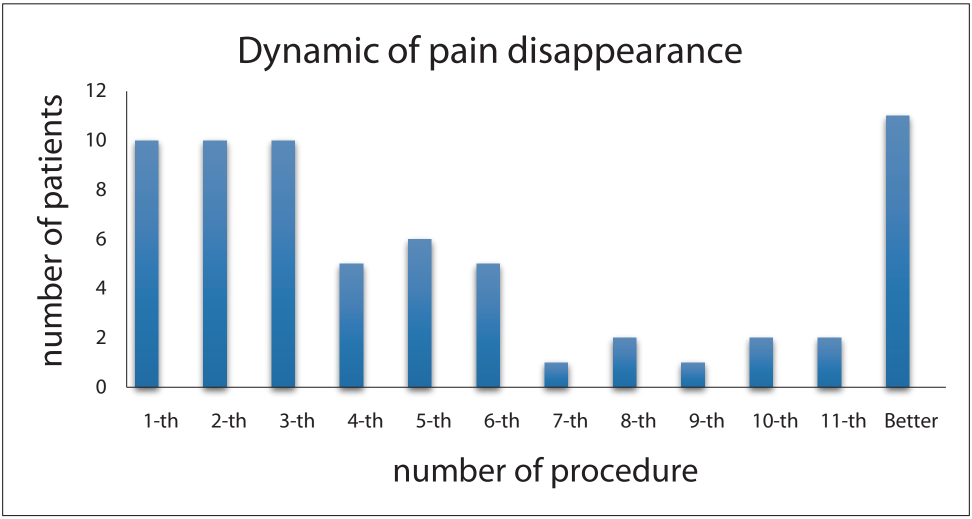
Points of a wide spectrum of action were used widely enough. To relieve the pain syndrome, the inhibitory method of variants I or II was used. In the case of sensitivity disorders, a stimulating method was applied.

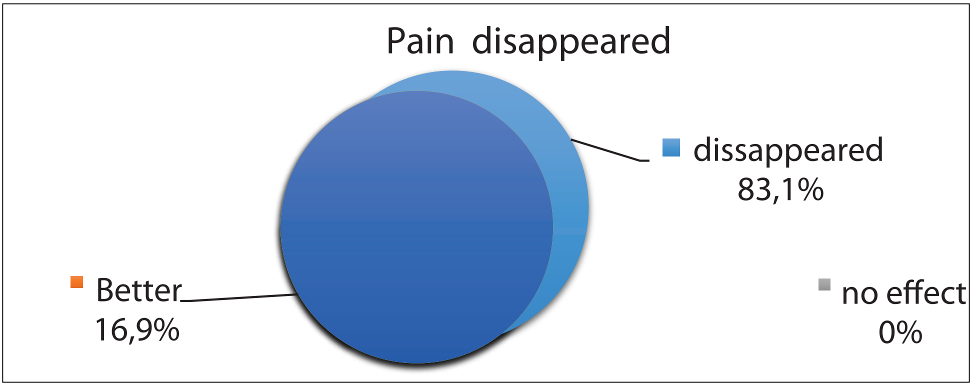
Exposure time for children was from 5% up to 70% of the conventional exposure in adults. The choice of exposure time depended on the age of the patient and the severity of the pain syndrome.

The interval of procedures depended on the severity of the pain syndrome. In the case of intensive pain, the procedures were conducted daily. As the pain subsided, intervals between procedures decreased. The numbers of procedures have been determining by the dynamics of neurologic disorders during treatment. The course of treatment consisted of no more than 12 procedures.

Results

The comparative analysis of the treatment results revealed that the most effective treatment is proved using differential acupuncture technique which made the pain syndrome reduced in significantly shorter terms. The pain syndrome in the main group disappeared at 3rd–27th day from the beginning of the treatment while in the control group it happened only at 23rd–55th day from the beginning of treatment.


Dynamic of pain disappearance
number of patients
12
10
8
6
4
2
0
1-th
2-th
3-th
4-th
5-th
6-th
7-th
8-th
9-th
10-th
11-th
Better
number of procedure


Pain disappeared
dissappeared
83,1%
Better
16,9%
no effect
0%

Professor Milan Bayer, MD, PhD on the right, on the letf Piet van Loon, MD as active participants of The 19th Prague-Lublin-Sydney-St. Petersburg Symposium, Medical House, Prague, 2017.

PROFESSOR MILAN BAYER, MD, PHD.

Prof. Milan Bayer, MD, PhD is a respected pediatrician in our country and abroad.

