Perthes' disease and femoroacetabular impingement in a growing patient

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Perthes disease

- Legg-Calvé-Perthes disease (LCPD) is described as a condition of unknown aetiology affecting the development of femoral head where the vascularity of the femoral capital epiphysis is disrupted by yet undefined mechanism/theory
  - eg. coagulation abnormalities, femoral head blood supply, the ‘Predisposed’ child, attention deficit and hyperactivity disorder, trauma, hereditary or environmental influences
- with resulting epiphyseal osteonecrosis and chondronecrosis, followed by resorption of necrotic tissue, repairand by remodelling.

RamachandranM., Reed DV, Legg–Calvé–Perthes Disease of the Hip, Orthopaedics and Trauma, 2016, 30,6: 461-470, ISSN 1877-1327, https://doi.org/10.1016/j.mporth.2016.09.001.
Wainwrightan A.M., Catterall Anthony. Legg–Calvé–Perthes Disease in Children’s Orthopaedicsand Fractures, 2010, Springer, ISBN 978-1-84882-610-6

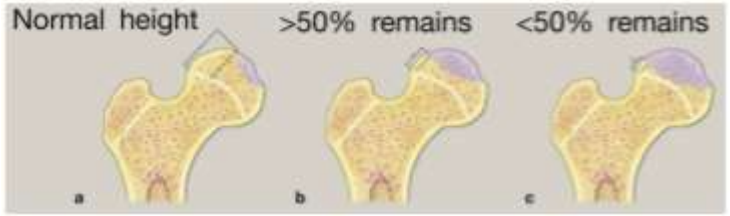
Classifications

Classification initial phase of disease

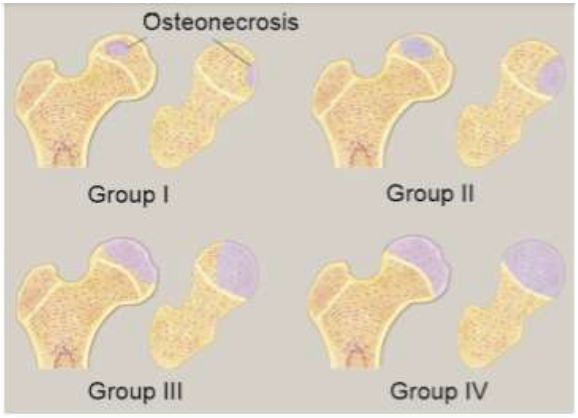
The Salter–Thompson classification

Fragmentation phase of disease

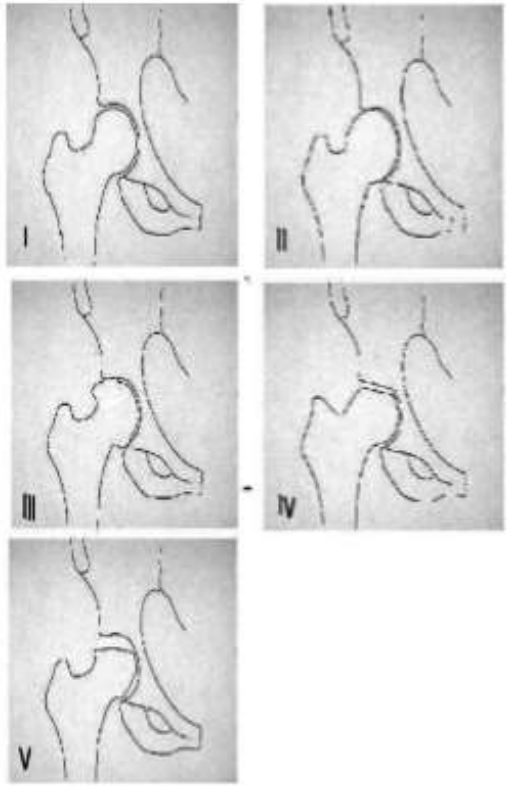
The Herring lateral pillar classification



The Catterall classification groups I–IV



Remodeling phase of disease



The Stulberg classification

Ramachandran, Manoj et al., Legg–Calvé–Perthes Disease of the Hip,Orthopaedics and Trauma, Volume 30, Issue 6, 461 – 470,

Treatment

- Conservative Treatment
  - Bed Rest
  - Physiotherapy
  - Pharmacological Treatment
- Containment Treatment
  - Weight-Bearing Abduction Braces
  - Femoral Varus Osteotomy
  - Valgus,Extension Femoral Osteotomy
  - Shelf Procedures
  - Hip Distraction
  - OtherProcedures
    - Cheilectomy, Arthrodesis, Arthroplasty

A large panEuropean study of treatment indications in Perthes disease [Hefti et al.] showed that the indications varied widely between surgeons and appeared to be based more upon personal experience than on scientific data.

