Estabilizadores de la cadera: anatomía y biomecánica.

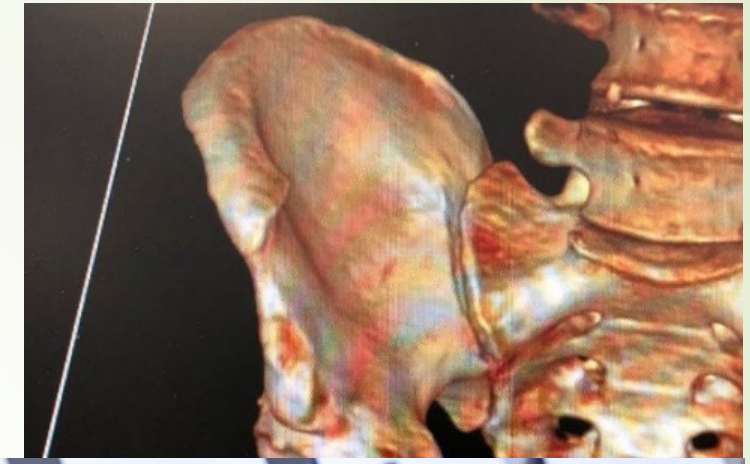
Ángel del Río Mangada

Unidad de Cadera y Rodilla. Hospital Son Llàtzer

Profesor asociado de la Facultad de medicina de la UIB

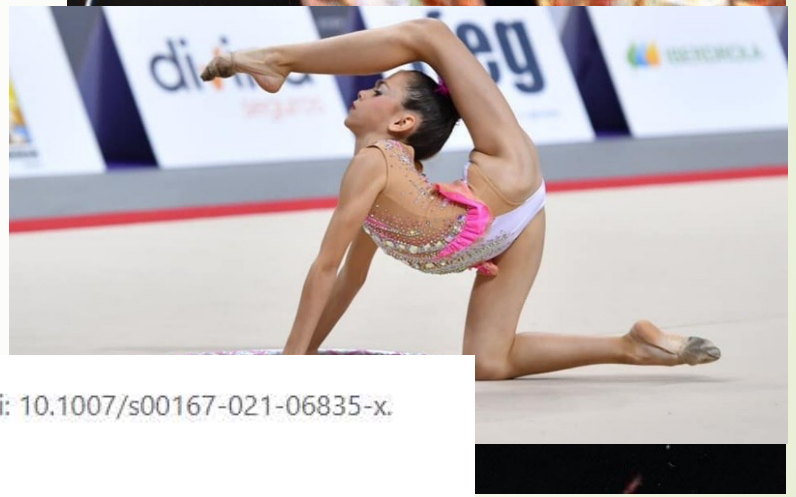
Palma de Mallorca

INTRODUCCIÓN



- Articulación estable
- Microinestabilidad sintomática:

  Movilidad extrafisiológica que produce dolor con o sin síntomas de inestabilidad articular objetiva y puede ser producida por defecto óseos o de partes blandas. *Shu B, Safran MR: Hip instability:Anatomic and clinical considerations of traumatic and atraumatic instability. Clin Sports Med 2011;30:349-367.*



- Escasa literatura:
- Controvertido

Editorial > Knee Surg Sports Traumatol Arthrosc. 2022 Jan 22. doi: 10.1007/s00167-021-06835-x.

Online ahead of print.

Hip microinstability: fact or fiction?

Pierre-Olivier Jean [1], Marc R Safran [2], Olufemi R Ayeni [3]

Affiliations + expand

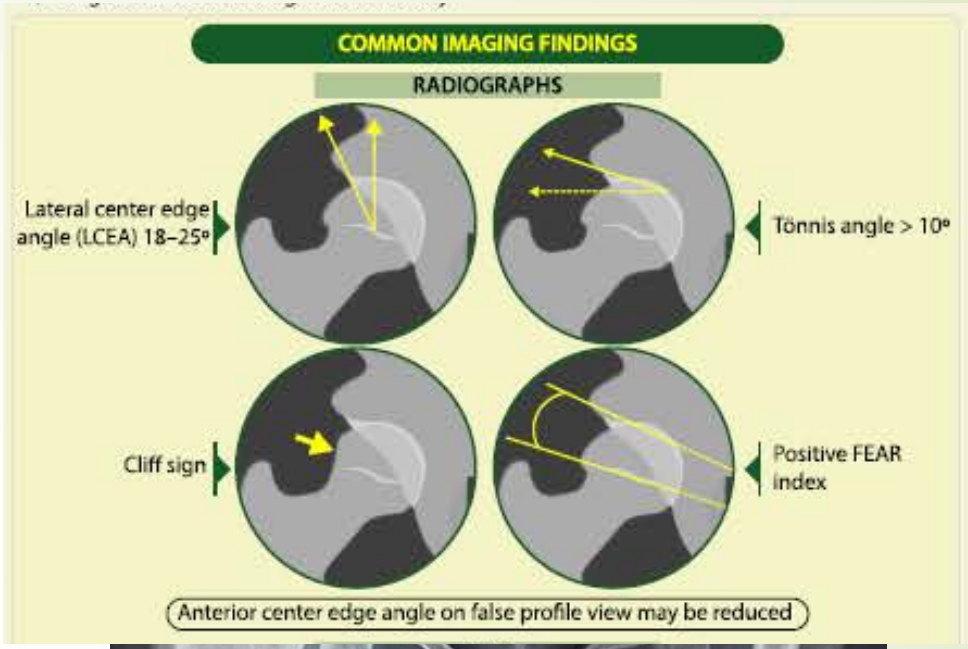
PMID: 35064288 DOI: 10.1007/s00167-021-06835-x

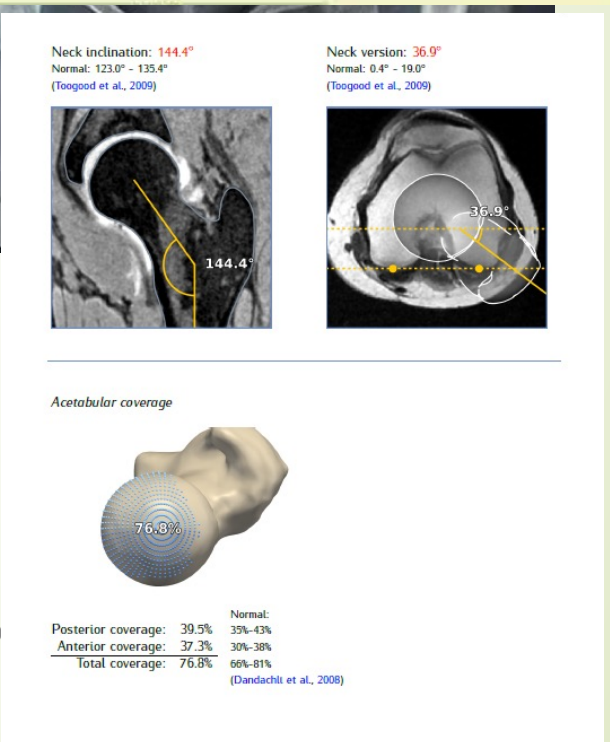
CONTENIDO

- Estabilizadores estáticos
  - Inestabilidad ósea
  - Inestabilidad de partes blandas
- Factores dinámicos
  - Fuerzas de cohesión-adhesion
  - Musculatura
  - Balance lumbopelvico
  - Esfuerzos suprafisiológicos

INESTABILIDAD ÓSEA

- Acetábulo
  - Profundidad
  - Inclinación: 45º
  - Versión: 15-20º
- Fémur
  - Versión: 0-19º
  - Ángulo cervicodiafisario: 123º-135º
  - Anteversion combinada (McKibbin 1970) >50º
- Nuevos signos radiológicos
  - Femoroepiphyseal acetabular roof (FEAR)
  - Cliff sign
- Proporcionan cobertura posterior en flexión y abducción, la estabilidad anterior va a depender de las partes blandas





ESTABILIZADORES ESTATICOS

- Inestabilidad de partes blandas
  - Ligamentos capsulares
    - Iliofemoral
    - Isquiofemoral
    - Pubofemoral
    - Zona orbicularis
  - Ligamento redondo
  - Labrum

