The 27th February 2016 Tartu, Estonia

Preventing Low Back Pain in Sports

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Cert. Sports Physiotherapist OMT

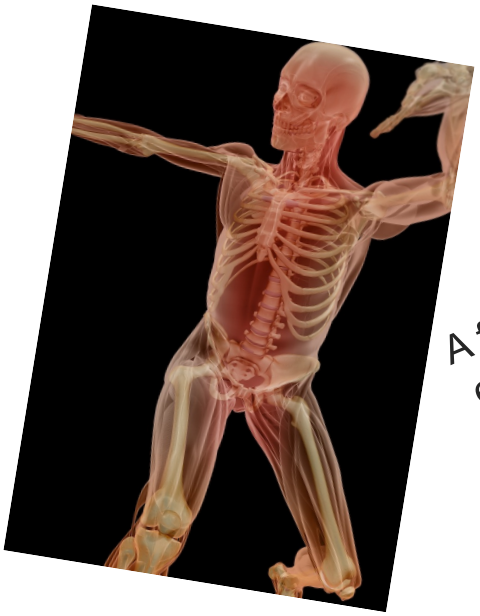
The Finnish Sports Physiotherapists Association, FSPA

Athletic low back pain is primarily a movement quality and control problem

Prof. Philip Glasgow: Prevention – Mission Possible 2015, Helsinki Finland

- Efficient sporting movement requires effective storage and release of energy through the elastic recoil of myotendious and fascial tissues.
- Failure to utilise this highly efficient system during repetitive high and low load movements can result in *reduced performance* as well as *increased mechanical loading* of the spine.

Prof. Philip Glasgow: Prevention – Mission Possible 2015, Helsinki Finland



A functional pelvis is essential for almost every functional task.

Phys Med Rehabil Clin N Am. 2016 Feb;27(1):237-317. doi: 10.1016/j.pmr.2015.08.005.

Malalignment Syndrome in Runners

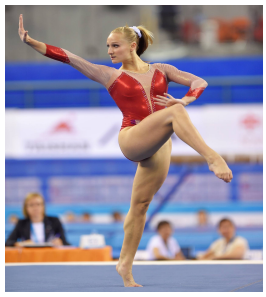
Schamberger W.
Division of Physical Medicine and Rehabilitation, Faculty of Medicine, University of BC, Vancouver, Canada

More than 80% of runners are out of alignment. The standard back examination should include assessment of pelvic alignment. An awareness of pelvic malalignment and the the malalignment syndrome is essential to allow one to provide proper care of a runner. The 3 most common presentations usually respond to a supervised, progressive treatment program. The validity of any research into the biomechanics of running should be questioned if the study has failed to look at whether pelvic malalignment was present and whether the altered, asymmetrical biomechanical changes attributable to the malalignment itself could have affected the results of the study.

Prevalence

- Low back pain is **highly prevalent** in gymnasts and multiple epidemiologic studies and reviews have documented this with prevalence ranging from:

  ➔ 25% to 85%



  - D.Kruse, B. Lemmen, Curr. Sports Med. Rep., Vol. 8, No. 1, pp. 20Y28, 2009
  - Caine D, Nassar L. Gymnastics Injuries. In: Epidemiology of Pediatric Sports Injuries. Caine DJ, Maulli N, eds. Individual Sports. Med Sport Sci. Basel, Karger. 2005

- United Kingdom / artistisc gymnastiscs ≈ 10 %
  - Personal communication; Dr Chris Tomlinson | Senior Sports Physician/Chief Medical Officer British Gymnastics, 2015

LOW BACK PAIN IN YOUNG TEAM SPORT PLAYERS: A RETROSPECTIVE STUDY

- A retrospective cross-sectional study.
- Finnish female & male basketball, floorball, ice hockey and volleyball teams, 22 teams, 464 young players (16±1.9 years)
- Prevalence of LBP provided by a standardized Nordic questionnaire. LBP was defined: ache, pain or discomfort of lumbar region with or without radiation to one or both legs.
- 255 (54.9 %) of all players had suffered LBP during the previous year. 73 (15.7 %) had received medical attention for LBP
- 80 (17.2 %) reported missing training because of LBP. Male players had more time-loss from training due to LBP than females.
- LBP is a relatively common complaint in young team sport players.