He has been dealing with metabolic osteopathies of childhood, pediatric gastroenterology and general pediatrics. In the 1990s, he became the chair of the newly established Section for Bone Metabolic Diseases of Children at the Pediatric Society of Czech Medical Association J.E. Purkynje. Later he was repeatedly elected by the Vice-chairman of the Society for Metabolic Diseases of the skeleton of CMA JEP, which is headed by Prof. Vladimir Palicka, MD, PhD, Dr.h.c. in recent years. He used to be a Chief of Children's Clinic of the University Hospital in Hradec Kralove between the years 2008 and 2015.

Prof. Bayer takes an active part in symposia organized annually by the Society for Connective Tissues of CMA JEP. We greatly appreciate many years of clinical collaboration, such as the comprehensive treatment of children with congenital osteogenesis imperfecta. He was one of the first in the Czech Republic to treat infants with heavy types of OI by infusions of bisphosphonates. This symptomatic treatment significantly influenced the course of OI, both the incidence of fractures and the severity of skeletal deformities.

A brief scientific curriculum vitae of Professor Milan BAYER, MD, PhD

Third Faculty of Medicine, Charles University
University Hospital Královské Vinohrady, Dept. of Children and Adolescents
Šrobárova 50, 100 34 Prague 10, Czech Republic

Birth Date, Place

July 18, 1956, Prague, Czech Republic

Education

1975–1981 Faculty of Pediatrics, Charles University, Prague
1984 Postgraduate specialisation in Pediatrics of I.st degree
1989 Postgraduate specialisation in Pediatrics of II.nd degree
1999 PhD
2011 Postgraduate specialisation in Clinical osteology

Teaching appointments

1989–1991 Lecturer in Pediatrics
1991–2002 Senior Lecturer in Pediatrics
2002–2007 Associate Professor of Pediatrics
2007 Professor of Pediatrics

Fields of scientific activity

Pediatric osteology; disorders of mineral metabolism, general pediatrics

Publications

- Author – Monograph "Metabolic skeletal diseases in childhood" (in Czech, Grada Publishing 2002, 340 pages)
- Editor-in-chief – Monograph "Pediatrics" (in Czech, Triton 2011, Prague, 1st ed., 350 p)
- Co-author – Monograph "Dictionary of Rheumatology". (2nd ed. Springer International Publishing Switzerland 2016, 357 pages)
- Other chapters in books and monographs 23
- Papers 179
- Editor-in-Chief of the journal Osteological Buillet since 1996

Honorary membership and awards

- Czech Pediatric Association Award 1994
- Czech Society for Metabolic Skeletal Disease and Novartis Award 1997
- Czech Pediatric Association Award 2002
- Czech Pediatric Association Award 2005
- Slovak Medical Society – Jessenius Award 2010
- Annual Price of Czech Literary Fund Foundation- category scientific and special literature 2012
- Honorary membership – Czech Society for Metabolic Bone Diseases 2016
- Honorary membership – Slovak Society for Osteoporosis and Metabolic Skeletal Diseaases 2016
- Bronze Medal of Medical Faculty of Charles University in Hradec Králové 2016

Dear Milan,

The committee of the Society for Connective Tissues CMA JEP grants you an honorary membership for your lifelong scientific work and care for paediatric patients. The award will be handed you over at the occasion of The 20th Prague-Lublin-Sydney-St. Petersburg Symposium, September 13th, 2018, Hotel Octárna in Kroměříž.

Allow us to wish you by name of the Society for Connective Tissues CMA JEP good health and subsequent success during your professional work.

Sincerely Yours

Ivo and Olga

Professor Ivo Marik, MD, PhD & **Olga Hudakova, MD, PhD**
Ambulant Centre for Defects od Locomotor Apparatus l.l.c
Olšanská 7, 130 00 Praha 3, Czech Republic
Tel. +420 222 582 214

Associate Professor Michael Bellemore, MD, PhD, A.M.F.R.A.C.S. with Professor Jaroslav Blahoš, MD, DSc., president of the Czech Medical Association J.E. Purkynje, 2007, Medical House, Prague

ASSOCIATE PROFESSOR MICHAEL BELLEMORE, MD, PHD, A.M.F.R.A.C.S.

Assoc. Prof. Bellemore has specialised in paediatric orthopaedic surgery for 30 years. He is on staff at the Children's Hospital at Westmead in Sydney, Australia and he is the director of a busy private clinical practice based at the Children's Hospital Medical Centre.