LIGAMENTOS CAPSULARES

- Iliofemoral
- Isquiofemoral
- Pubofemoral
- Zona orbicularis

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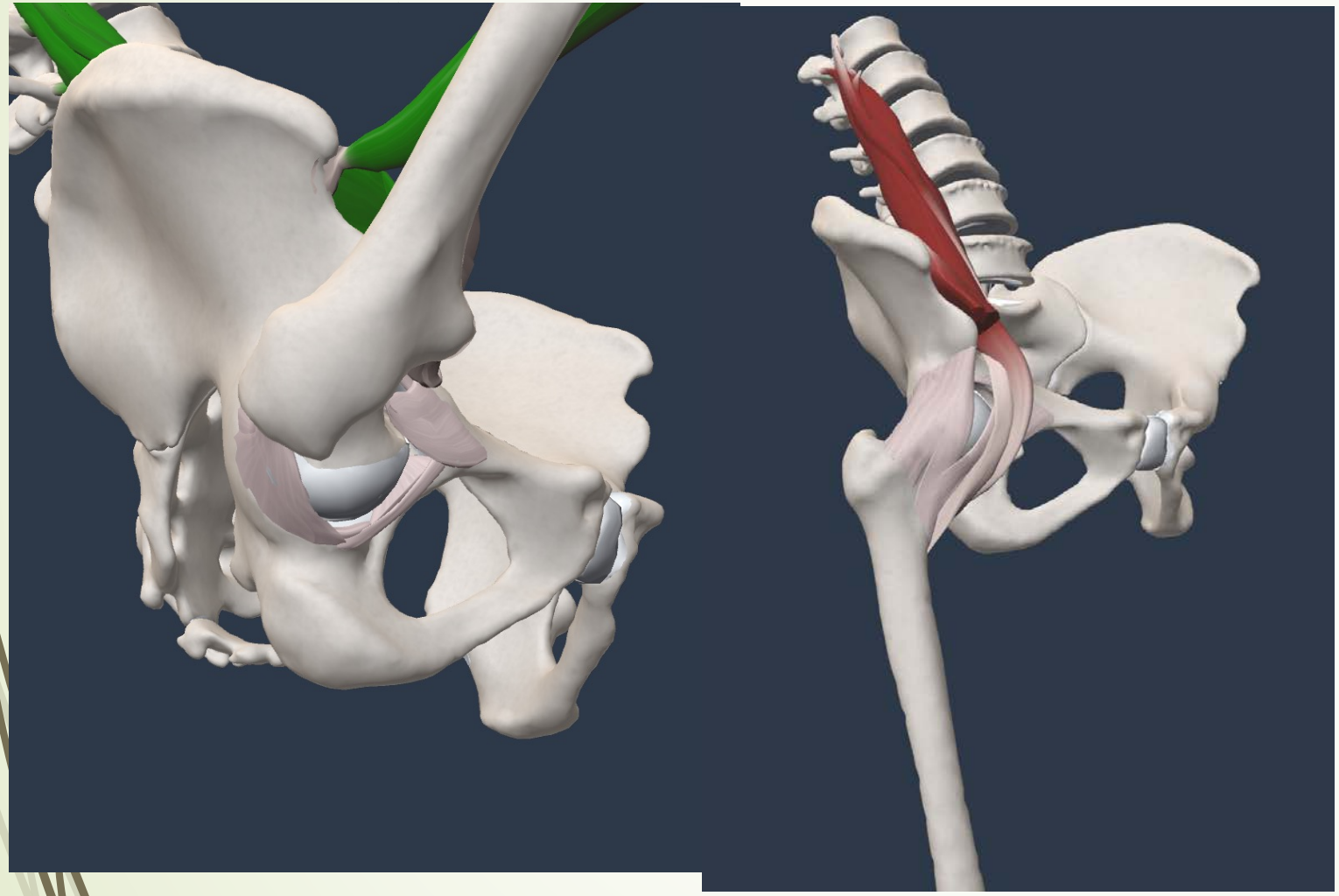
CURRENT CONCEPTS REVIEW

Hip Joint Capsular Anatomy, Mechanics, and Surgical Management

K.C. Geoffrey Ng, PhD, Jonathan R.T. Jeffers, PhD, and Paul E. Beaulé, MD, FRCSC

Investigation performed at the Imperial College London, London, United Kingdom, and the Division of Orthopaedic Surgery, University of Ottawa, Ottawa, Ontario, Canada

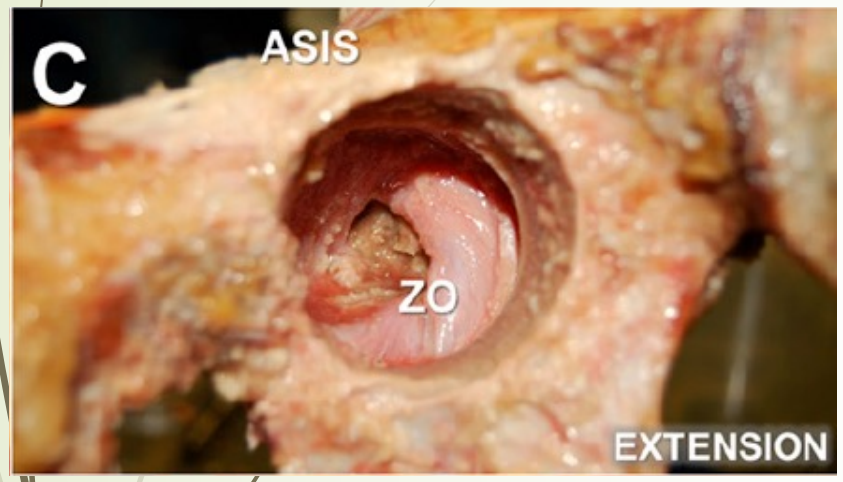
LIGAMENTOS CAPSULARES

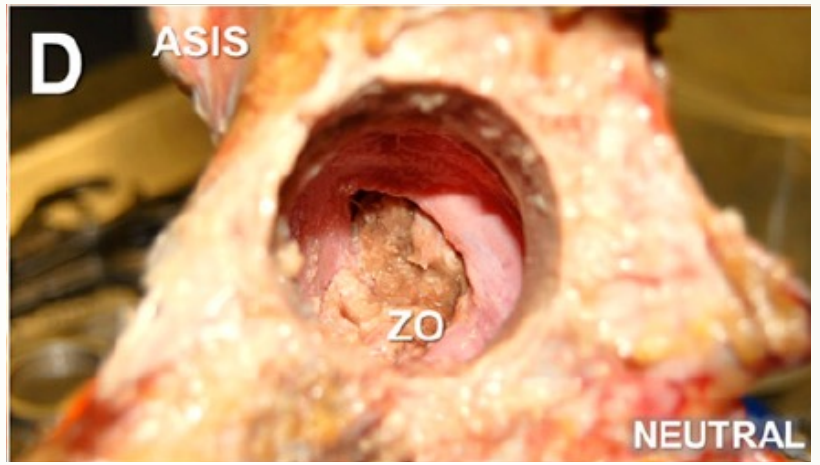


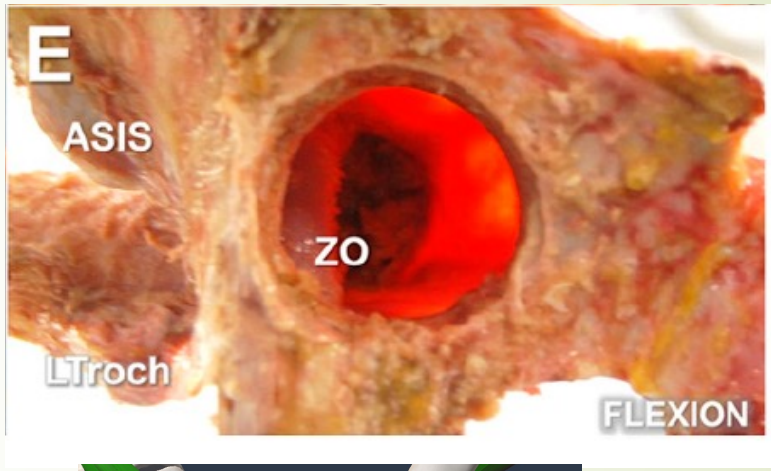
- ILF: RI/RE en extensión
- ISF: traslacion posterior y RI (Flexión/extensión)
- PF: RE y ABD en extensión

- Zona de laxitud en semiflexión
- Protegen en los extremos de movilidad para evitar
  - CFA
  - Inestabilidad
  - Edge loading