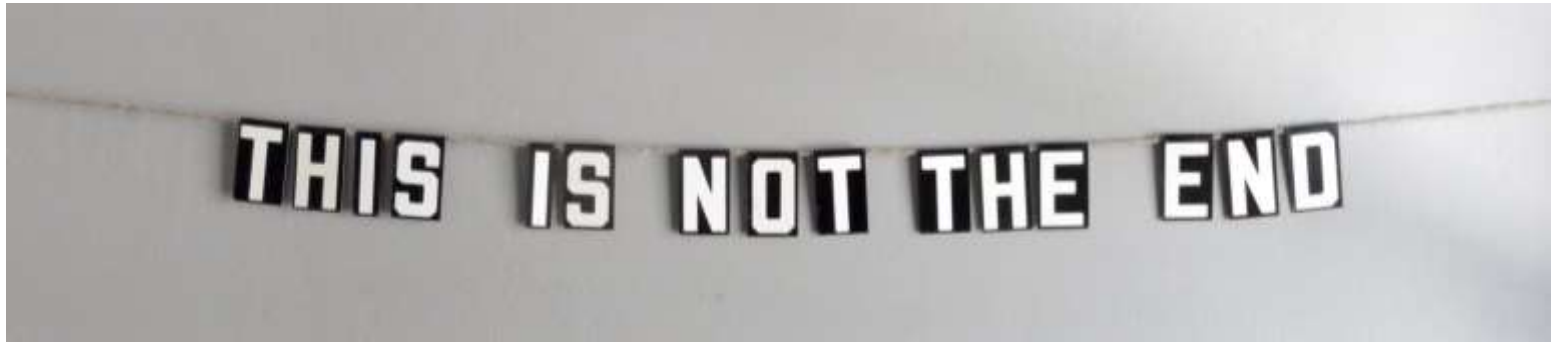
Varus femoral osteotomy

Radiograph of Salter innominate osteotomy

Radiograph of shelf osteotomy

Radiograph of distraction with external fixator

Hefti F, Clarke NMP. The management of Legg-Calvé-Perthes disease: is there a consensus? J Child Orthop 2007; 1:19–25.
Wainwrightan A.M., Catterall Anthony. Legg–Calvé–Perthes Disease in Children's Orthopaedicsand Fractures, 2010, Springer, ISBN 978-1-84882-610-6


THIS IS NOT THE END

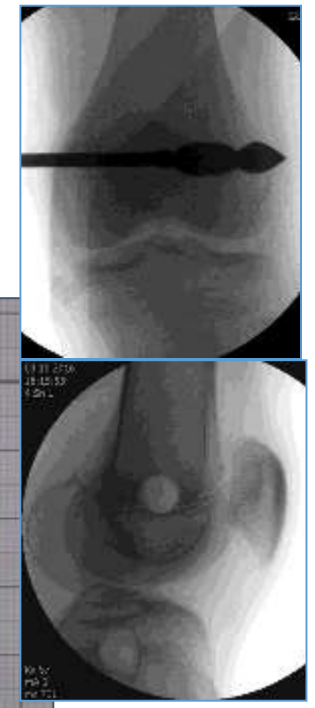
Unequal length LLB - miniinvasive growth control, Case 1

Morbus pseudo-Perthes l.dx., growth pattern type 3 (Shapiro 1982)

Bone age TW3 RUS 14,2 x calendar age 14 years

Hip X-ray - unequal limb length 2,4cm

Prediction of remaining growth: distal femur 1.5 cm, proximal tibia 0.7 cm



Epiphysiodesis of left distal femur – a modified technique by M. Macnicola, Edinburgh 1992

Case 2

- 2011/9 limping, 9years old boy
- 2011/9 diagnosis m.Perthes l.sin
- 2012/6 first consultation after AG coxae
  - Structural changes head (subluxation, aplanation,fragmentation) and femoral neck is shortened and enlarged
  - Rehabilitation, Atlanta brace, Aulin
- 2012/11 Catterall IV., Rehabilitation, Atlanta Brace walking
- 2013 design of Salter's and Varus Femoral OT
- 2014 Salter's and Varus Femoral OT with 20° IR recommendation, stage of late remodeling, left impingement
- 2015 consolidation of the previously fragmented head
- 2016 spa rehabilitation Bělohrad, grow acceleration, complete epiphysiodesis
- 2017 FAI surgery recomanded
- 2018 FAI surgery with ablation of external third of femur head
- 2019 1-1,5 cm, ↑ ROM, gait pattern, ↓↓ OA Risk

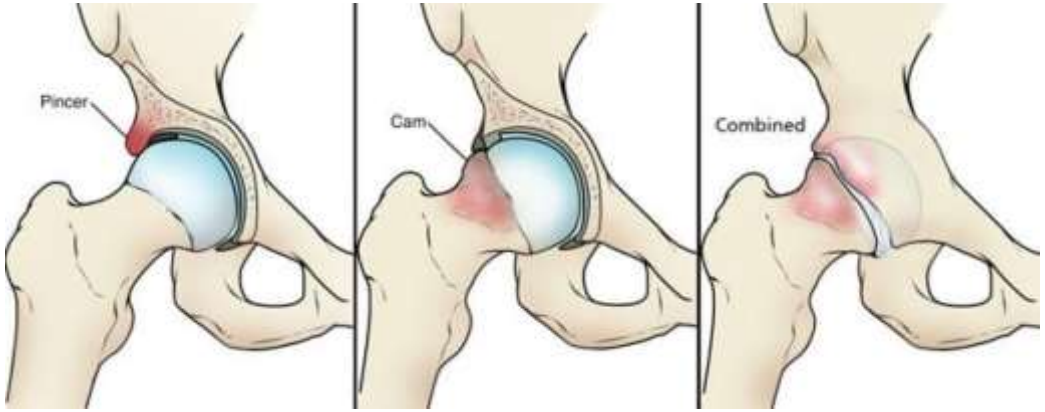
15 years old

6 month later

FEMOROACETABULAR IMPINGEMENT - FAI

- (FAI) syndrome a motion-related clinical disorder of the hip with a triad of symptoms, clinical signs and imaging findings. It represents symptomatic premature contact between the proximal femur and the acetabulum.
-