K.Pasanen et al. ; *Br J Sports Med* 2014;**48**:651 doi:10.1136bjsports-2014-093494.242

Prevalence of low back pain in children and adolescents: a meta-analysis

- The purpose of this research was to examine, by means of a meta-analytic investigation, the prevalence rates of LBP in children and adolescents.
- The most recent studies showed higher prevalence rates than the oldest ones, and studies with a better methodology exhibited higher lifetime prevalence rates than studies that were methodologically poor.

- Inmaculada Calvo-Muñoz, Antonia Gómez-Conesa, Julio Sánchez-Meta ; BMC-Pediatrics 2013

Sport specific considerations

- There are many different **body positions** required in the artistic gymnastics that are **relevant to back injury:**
  - **Take-off**
  - **Rebounding**
  - **Landing**
  - **Dismounts**

- Large amount of force is translated along the axial spine

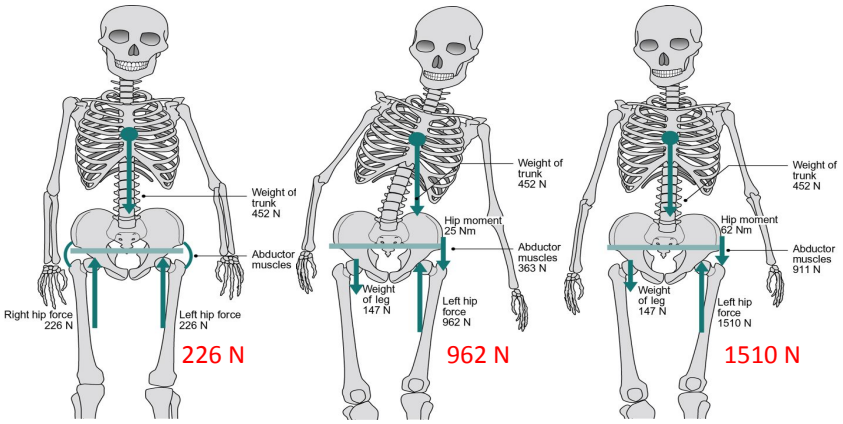
Jackson DW, Wiltse LL, Cirincoine RJ. Spondylolysis in the female gymnast.Clin. Orthop. Relat. Res. 1976; 117:68Y73.
Jackson DW, Wiltse LL, Dingeman RD, et al. Stress reactions involving the pars interarticularis in young athletes.Am. J. Sports Med. 1981; 9: 304Y12.

Sport specific considerations

- Take-off / backward somersault / vertical forces
  - **3,4 - 5,6 x the bw**
- Achilles tendon / force generated / backward take-off
  - **max. 16 x bw**

Bruggeman GP. Biomechanics in gymnastics.Med. Sport Sci . 1987; 25: 142Y76.

Load transfer



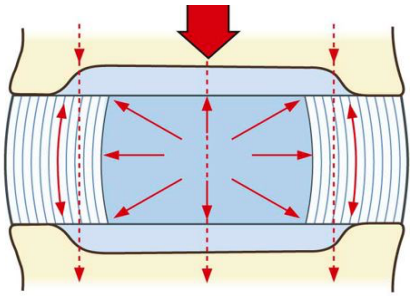
Levine D., Richards J., Whittle M.W., *Whittle's Gait Analysis – 5th Edition*. Churchill Livingstone Elsevier, 2012

- Stress fractures of the pars interarticularis
  - **initially** thought to be **congenital**
  - probably an **acquired overuse injury**
    - Wiltse LL, Widell, Jackson DW. Fatigue fracture: the basic lesion in isthmic spondylolisthesis. J Bone Joint Surg [Am] 1975;57:17–22
- Occurs in **young** sportspeople
  - episodes of hyperextension
  - combined with

    rotation

P.Brukner & K.Khan's Clinical Sports Medicine, Fourth Edition, ISBN-13: 9781121595132, 2013