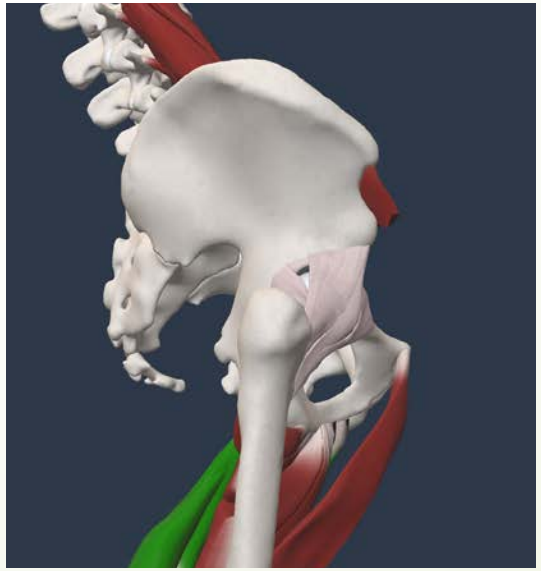
ZONA ORBICULARIS



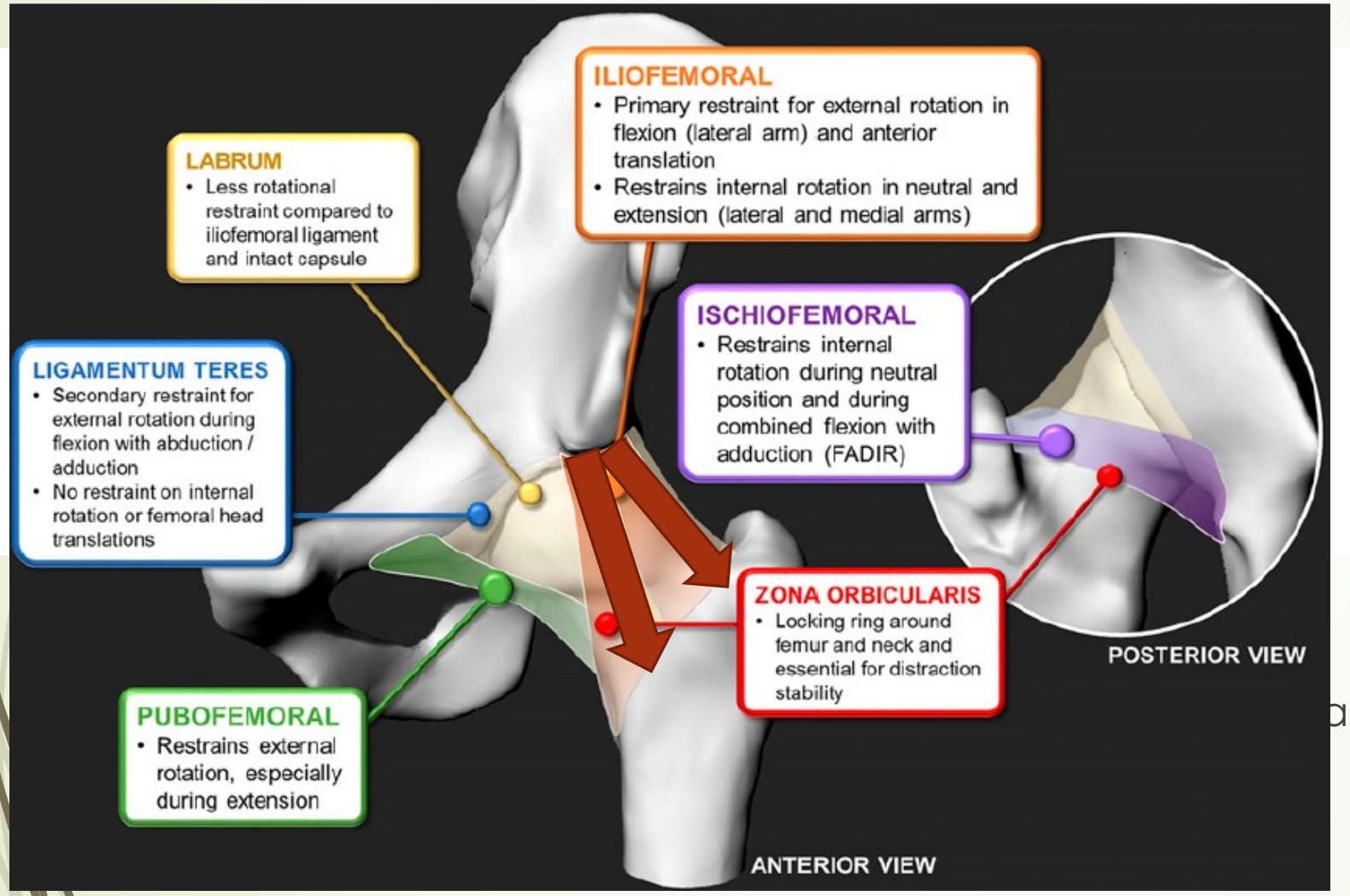




- En extensión la parte posteroinferior medializa y estabiliza anteriormente
- En flexión la parte anteroinferior estabiliza posteriormente



LIGAMENTO ILIOFEMORAL

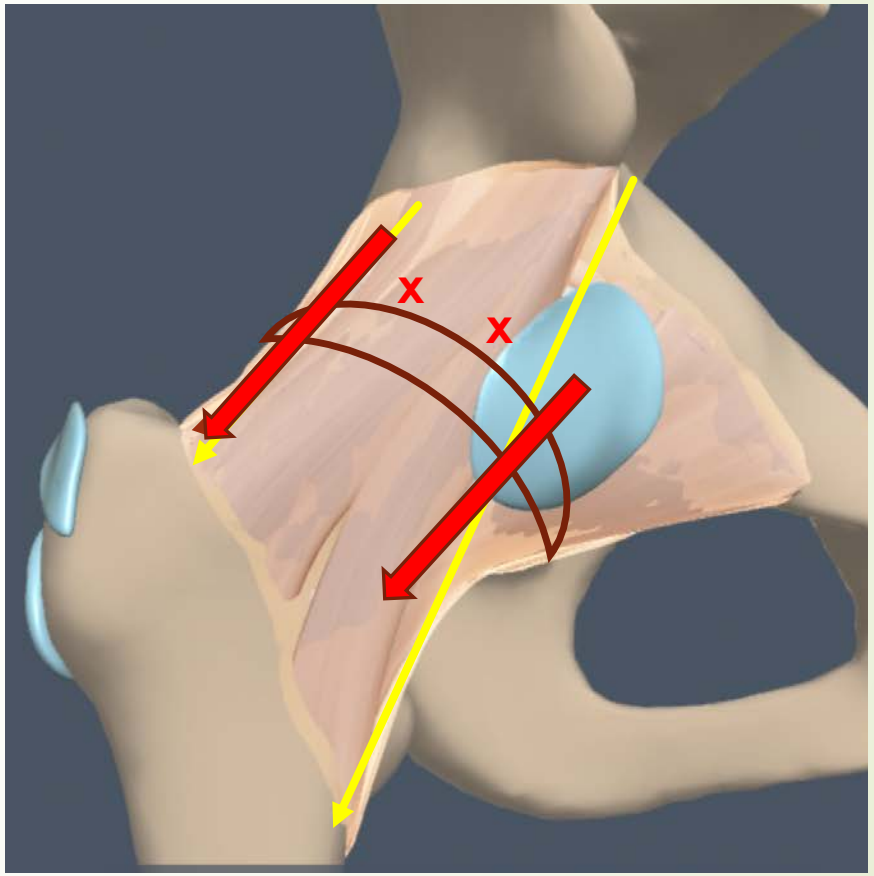


La banda lateral es restrictor primario de la RE en todas las posiciones

- En flexión limita la rotación externa
- En extensión limita tanto la rotación externa como interna

ANATOMIA ARTROSCOPICA LIF

- En el compartimento central el borde lateral del ILFL esta mas lateral que el portal AL y el borde medial es mas medial que el portal anterior.
- En el periferico se encuentra medial al repliegue retinacular lateral y lateral al repliegue retinacular medial a nivel de la zona orbicularis