Recommended terminology	Terminology to be avoided
FAI syndrome	Asymptomatic FAI
Cam morphology	Symptomatic FAI
Pincer morphology	FAI morphology
	Deformity, abnormality or lesion when referring to cam or pincer morphology
Level of agreement: mean score 10 (95% CI 9.8 to 10)	

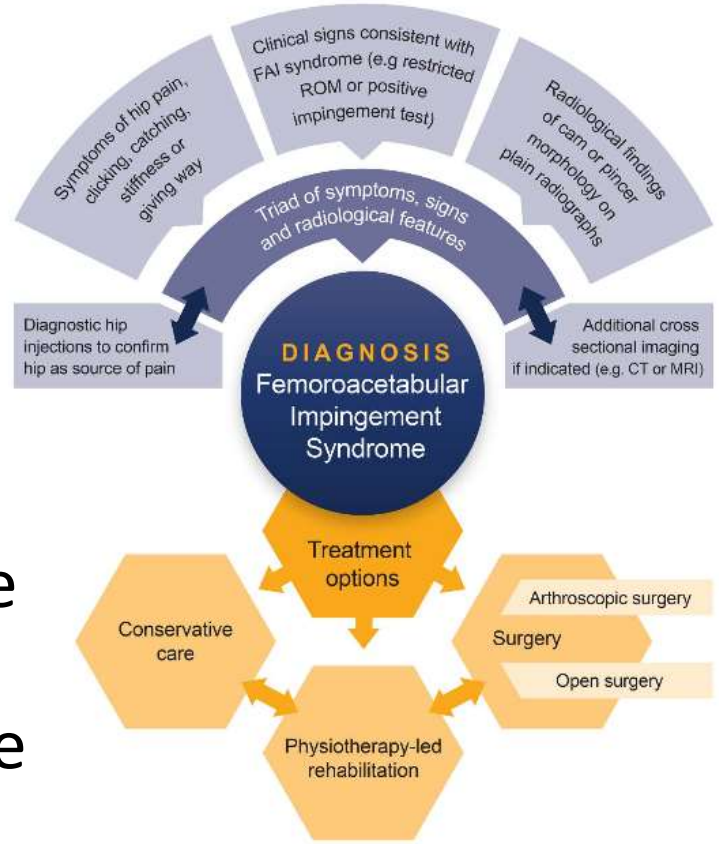


orthoinfo.aaos.org

Griffin DR, Dickenson EJ, O'Donnell J, et al. The Warwick Agreement on femoroacetabular impingement syndrome (FAI syndrome): an international consensus statement. Br J Sports Med 2016;50:1169–1176.

Treatment

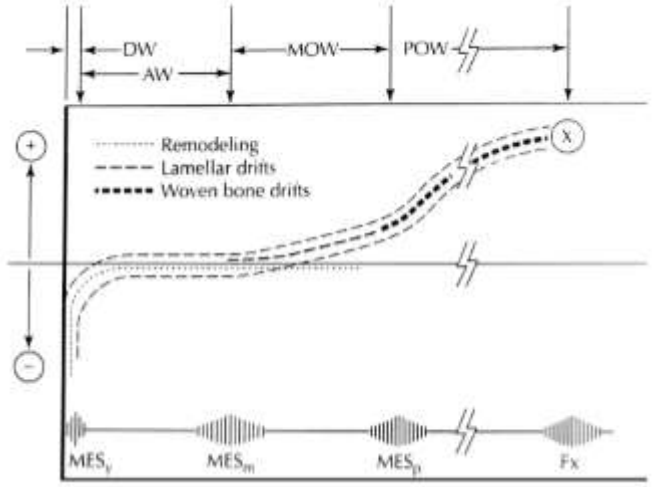
- Conservative care may involve education, watch fulwaiting, lifestyle and activity modification.
  - Physiotherapy
    - improve hip stability, neuromuscular control, strength, ROM and movement patterns.
- Surgery, either open or arthroscopic, aims to improve the hip morphology and repair damaged tissue. The good management of the variety of patients with FAI syndrome requires the availability of all of these approaches.
- Level of agreement: mean score 9.5 (95% CI 9.0 to 10).



Griffin DR, Dickenson EJ, O'Donnell J, et al. The Warwick Agreement on femoroacetabular impingement syndrome (FAI syndrome): an international consensus statement. Br J Sports Med 2016;50:1169–1176.

Can we find the similarities

- The similarities are hidden in morphology
- The similarities are hidden in formative bone effect according to Wolf's law (“Utah paradigm of skeletal physiology”)
- Optimal development / remodeling of the hip joint.[8]
- Symptoms
  - Pain, ROM , Shorteness, Limping
- Osteorathritis



Frost HM, A 2003 Update of Bone Physiology and Wolff's Law for Clinicians. The Angle Orthodontist: 2004, 74, 1: 3-15.
Kolář,P et al. Clinical rehabilitation. [translation Vanda Andelova]. - 1st ed. - Praha : Alena Kobesová, 2013. ISBN 978-80-905438-0-5
Frost HM. Strain and other mechanical influences on bone strength and maintenance. C u r r O p i n Orthop. 1997;8:60–70).