Discus intervertebralis

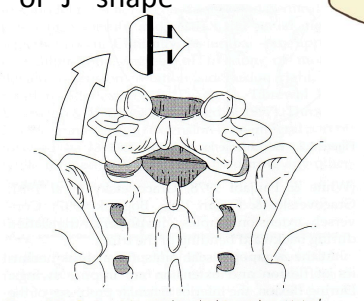


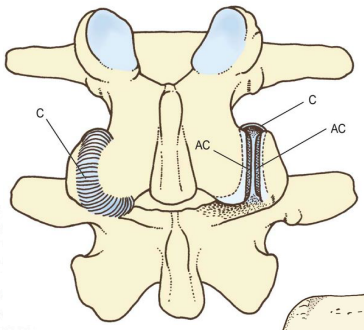
- Pressure in NP +
- Tension in AF +
- Expanding of the NP is reduced
- Nuclear pressure is transfered to endplates
- Load on NP ja AF
- Load transmission through endplates downward

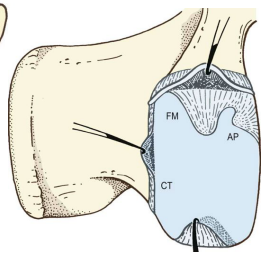
Bogduk, Nikolai. *Clinical and Radiological Anatomy of the Lumbar Spine E-Book, 5th Edition*. 2012, Churchill Livingstone, e ISBN 9780702051661

Zygapophyseal - joints

- C - joint capsule
- AC - artic.cartil.
- Sagittal
- Flexion, extension
- C – or J - shape

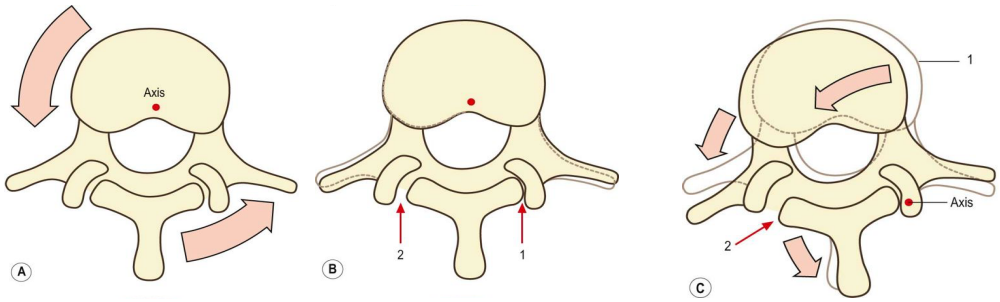






Bogduk, Nikolai. *Clinical and Radiological Anatomy of the Lumbar Spine E-Book, 5th Edition*. 2012, Churchill Livingstone, e ISBN 9780702051661

The mechanism of left axial rotation of a lumbar intervertebral joint.



Bogduk, Nikolai. *Clinical and Radiological Anatomy of the Lumbar Spine E-Book, 5th Edition*. 2012, Churchill Livingstone, e ISBN 9780702051661

Fatigue failure

- If the segment **rotate beyond 1.5°**
  - ➔exhibit failure after 2000 or 3000 reps
  - ➔ in some cases after 200–500 reps
- **Failure occurs:**
  - **fractures** of the facets, laminae, vertebral bodies
  - **tears** in the anulus fibrosus, zygapophysial joint capsules

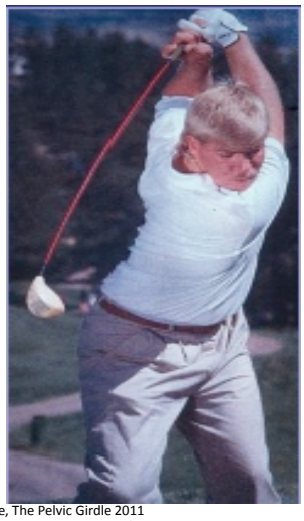
Bogduk, Nikolai. *Clinical and Radiological Anatomy of the Lumbar Spine E-Book, 5th Edition*. 2012, Churchill Livingstone, e ISBN 9780702051661

Thorax – The missing link?