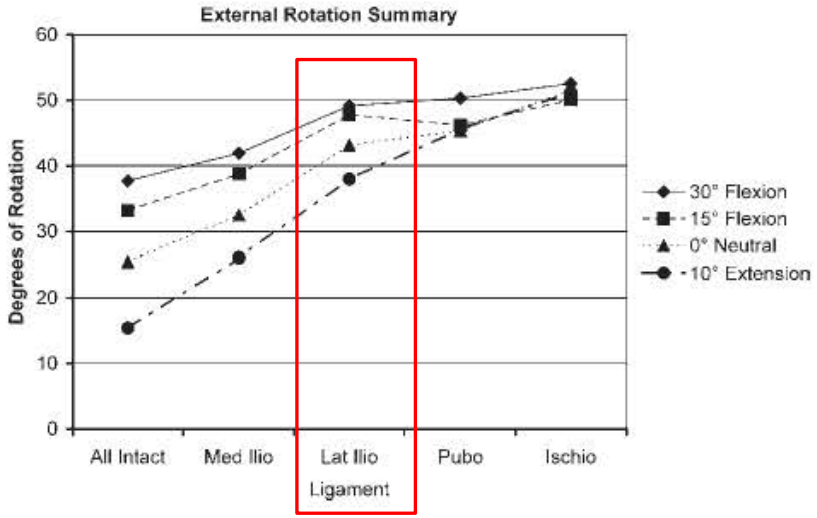
BIOMECANICA

The Function of the Hip Capsular Ligaments: A Quantitative Report

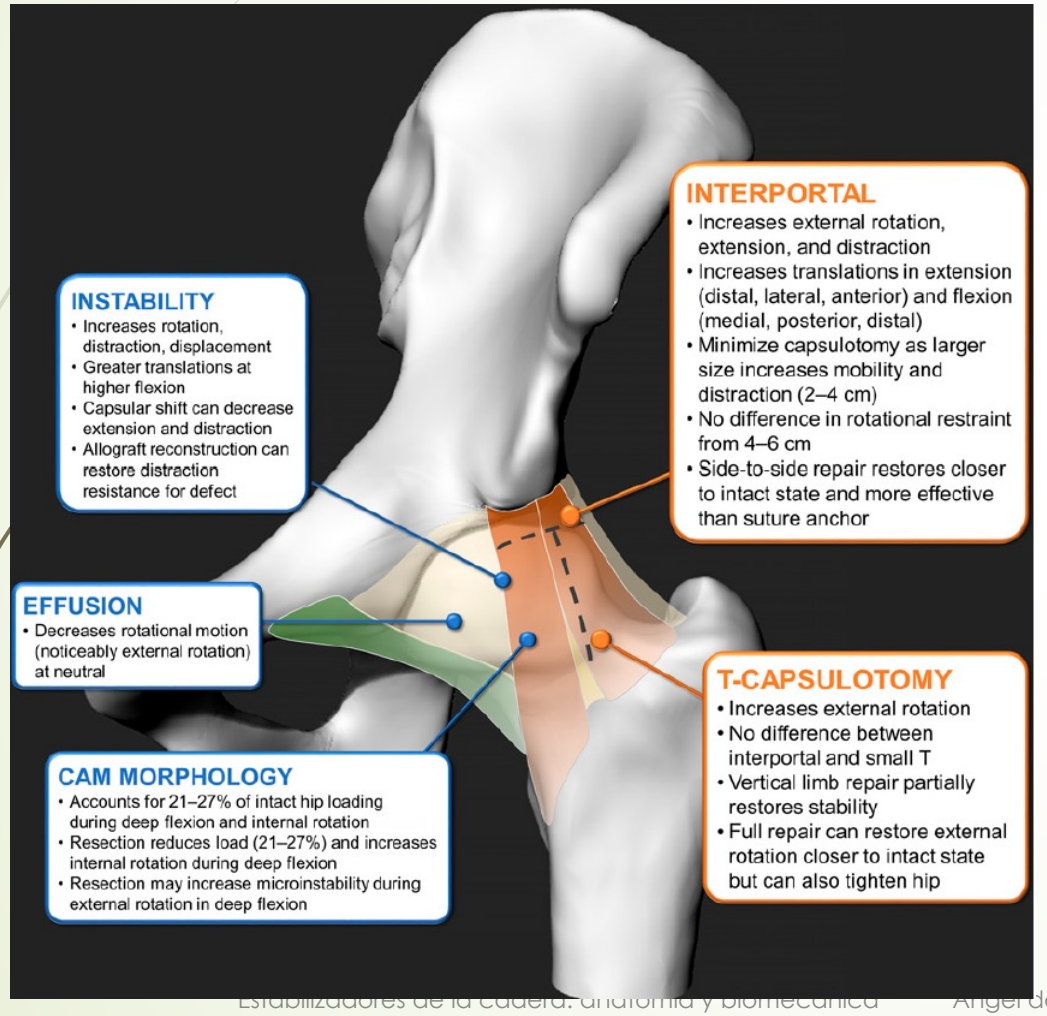
Hal D. Martin, D.O., Adam Savage, B.S., Brett A. Braly, B.S., Ian J. Palmer, Ph.D., Douglas P. Beall, M.D., and Bryan Kelly, M.D.

Arthroscopy: The Journal of Arthroscopic and Related Surgery, Vol 24, No 2 (February), 2008: pp 188-195

- La sección de la rama lateral era la que mas aumentaba la **rotación externa** en todas las posiciones



CAPSULOTOMIA



- La capsulotomía interportal corta siempre el ILFL
  - aumenta la RE, extensión y distracción
  - Aumenta las traslación anterior y posterior
- Capsulotomia en T
  - Aumenta la RE
  - La reparación de la rama vertical restablece parcialmente la estabilidad

TEST CLINICOS

Photograph showing the anterior apprehension test. The anterior apprehension test, also known as the hyperextension, external rotation test, is performed with the patient supine at the end of the examination table, with their buttocks just at the edge of the table. The patient holds one knee toward their chest, whereas the extremity to be examined is passively allowed to fall into hyperextension. The extremity being examined is then externally rotated by the clinician, which stresses the anterior capsule and labrum, and should reproduce the patient's anterior pain or apprehension. Posterior pain with this maneuver may be the result of posterior impingement. We have found that the anterior apprehension test has a sensitivity of 71% and specificity of 85% (Hoppe et al[25]).

HEER

Photograph showing the abduction-extension-external rotation test. The abduction-extension-external rotation test is performed with the patient in the lateral decubitus position, and the leg to be examined is abducted about 30°, extended, and then externally rotated. Then, an anteriorly directed force is applied to the posterior greater trochanter. This should reproduce the patient's symptoms. We have found this test to have a sensitivity and specificity of 81% and 89%, respectively (Hoppe et al[25]).

ABHEER

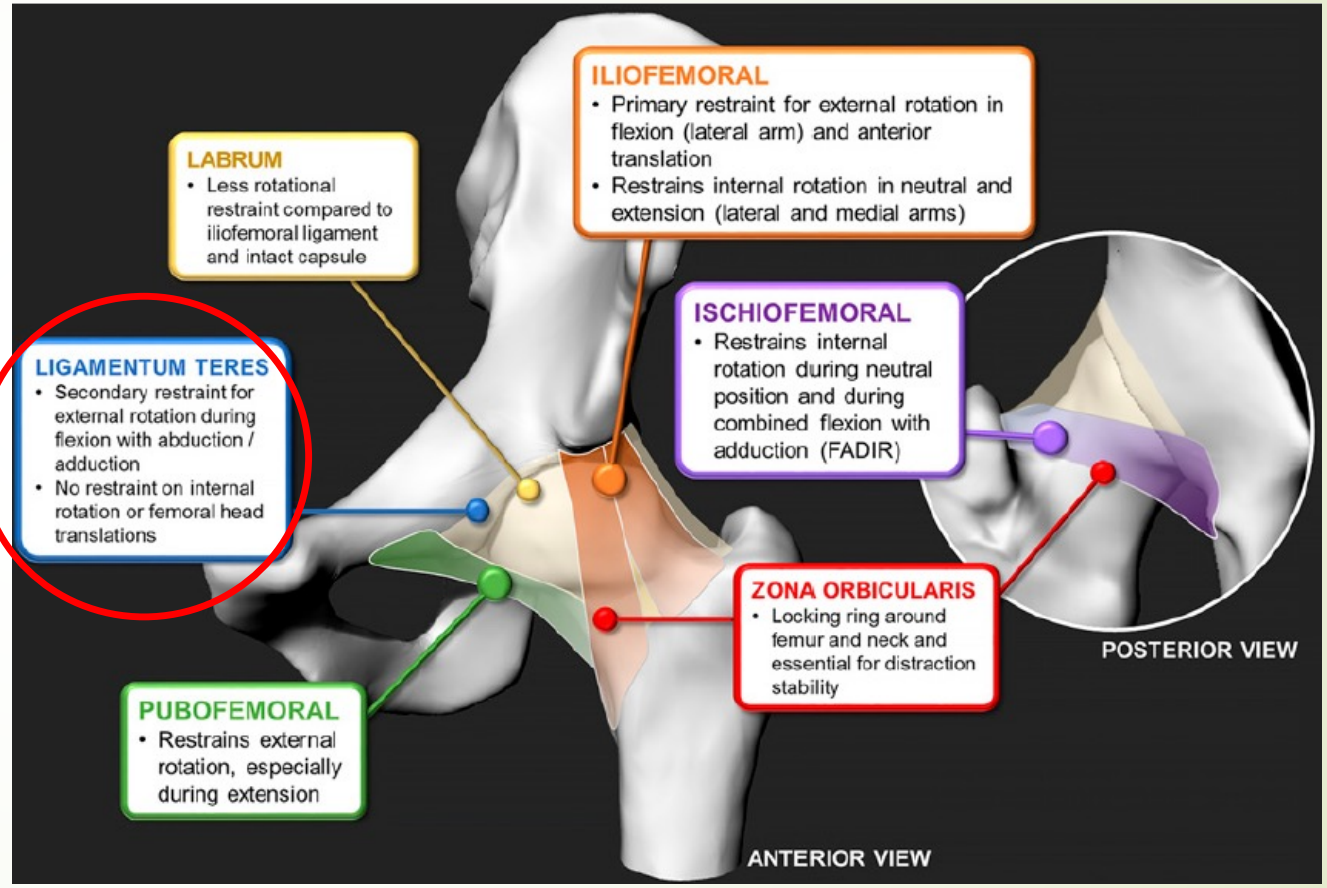
Photograph showing the prone external rotation test. The prone external rotation test is performed with the patient prone, and thus, their hip is in neutral flexion-extension. The hip is then externally rotated, and the examiner applies an anterior directed force to the posterior trochanter. Pain or apprehension felt anteriorly is consistent with the diagnosis of hip instability, and we found that this test to be sensitive 33% of the time but have a 98% specificity (Hoppe et al[25]).