Dr. Bellemore is actively involved in undergraduate and postgraduate teaching. Under the auspices of the Australian Orthopaedic Association he is a supervisor of orthopaedic training and he has clinical academic appointments at the University of Sydney and The University of Notre Dame.

Dr. Bellemore has pioneered many paediatric orthopaedic endeavors in Australia including the use of ultrasonography in the management of DDH, Ilizarov limb lengthening and deformity correction, the Ponseti method of treating clubfeet, guided growth surgery and the use of the Fassier Duval telescopic nail in the treatment of children with osteogenesis imperfecta.

In 2011 and 2014 Dr Bellemore was honoured by his peers by being elected President of the Australian Paediatric Orthopaedic Society. In 2018 Dr Bellemore was awarded the Order of Australia for services to paediatric orthopaedic surgery and medical societies.

A brief scientific curriculum vitae of Associate Professor, Michael BELLEMORE, MD, PhD, A.M.F.R.A.C.S.

Department of Orthopaedic Surgery The Children's Hospital at Westmead Sydney, Australia
www.michaelbellemore.com
Email: mbellemore@michaelbellemore.com

Education

1977 M.B., B.S. (Hons) University of New South Wales
1985 Fellow Royal Australasian College of Surgeons

Appointments

1977–79	Surgical RMO, St Vincent's Hospital
1980	Orthopaedic Registrar Westmead Hospital, Sydney
	Clinical Lecturer, University of Sydney
1981–84	Orthopaedic Registrar Australian Orthopaedic Association, Sydney Board of Studies
1985	Clinical Fellow in Orthopaedic Surgery The Royal Alexandra Hospital for Children, Sydney
1985 – 86	Clinical Fellow in Orthopaedic Surgery, The Hospital for Sick Children, Toronto, Canada
1986 – 87	Orthopaedic Registrar, The Royal Bristol Hospital for Sick Children, Bristol, England
1987 – 89	Orthopaedic Surgeon, The Lewisham Institute of Sports Medicine
1987	Orthopaedic Surgeon, The Children's Hospital at Westmead
2003	Head of the Department of Orthopaedic Surgery, The Children's Hospital at Westmead

Fields of scientific activity

Orthopedic surgical treatment of children
Prolongation of long bones in children with congenital bone fractures

Membership of professional societies

Royal Australasian College of Surgeons
Australian Orthopaedic Association
Australian Paediatric Orthopaedic Society
Canadian Society of Orthopaedic Technologists (Life Member)
Australian Society for Limb Lengthening and Reconstruction
Australian Society of Orthopaedic Surgeons
Society of Connective Tissue of the CzMA JEP (Honorary member since 2007).

Associate Professor Michael Bellemore, MD, PhD, A.M.F.R.A.C.S. and Professor Ivo Marik, MD, PhD invited participants of The Human Biomechanics 2014, Techmania Science Center, Pilsen.

Academic awards

1970 Commonwealth Scholarship, University of New South Wales
1985 Zimmer Travelling Fellowship
1988 Inaugural Research Fellowship Australian Orthopaedic Association
1993 Diploma in Management for Clinicians
2003 Best Lecturer, Diploma of Child Health Course
2007 Honorary Membership of the Society for Connective Tissue of the CzMA JEP.

Michael Bellemore was at the birth of the international "Prague-Sydney Symposium" (Prague-Lublin-Sydney-St. Petersburg Symposium at present). The first Symposium was held in Sydney in 1999 with the participation of Prof. Kazimierz Kozlowski and Prof. David Sillence. At this Symposium he lectured again in 2001 and 2007.

He has been a member of the Editorial Board of the Locomotor Apparatus journal since 2001. He occasionally publishes in Locomotor Apparatus journal and we appreciate him as a valuable reviewer.

Dear Michael,

We high value your knowledge and experience in orthopedic surgical treatment of children with congenital malformations, particularly in the field of long bone prolongation and in the surgical treatment of children with osteogenesis imperfecta.

The Committee of the Society for Connective Tissues CMA JEP decided to appreciate your professional work and longtime cooperation by the Honorable Medal of Czech Medical Association JEP within the occasion of 20th Prague - Lublin - Sydney – St. Petersburg Symposium.

We sincerely wish you good health and next success during your medical praxis and university activities.