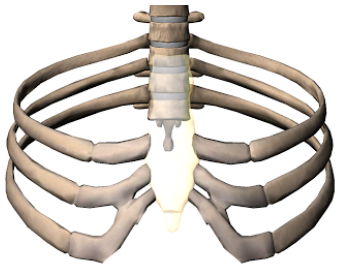
Thorax is the Centre of Trunk Rotation

- 6-22º rotation / segment
- 4-6º flex-ext / segment
  - Compare to **1-3º** of rotation /lumbar region
- Thoracic spine - largest region of the vertebral column
- Thorax is not stiff!

Thoracic Ring

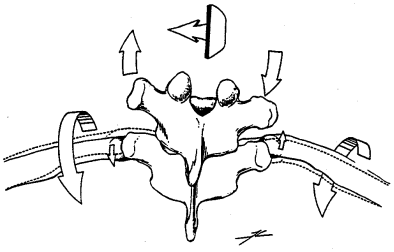


- 13 joints per typical thoracic ring = 136 joints that move – but how?



Diane Lee, The Pelvic Girdle 2011
Diane Lee; Discover the Role of the Pelvis in Whole Body Function 2012

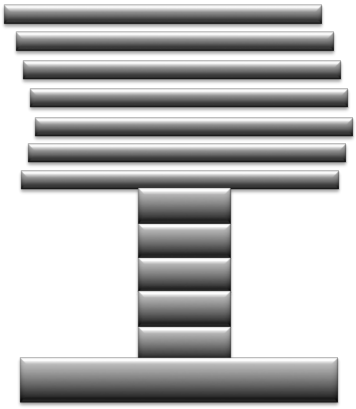
Left rotation biomechanics



Vertberal rotation left

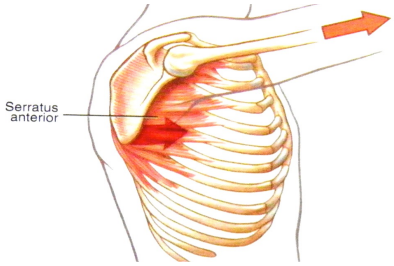
Left rib ➔ posterior / superior
Right rib ➔ anterior / inferior

Ring dance!

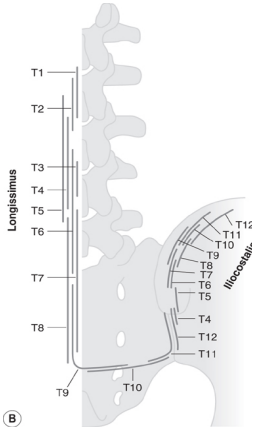


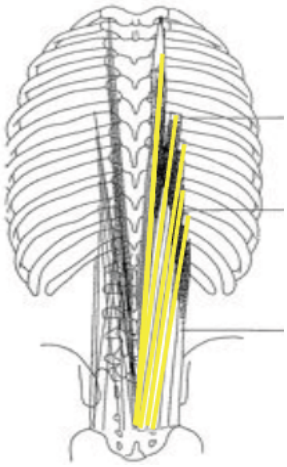
Left Rotation -> Right Ring Translation

Diane Lee, The Pelvic Girdle 2011
Diane Lee; Discover the Role of the Pelvis in Whole Body Function 2012

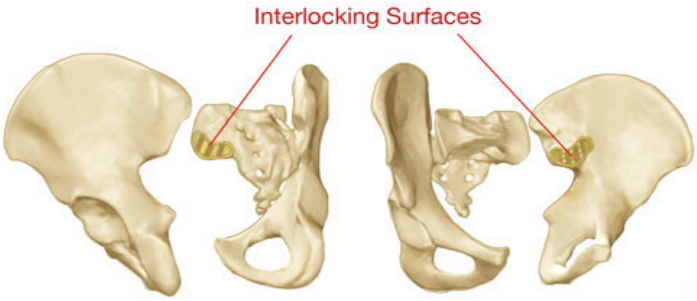


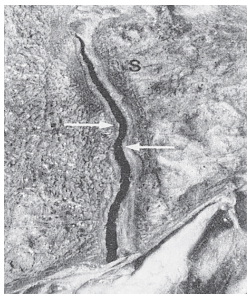
- Ilicostalis
- Longissimus
- Serratus anterior
- Oblique external