Prone instability

Si los 3+ ⟶ 95% de precisión diagnostica

Diagnostic Accuracy of 3 Physical Examination Tests in the Assessment of Hip Microinstability Daniel J. Hoppe,* MD, MEd, FRCSC, Jeremy N. Truntzer,* MD, Lauren M. Shapiro,* MD, Geoffrey D. Abrams,* MD, and Marc R. Safran,*† MD
The Orthopaedic Journal of Sports Medicine, 5(11), 2325967117740121 DOI: 10.1177/2325967117740121

LIGAMENTO REDONDO



Review Article

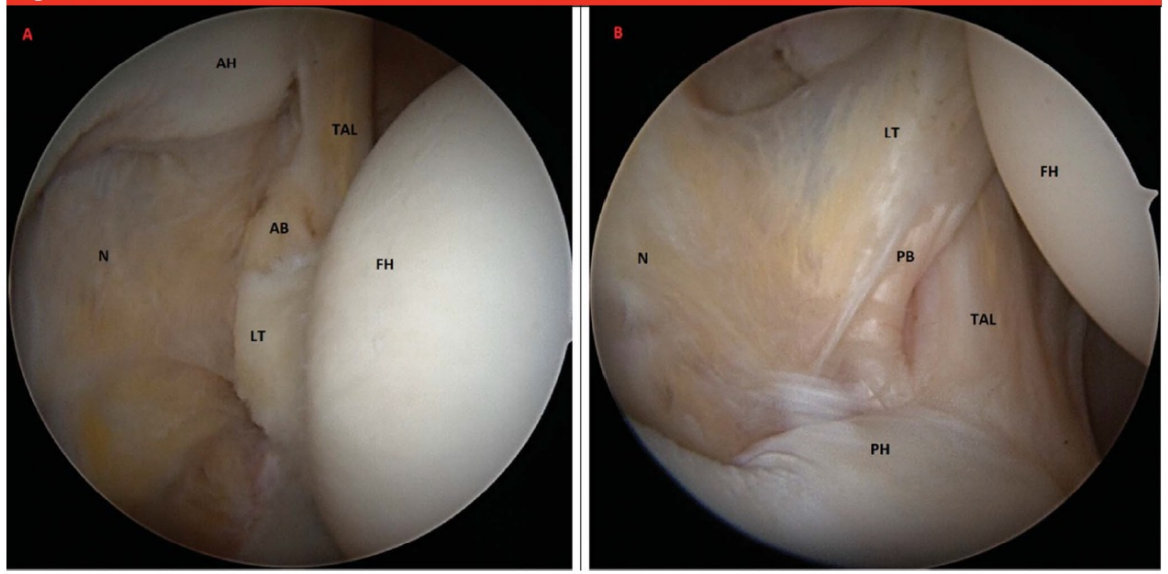
All About the Ligamentum Teres: From Biomechanical Role to Surgical Reconstruction

Philip J. Rosinsky, MD
Jacob Shapira, MD
Ajay C. Lall, MD, MS
Benjamin G. Domb, MD

J Am Acad Orthop Surg 2019;00:1-12

- Previene la subluxación a partir de 100º de flexión y 20º de abducción
- La banda posterior es la mas importante, se tensa en RE
- Stability Index (SI): las roturas del LT se aocian a displasia (< LCEA)

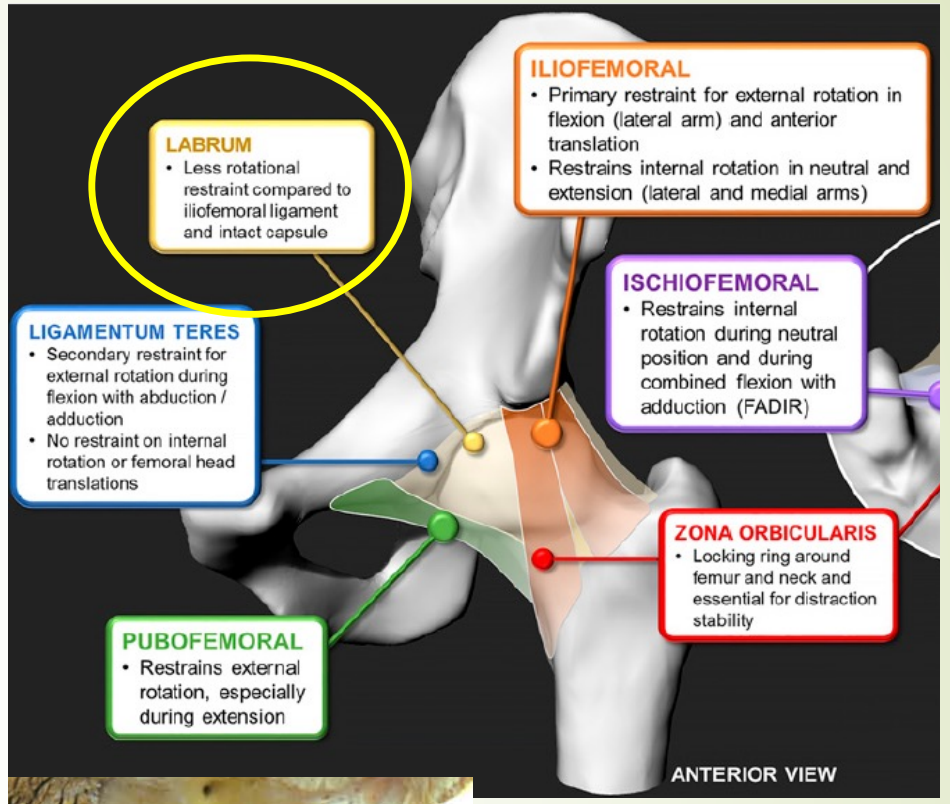
Figure 1

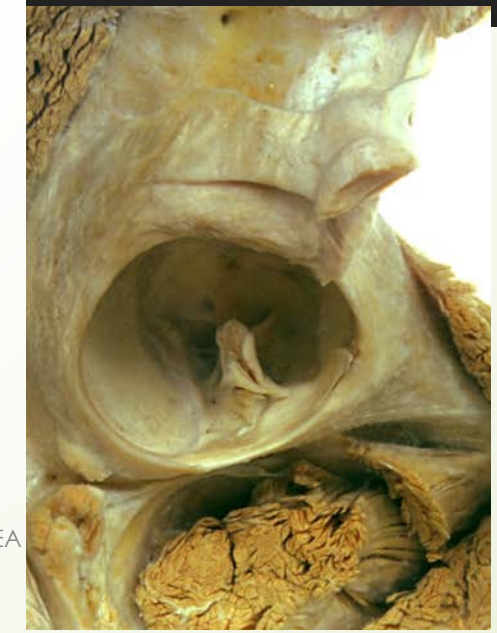


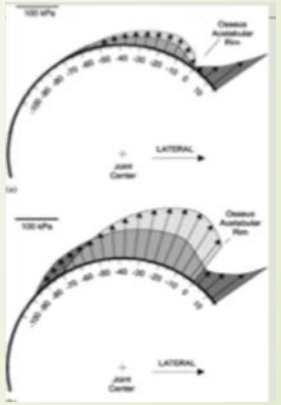
Arthroscopic view of right hip ligamentum teres. **A**, Anterior view, femur internally rotated. **B**, Posterior view, femur externally rotated. Note the tension of the posterior band, as well as expansion of LT acetabular origin and relationship to TAL. AB = anterior band of LT, AH = acetabular anterior horn, FH = femoral head, LT = ligamentum teres, N = acetabular notch, PB = posterior band of LT, PH = acetabular posterior horn, TAL = transverse acetabular ligament.