Rahabilitation / physiotherapy

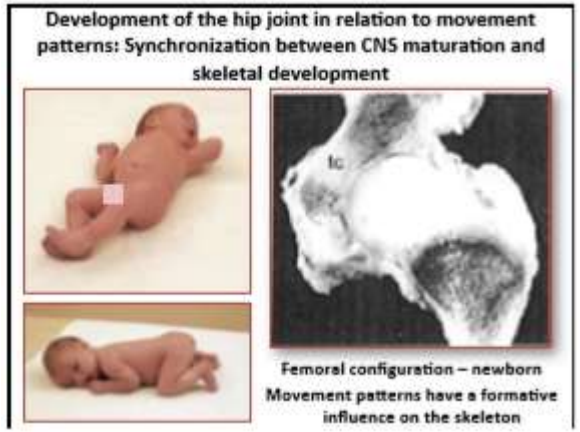
- There is a paucity of evidence on rehabilitation/ physiotherapy during conservative care, during remodelation phases and as well as postoperative rehabilitation

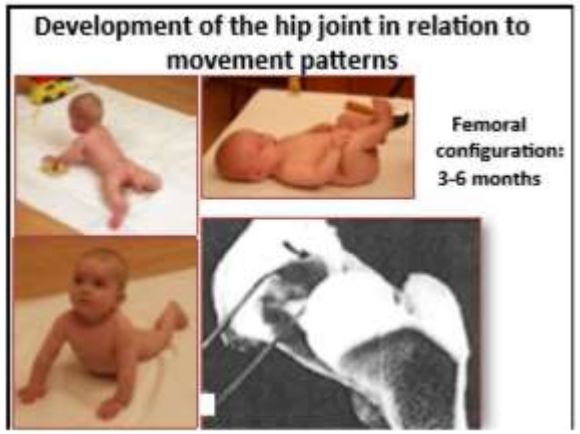
- If such studies exist, they are mostly limited to reduce pain, increasing/maintaining the range of motion and increasing/maintaining muscle strength [3,4,5].

- We did not find any study would discussed/explores rehabilitation as a positive formative effect on hip joint structures (bone, soft tissues) containment

The databased used for search were MEDLINE (OVID interface,1948 onwards), EMBASE (OVID interface, 1980 onwards), the Cochrane Central Register of Controlled Trials (Wiley interface, current issue) Science Direct (Elsewier interface) and Spiringerlink (Suweco).

No evidence based , but lot of practice knowledge






Wolff's Law and bone's structural adaptations to mechanical usage: an overview for clinicians


A 2003 Update of Bone Physiology and Wolff's Law for Clinicians

Harold M. Frost, BA, MD, DrSc

We have a knowledge, we have a practice…

Know we need Evidence….

Marcela Šafářová, Ph.D archiv

Methods with possible positive formative „Containment „ effect on hip joint structures

- There is possibility to use physiotherapy techniques based on concepts on the neurodevelopmental basis (e.g. NDT[7], DNS[8], PNF[9], Vojta[10])
- These techniques use :
  - Body position
  - Direction of movement
  - Load
  - Pressure and thrust.

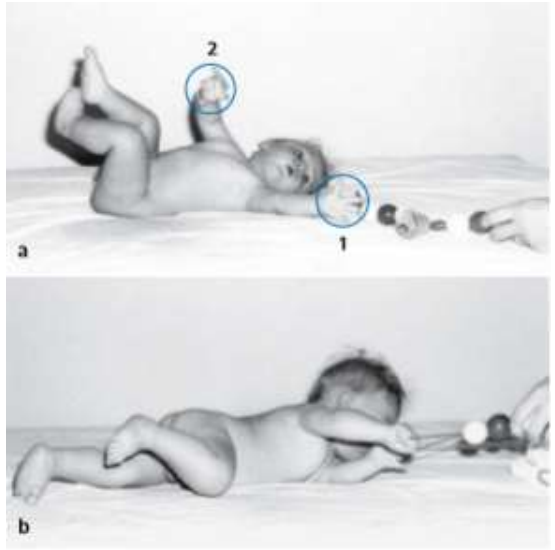
- Therapies that can improve both morphotype and cartilotype

Hogervorst T. et al. Hip Ontogenesis: How Evolution, Genes, and Load History Shape Hip Morphotype and Cartilotype. 2012, Clin Orthop Relat Res (2012) 470:3284–3296
DOI 10.1007/s11999-012-2511-4