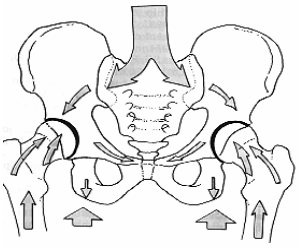


Form closure





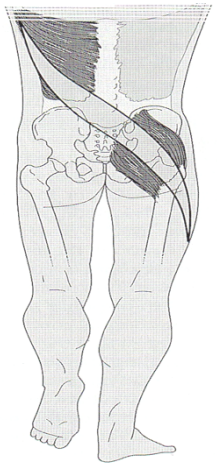
- Lining of the joint surfaces
- Incongruence of the joint surfaces



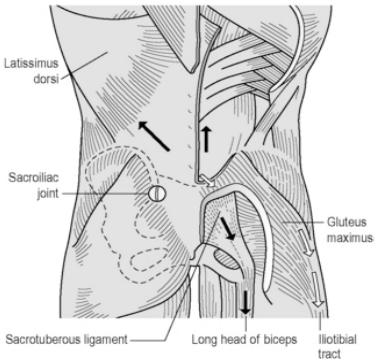
Diane Lee, The Pelvic Girdle 2011

Clinical Application of Neuromuscular Techniques; L.Chaitow, J.DeLany, Churchill Livingstone Elsevier 2011

Force closure



The extra forces increase articular compression, and thus friction between the joint surfaces (Vleeming et al 1989, Vleeming et al 1989) and also increase the joint's stiffness (stiffness = force/resultant displacement or distance).



Diane Lee, The Pelvic Girdle 2011

Feed forward

- Both the deep and superficial muscle systems work synergistically (coactivate) to prepare the body for loads by:
  - Increasing the intra-abdominal pressure
  - Fine-tuning the segmental stiffness of the intervertebral, intrapelvic and the hip joints, prior to the activation of the superficial system
  - (Hodges & Cholewicki 2007)

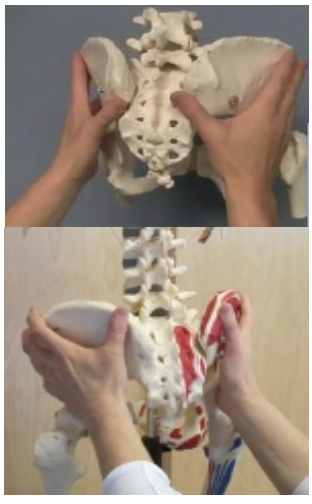
Diane Lee, The Pelvic Girdle 2011

…Feed forward

- Such that the large moments exerted by the powerful superficial muscles result in:
  - Evenly distributed transference of load;
  - Maintenance of optimal axes of rotation for each joint in the kinetic chain; and a
  - Uniform motion of the entire spine (Hodges & Cholewicki 2007)

Diane Lee, The Pelvic Girdle 2011

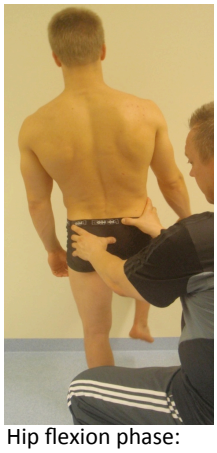
Intra Pelvic Rotation (IPR)



- Symmetric pelvis
  - Form and function
- Rotation left:
  - Left innominate dorsally
  - Right innominate ventrally
  - Sacrum left, maintain nutated l.a.