LABRUM

- Aumenta un 20% el volumen y un 25% la superficie del acetábulo.
- Aumento la función de sellado articular
- Las lesiones del labrum reducen un 60% la fuerza de distracción articular y aumento de la traslación lateral
- Estabilizador secundario de la rotación







Contributions of the Capsule and Labrum to Hip Mechanics in the Context of Hip Microinstability

Adam M. Johannsen,* MD, Leandro Ejnisman,*† MD, PhD, Anthony W. Behn,* MS, Kotaro Shibata,* MD, Timothy Thio,* MS, and Marc R. Safran,*‡ MD

Investigation performed at Department of Orthopaedic Surgery, Stanford University, Redwood City, California, USA

The Orthopaedic Journal of Sports Medicine, 7(12), 2325967119890846
DOI: 10.1177/2325967119890846
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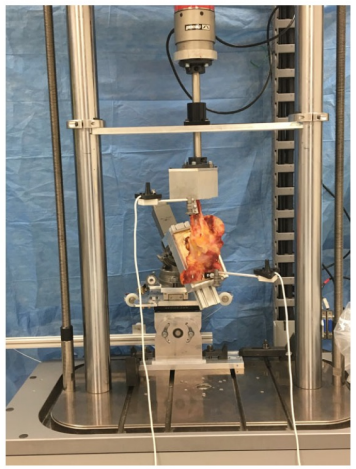


Figure 1. Image of the experimental setup on the materials testing system.

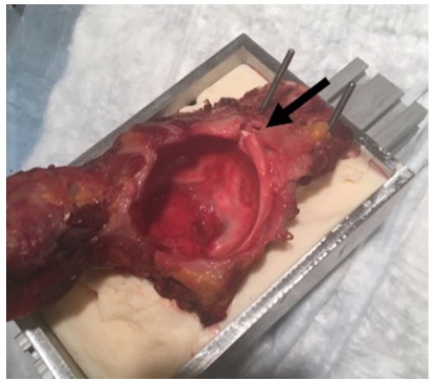
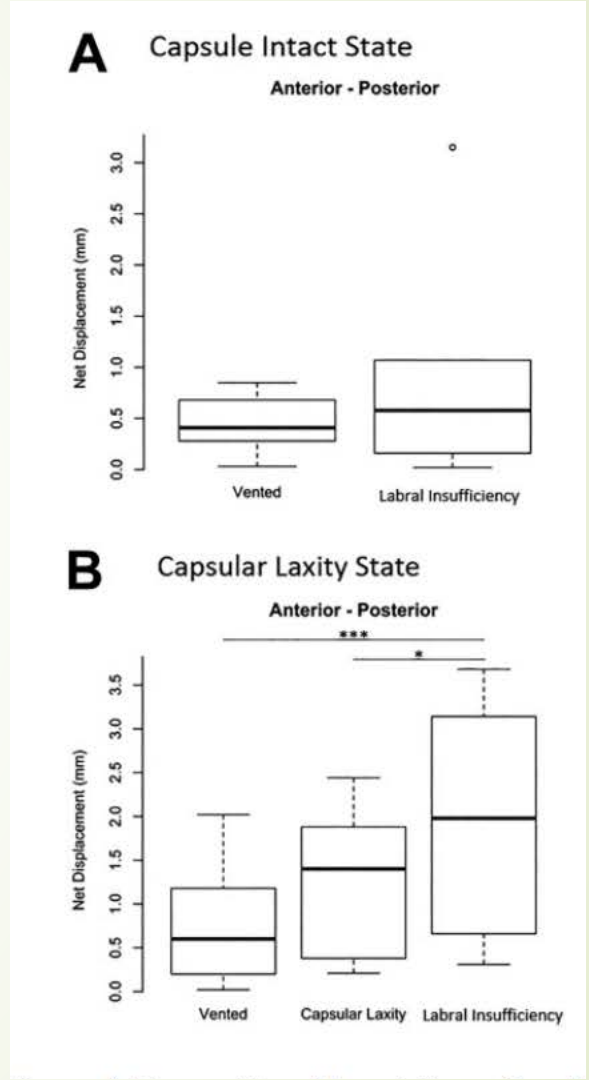


Figure 2. Postdissection view of the acetabulum demonstrating the combination of the chondrolabral and radial tears of the superior-lateral labrum (arrow).

- ***Las roturas aisladas del labrum producen unos cambios mínimos en la traslación de la cabeza femoral****, pero en casos de cápsulas laxas si que se asocian a aumentos significativos en la traslación de la cabeza, lo cual si podría asociar a síntomas de inestabilidad articular*



Role of the Acetabular Labrum and the Iliofemoral Ligament in Hip Stability

An In Vitro Biplane Fluoroscopy Study

Casey A. Myers,*† MSc, Bradley C. Register,‡ MD, Pisit Lertwanich,§ MD, Leandro Ejnisman,* MD, W. Wes Pennington,* MSc, J. Erik Giphart,* PhD, Robert F. LaPrade,* MD, PhD, and Marc J. Philippon,*|| MD
Investigation performed at the Biomechanics Research Department of the Steadman Philippon Research Institute, Vail, Colorado

The American Journal of Sports Medicine, Vol. 39, Supplement 1
DOI: 10.1177/0363546511412161
© 2011 The Author(s)

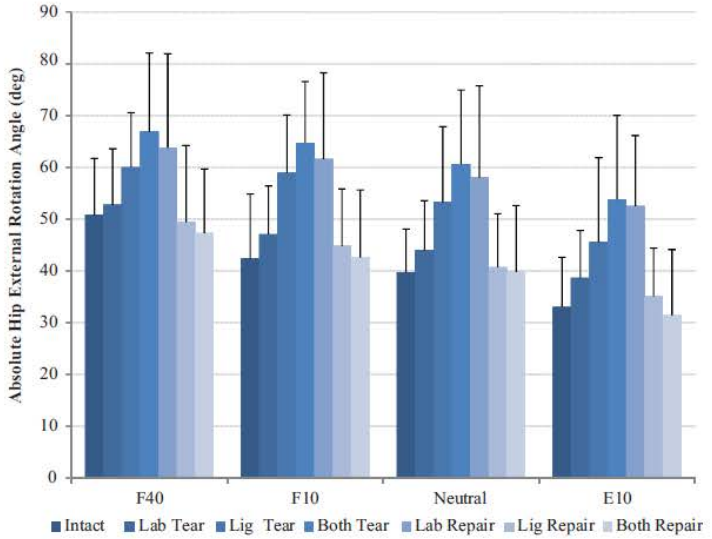
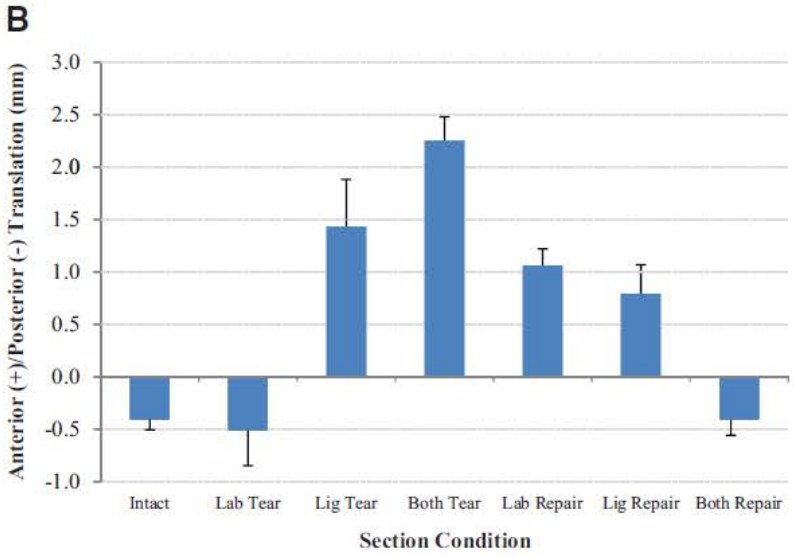


Figure 4. Hip external rotation angle after the application of 5 N·m of external rotation torque for each of the sectioned conditions at the 4 hip flexion angles tested.