Maturation and skeletal development

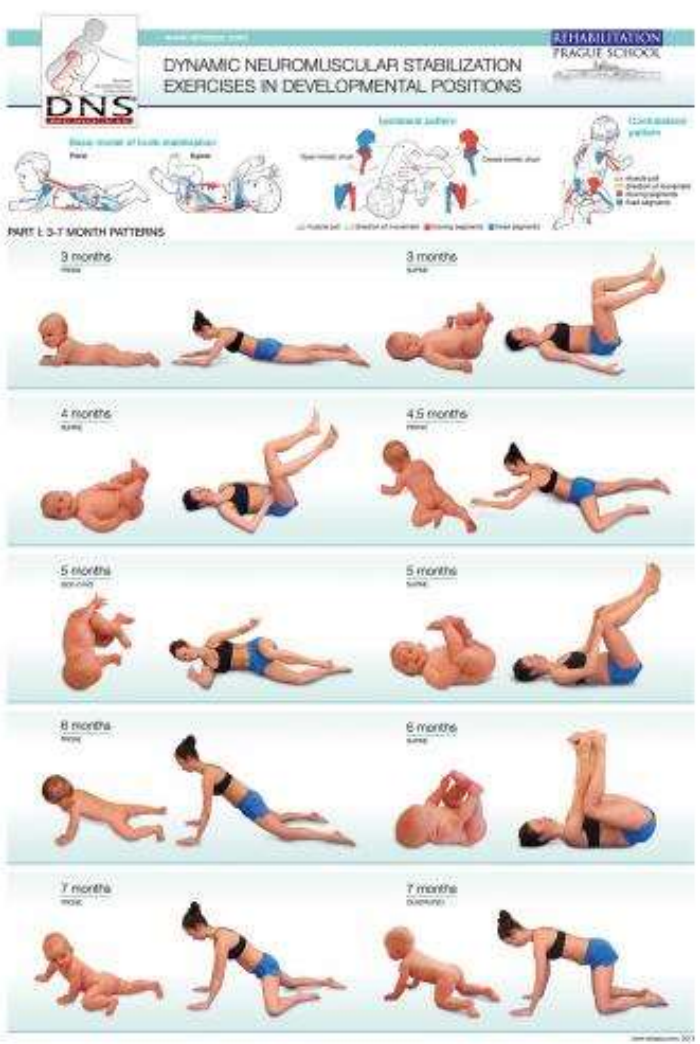
The Function Forms an Organ

Rolling pattern

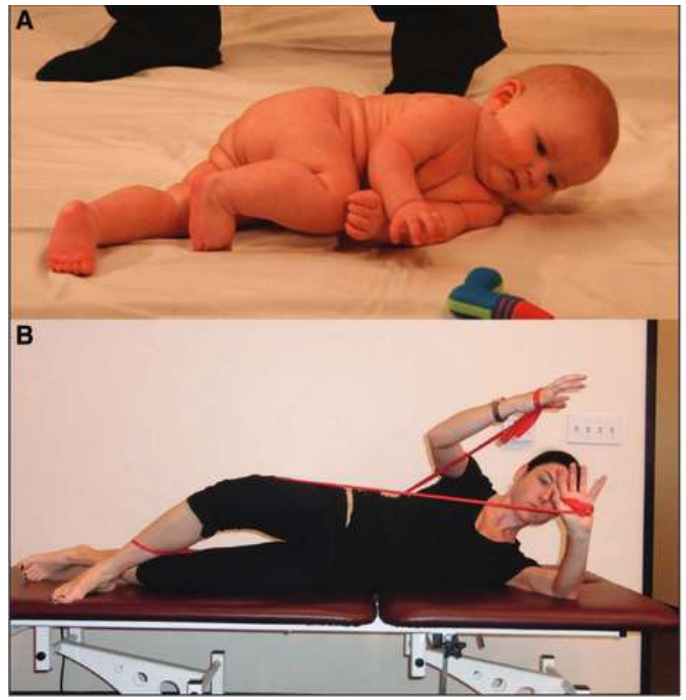


Vojta, Václav & Peters, Annegret. (2007). Das Vojta-Prinzip: Muskelspiele in Reflexfortbewegung und motorischer Ontogenese. 10.1007/978-3-540-46524-9.