Sincerely Yours

Ivo and Olga

Professor Ivo Marik, MD, PhD & **Olga Hudakova, MD, PhD**
Ambulant Centre for Defects od Locomotor Apparatus l.l.c
Olšanská 7, 130 00 Praha 3, Czech Republic
Tel. +420 222 582 214

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Uchytil Jaroslav, MSc, PhD *(Ostrava, Czech Republic)*
Vasilevich Sergey, MD, PhD *(St. Petersburg, Russia)*
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Wilczyński Michal, MD *(Lublin, Poland)*
Zaltsman Polina, MD. *(St. Petersburg, Russia)*
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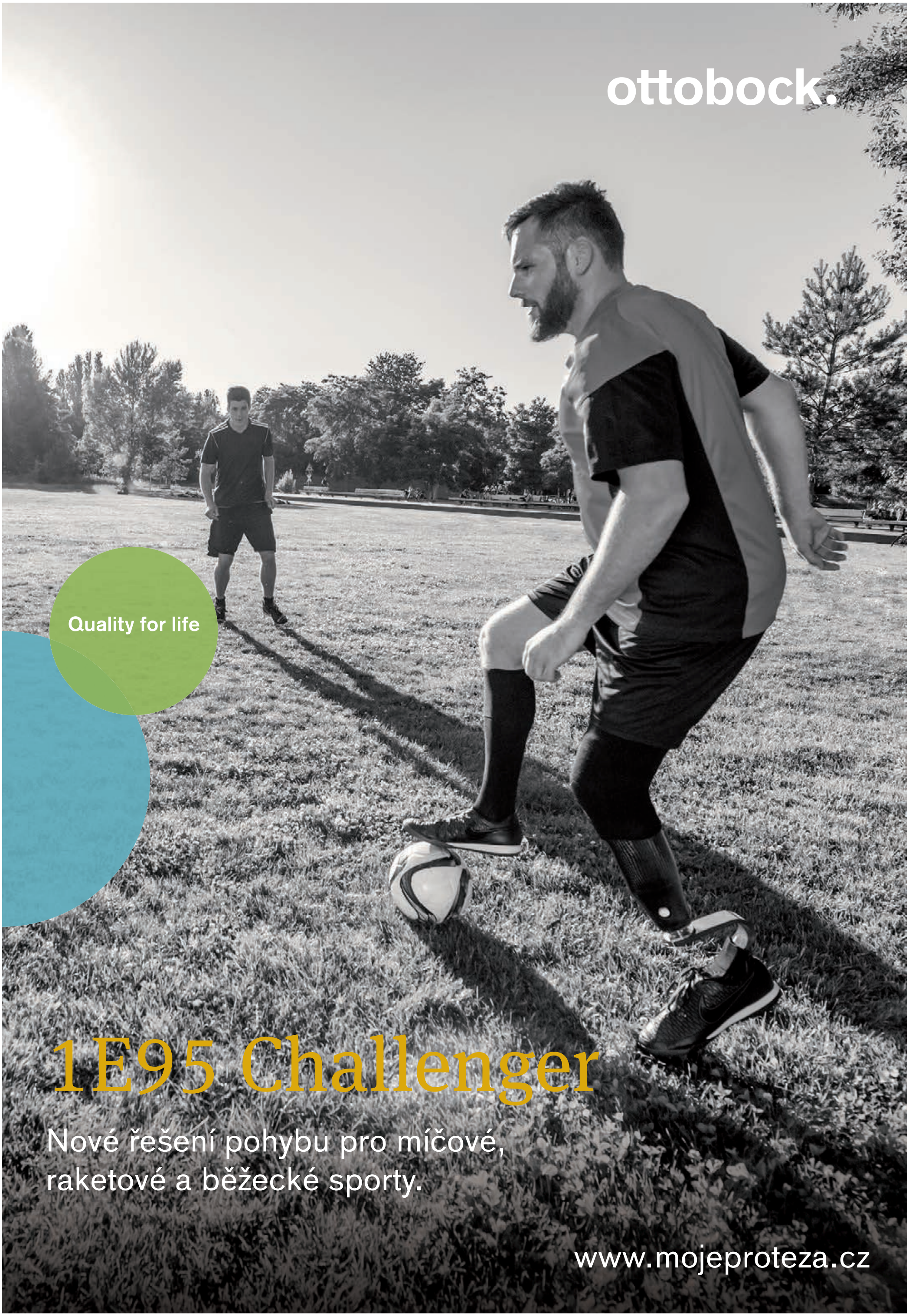
Żurakowski Wojciech, MD *(Krasnobród, Poland)*
Zwipp Hans, Professor, MD, DSc *(Dresden, Germany)*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