- *The iliofemoral ligament had a significant role in limiting **external rotation and anterior translation** of the femur, while the acetabular labrum provided a secondary stabilizing role for these motions.*



FACTORES DINAMICOS

- Fuerzas de cohesión-adhesión y presión negativa
- Musculatura
  - Musculatura flexora
  - Iliopsoas
  - iliocapsular
- Balance lumbopelvico
- Esfuerzos suprafisiológicos

TABLE 2 MUSCLES OF THE HIP, ORGANIZED ACCORDING TO PRIMARY OR SECONDARY ACTIONS*

Muscles	Primary	Secondary
Flexors	• Iliopsoas • Sartorius • Tensor fasciae latae • Rectus femoris • Adductor longus • Pectineus	• Adductor brevis • Gracilis • Gluteus minimus (anterior fibers)
Extensors	• Gluteus maximus • Adductor magnus (posterior head) • Biceps femoris (long head) • Semitendinosus • Semimembranosus	• Gluteus medius (middle and posterior fibers) • Adductor magnus (anterior head)
External rotators	• Gluteus maximus • Piriformis • Obturator internus • Gemellus superior • Gemellus inferior • Quadratus femoris	• Gluteus medius (posterior fibers) • Gluteus minimus (posterior fibers) • Obturator externus • Sartorius • Biceps femoris (long head)
Internal rotators	Not applicable	• Gluteus minimus (anterior fibers) • Gluteus medius (anterior fibers) • Tensor fasciae latae • Adductor longus • Adductor brevis • Pectineus • Adductor magnus (posterior head)
Adductors	• Pectineus • Adductor longus • Gracilis • Adductor brevis • Adductor magnus (anterior and posterior heads)	• Biceps femoris (long head) • Gluteus maximus (posterior fibers) • Quadratus femoris • Obturator externus
Abductors	• Gluteus medius (all fibers) • Gluteus minimus (all fibers) • Tensor fasciae latae	• Piriformis • Sartorius • Rectus femoris

** Each action assumes a muscle is fully activated from the anatomic position. Several of these muscles may have a different action when they are activated outside of this reference position.*

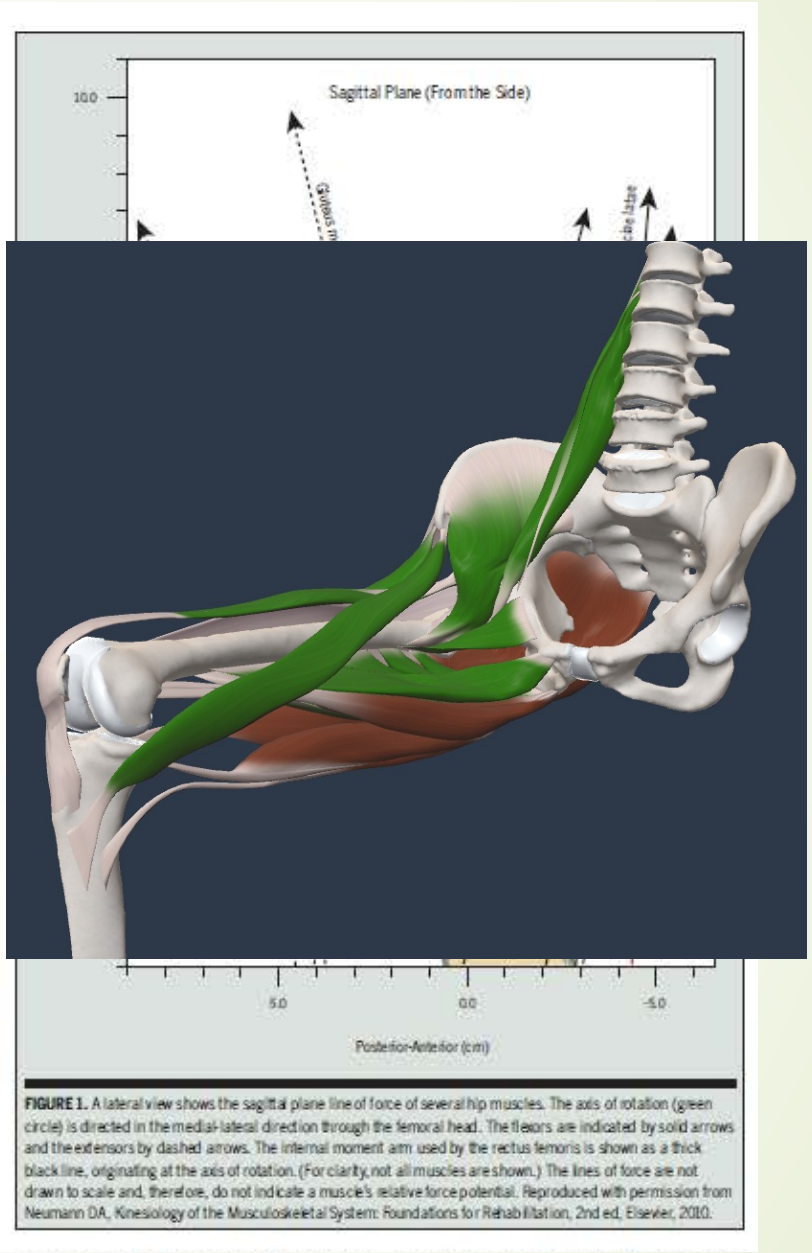


FIGURE 1. A lateral view shows the sagittal plane line of force of several hip muscles. The axis of rotation (green circle) is directed in the medial-lateral direction through the femoral head. The flexors are indicated by solid arrows and the extensors by dashed arrows. The internal moment arm used by the rectus femoris is shown as a thick black line, originating at the axis of rotation. (For clarity, not all muscles are shown.) The lines of force are not drawn to scale and, therefore, do not indicate a muscle's relative force potential. Reproduced with permission from Neumann DA, Kinesiology of the Musculoskeletal System: Foundations for Rehabilitation, 2nd ed, Elsevier, 2010.

ILIOPSOAS

Systematic Review

Is the Iliopsoas a Femoral Head Stabilizer?
A Systematic Review

Takashi Hirase, M.D., M.P.H., Jason Mallett, B.S., Lindsay E. Barter, M.S., David Dong, B.S., Patrick C. McCulloch, M.D., and Joshua D. Harris, M.D.

Arthroscopy, Sports Medicine, and Rehabilitation, Vol 2, No 6 (December), 2020: pp e847-e853

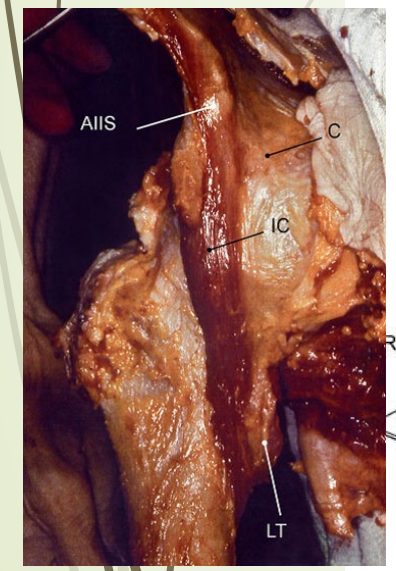
Author/Year	Study Sample
Yoshio et al. 2012	35 cadavers
Andersson et al. 1997	11 healthy active subjects
Andersson et al. 1995	7 healthy active subjects

- Estabilizador dinámico de la traslación anterior
  - Estabilizador a 0-15° de flexión (Yoshio 2012)
  - Activación EMG de la porción iliaca en extensión (Anderson 1997)