DNS exercises

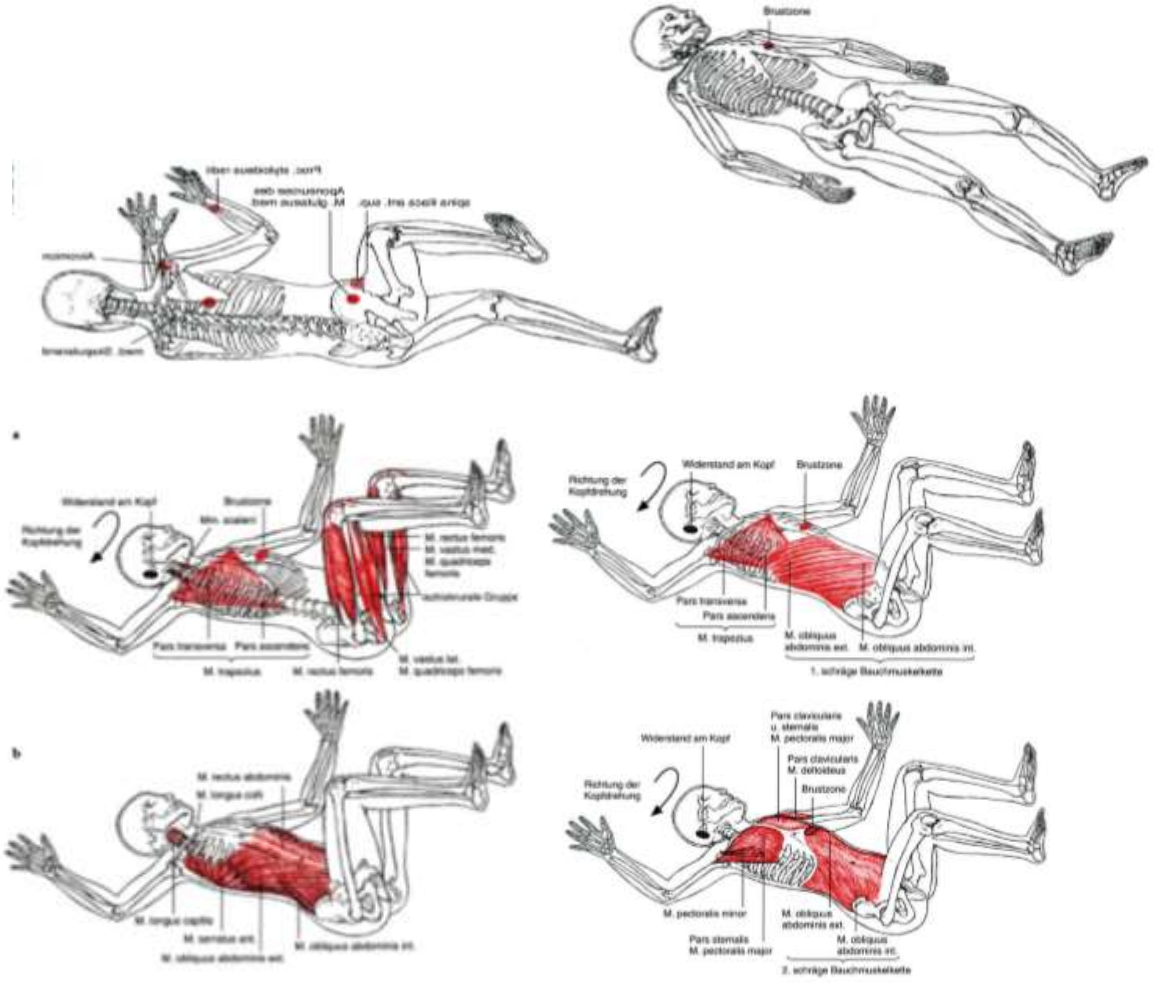


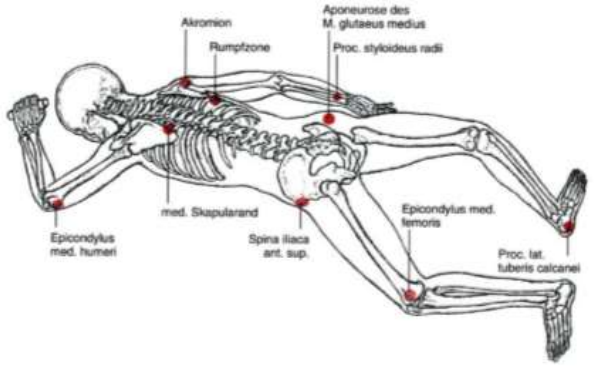
Rolling pattern

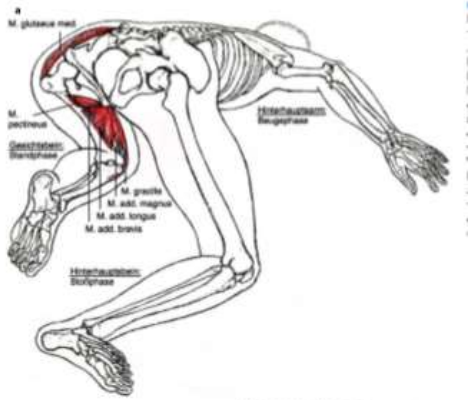


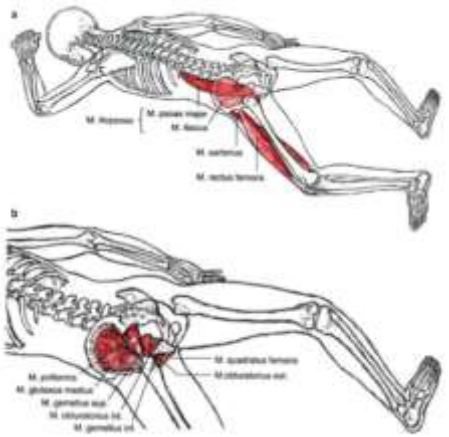
Frank C, Kobesova A, Kolar P.Dynamic Neuromuscular Stabilization & Sports Rehabilitation, Int J Sports Phys Ther. , 2013 Feb;8(1):62-73
http://www.rehabps.com/REHABILITATION/Posters.html