Diane Lee, The Pelvic Girdle 2011
Diane Lee; Discover the Role of the Pelvis in Whole Body Function 2012

One-leg Standing Test



Hip flexion phase:
Ilium should posteriorly rotate relative to sacrum

Hungerford 2002

Support phase:
Ilium should remain posteriorly rotated relative to sacrum

Hungerford 2002

Support phase:
Ilium should extend relative to femur or remain vertical

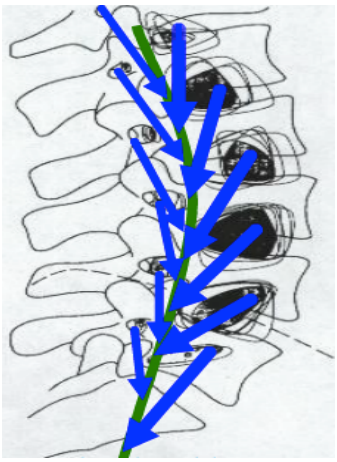
Hungerford 2002

Diane Lee; The Pelvic Girdle 2009, Churchill Livingstone

Iliopsoas group

- **Psoas major**
  - Anterior- / posterior fascicles
  - Ilium posterior rotation
  - SI-joint stabilizer
  - Lumbar stabilizer (compression)
  - Centralizing femoral head
  - Assisting hip flexion
  - Supporting diaphragm/thorax

  - Commonly elongated ➔ **WEAK**

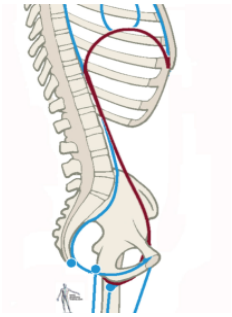


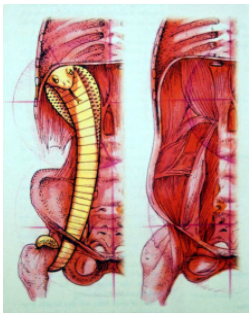
Movement, Stability&Lumbopelvic Pain, Integration of Researc and Therapy; A.Vleeming, V.Mooney, R.Stoeckart 2007, 2nd edition, Churchill Livingstone

Bogduk, Nikolai. *Clinical and Radiological Anatomy of the Lumbar Spine E-Book, 5th Edition*. 2012, Churchill Livingstone, e ISBN 9780702051661

The Inner Cobra

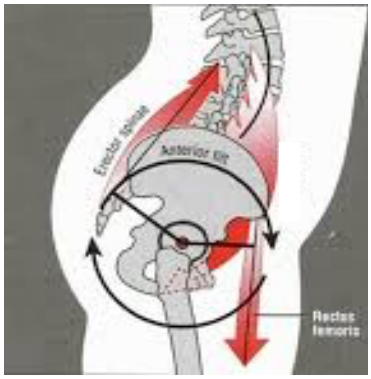
- Considered as a functional whole, the balance of these two muscles (PM & Diaphragma) is essential for respiratory and spinal health.
- Get the balance and function of these two cobras correctly, and it will matter less whether your patient has 'washboard' abs or 'washtub' abs.
- **With a strong and balanced cobra, tight abs are less necessary to upper body support**.





Thomas Myers, Anatomy Trains News, 20.01.2013

- Imbalance between Glut Max / Med and Rectus femoris / TFL-ITB
  - Pelvic anterior tilt
  - Failed load transfer / Force closure



Alternative training

What an athlete CANNOT/ NOT ALLOWED to perform:

- No axial loads next 3 months…
- No rotation, no extension, no heavy carrying…
- No running, no jumping…
- No gymnastics training during next 4 months…

What an athlete CAN / ALLOWED to perform:

- Aqua jogging, powerwalking, walking in stairs, rowing machine, stationary bicycle…
- Co-ordination, balance, strengthen the other body areas…
- Optimize flexibility and muscle balance…
- Rehabilitate the injured area/structure safely without compromising the healing process…

Juha Koistinen, Chief physiotherapist NOC Finland, 2015

Return to sport

- Most patients with symptomatic spondylolysis do well with **conservative care**
- **Relative rest period**
- Treatment should **proceed on an individual basis** after a careful assessment of the patient's overall status and identification of concrete treatment goals
- **Osseous healing is not necessary** to achieve an excellent clinical outcome with full return to activities, although it would seem desirable to achieve this where possible

Spondylolysis: a critical review, C J Standaert, S A Herring, Br J Sports Med 2000;34:415–422


Thank you!