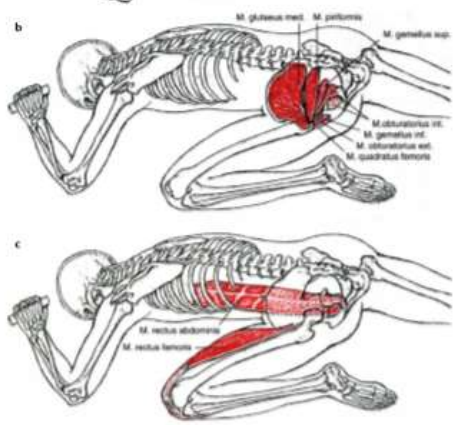
Vojta therapy









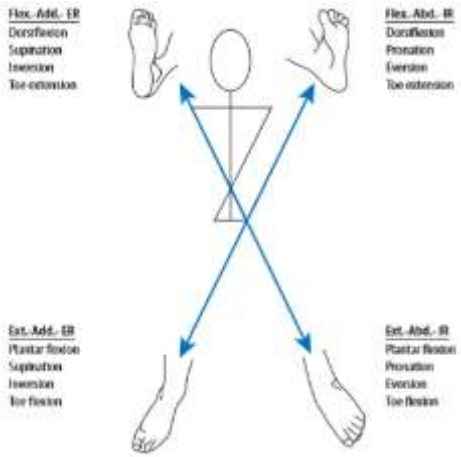


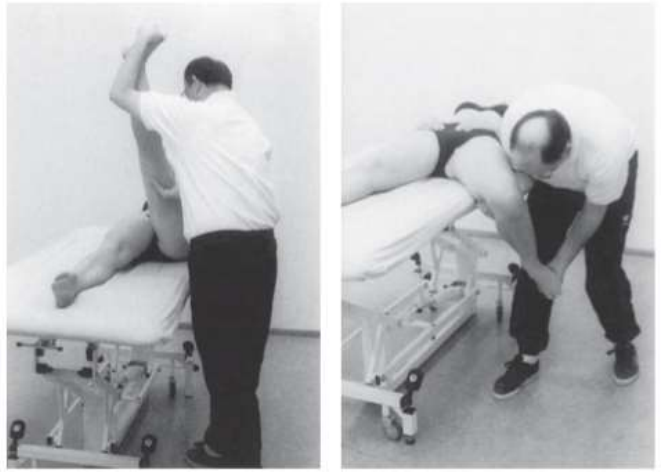
Use of reflex turning /creeping in childs /adults

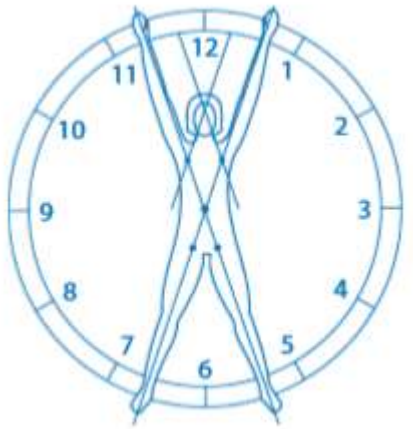
Vojta, Václav & Peters, Annegret. (2007). Das Vojta-Prinzip: Muskelspiele in Reflexfortbewegung und motorischer Ontogenese. 10.1007/978-3-540-46524-9.

Vojta.com

Proprioceptive neuromuscular facilitation







Knott M,Voss DE.Proprioceptive Neuromuscular Facilitation:Patterns and Techniques.New York,NY:Paul B Haeber;1956:1-113.
Adler, S.S. & Beckers, D & Buck, M. (2008). PNF in practice: An illustrated guide. PNF in Practice: An Illustrated Guide. 1-299. 10.1007/978-3-540-73904-3.

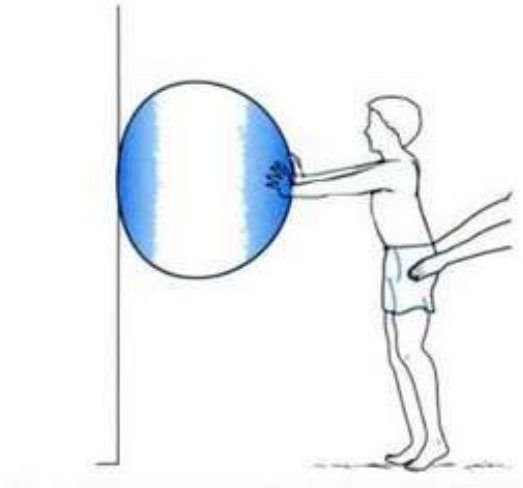
Bobath = NDT (Neuro-development Treatment)

Hip abduction cotrol

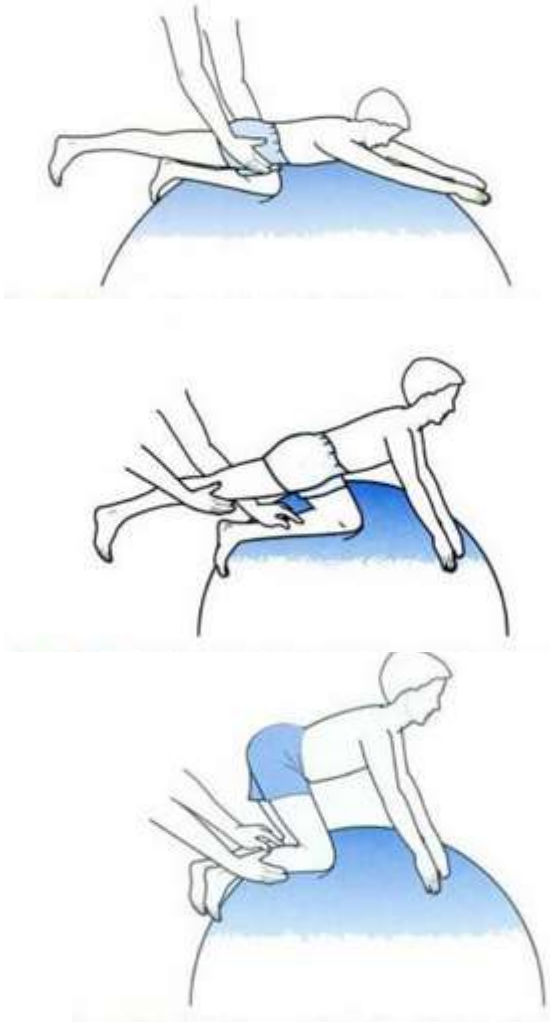
Triceps surrae activation

Facilitation of left single leg stance

Pushing hand activities



Rolling facilitation

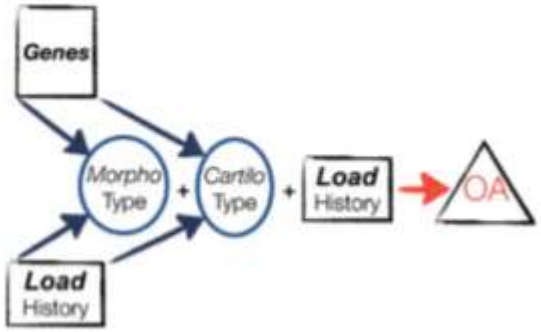


Maintaining three point on the ball

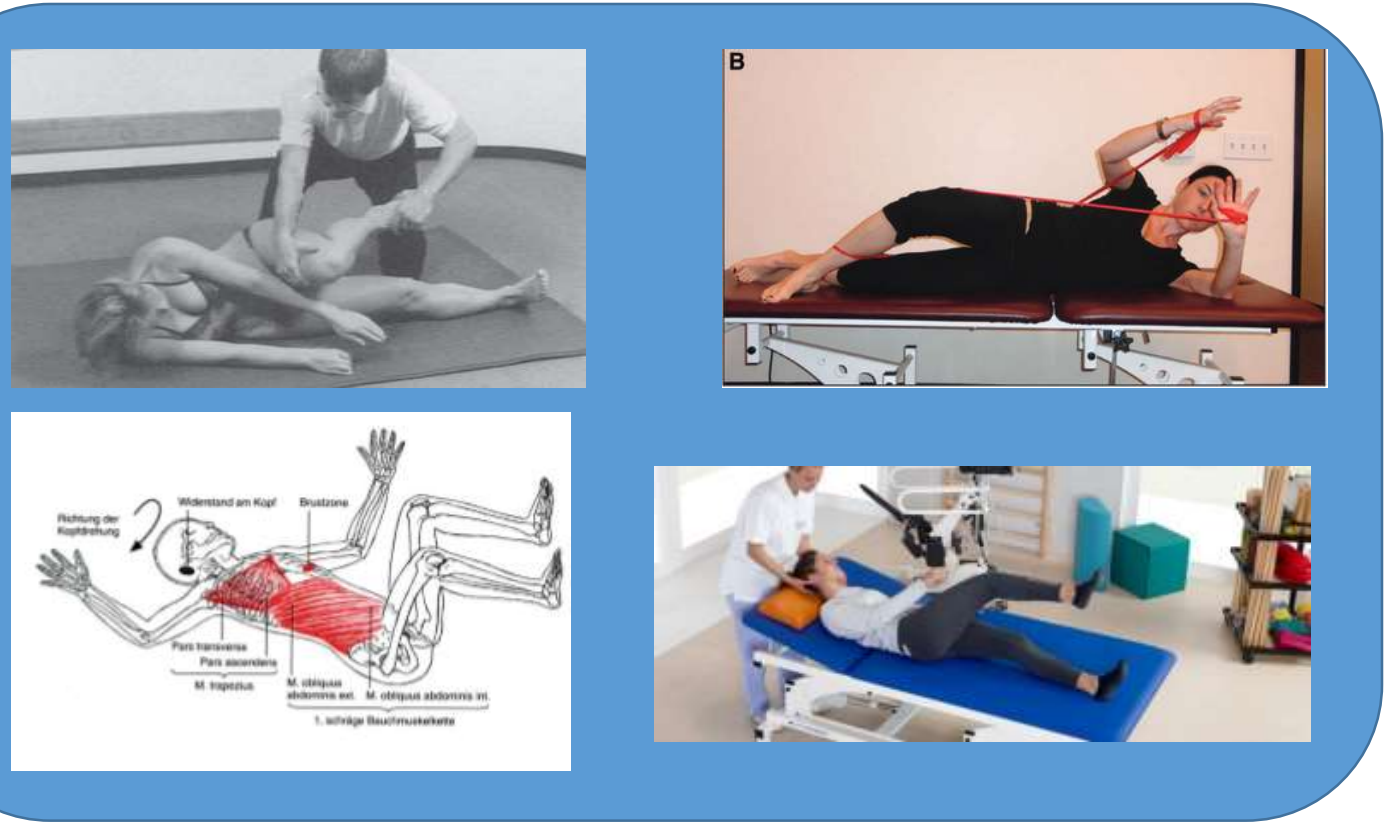
The Bobath Concept: Theory and clinical practice in neurological rehabilitation / edited by Sue Raine, Linzi Meadows, Mary Lynch-Ellerington.
Tecklin J. S. Pediatric physical therapy 2015 Publisher Lippincott Williams & Wilkins, a Wolters Kluwer business Pub ,Baltimore, MD Edition Fifth edition ISBN-10 1451173458
Bierman JC, Franjoine MR, Hazzard CM. Neuro-Developmental Treatment: A Guide to NDT Clinical Practice, Thieme Publishers Stuttgart, 2016, ISBN 978-3-13-201321-8

Conclusions and disscusion

- Education, screening, and early treatment programs
- Containment therapy
- OA prevention



We need therapies that can improve both morphotype and cartilotype…
We need optimal load pressure trust



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DOI 10.1007/s11999-012-2511-4

Thank you for atention !!!

The above material is certainly not the ‘‘whole thing’’ (‘‘no matter how much we know now, there is always more’’), but it provides a good foundation on which to build. The prospect seems so exciting that I wish I could begin my career a new and help that building. But age and other factors indicate that this cannot be.

Harold M. Frost, BA, MD, DrSc 2003

Frost HM, A 2003 Update of Bone Physiology and Wolff's Law for Clinicians. The Angle Orthodontist: 2004, 74, 1: 3-15.