ILOPSOAS

- Resultados clínicos de la tenotomía
- 3 casos de luxacion (sobre 538)
- En tres estudios se estudió la versión femoral
  - *En los pacientes con mayor anteversion femoral se realizaban mas tenotomias de psoas (Ferro 2015)*
  - *En los pacientes con mayor anteversión femoral se obtuvieron peores resultados en mHHH (Fabricant 2012)*
  - *Otro no encontró correlación con malos resultados o mayor "necesidad" de tenotomías (Jackson 2015)*

ILIOCAPSULARIS



Clin Orthop Relat Res (2015) 473:3725–3734
DOI 10.1007/s11999-015-4382-y

Clinical Orthopaedics and Related Research®
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SYMPOSIUM: 2014 INTERNATIONAL HIP SOCIETY PROCEEDINGS

An Increased Iliocapsularis-to-rectus-femoris Ratio Is Suggestive for Instability in Borderline Hips

Pascal Cyrill Haefeli MD, Simon Damian Steppacher MD, Doris Babst MD, Klaus Arno Siebenrock MD, Moritz Tannast MD

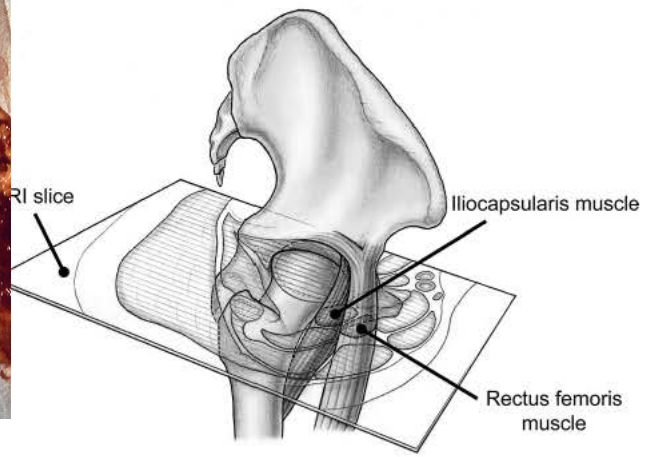


Fig. 2 The anatomical dimensions of the iliocapsularis and rectus femoris muscle were evaluated on an axial MRI slice on the height of the femoral head center. Reproduced with permission from Klaus Oberli.

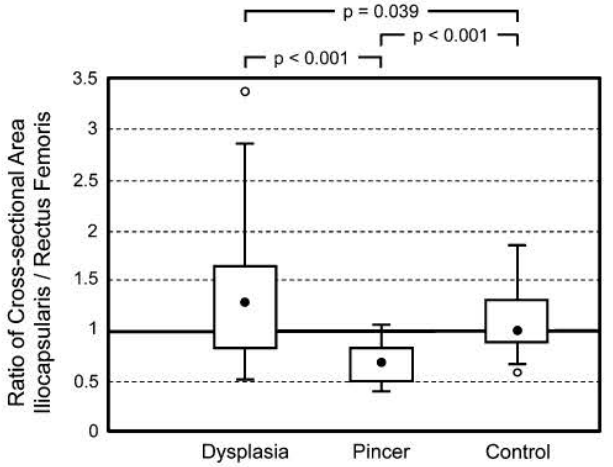


Fig. 4 The boxplots represent the iliocapsularis-to-rectus-femoris ratio of the cross-sectional area of the two study groups and the control group.

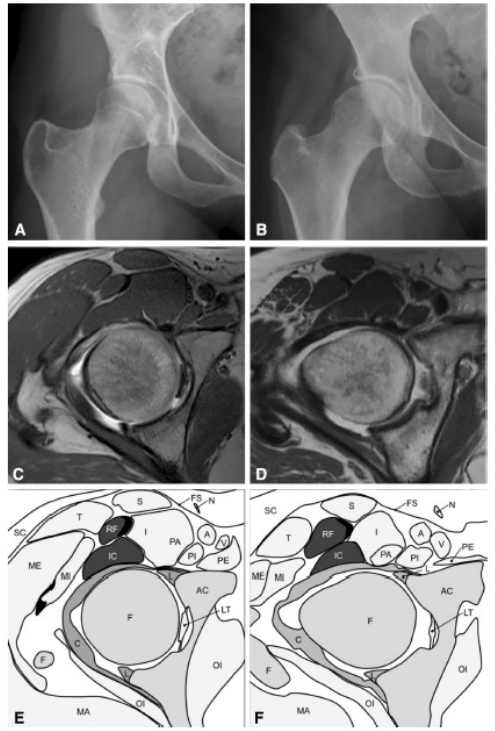


Fig. 5A–F Radiographs of two hips (**A–B**) with comparable acetabular coverage and no clear predominant pathophysiological problem are shown. In the corresponding axial MRI slice, the ratio of iliocapsularis (IC) to rectus femoris (RF) for the cross-sectional area is increased in the left hip (**C**) and slightly decreased in the right one (**D**). This indicates that DDH is the predominant pathophysiology in the hip on the left (**E**), whereas acetabular coverage seems not to be insufficient in the other hip (**F**). F = femoral head; AC = acetabulum; L = labrum; LT = transversum ligament; MA = gluteus maximus; ME = gluteus medius; MI = gluteus minimus; T = tenor fasciae latae; S = sartorius; I = iliacus; PA = psoas major; PI = psoas minor; PE = pectineus; OI = obturatorius internus; A = femoral artery; V = femoral vein; N = femoral nerve; FS = superficial fascia; SC = subcutaneous fatty tissue.

BALANCE LUMBOPELVICO

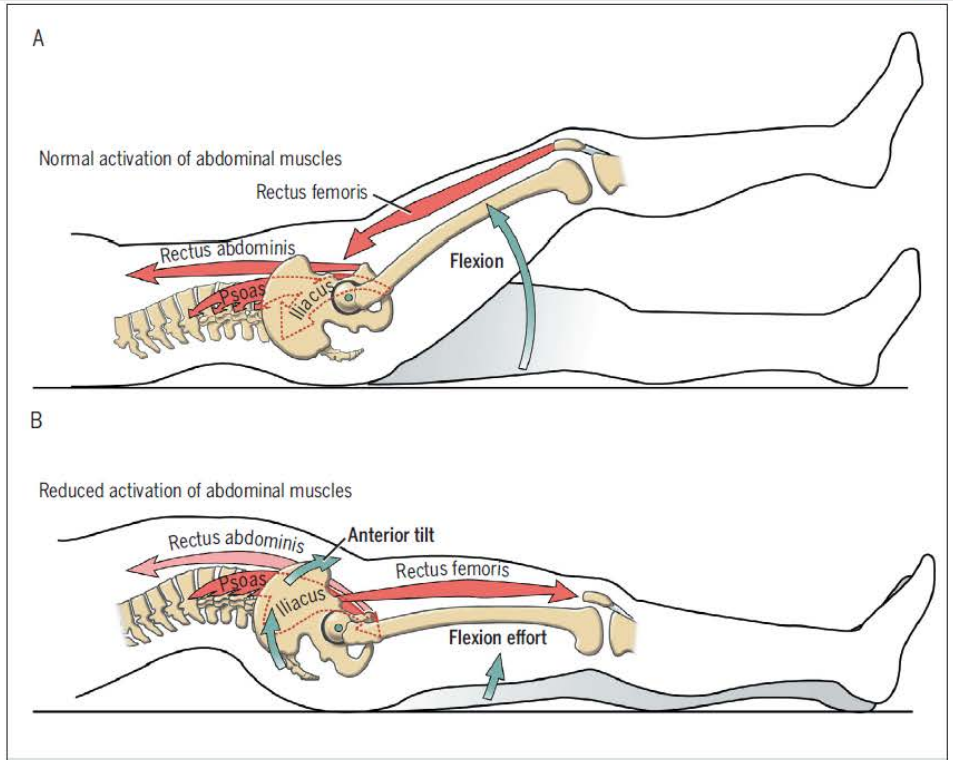


FIGURE 2. The synergistic action of one representative abdominal muscle (rectus abdominis) is illustrated while lifting the right lower limb. (A) With normal activation of the abdominal muscles, the pelvis is stabilized and prevented from anterior tilting by the downward pull of the hip flexor muscles. (B) With reduced activation of the abdominal muscles, contraction of the hip flexor muscles is shown producing a marked anterior tilt of the pelvis (increasing the lumbar lordosis). The reduced activation in the abdominal muscle is indicated by the lighter red color. Reproduced with permission from Neumann DA, Kinesiology of the Musculoskeletal System: Foundations for Rehabilitation, 2nd ed, Elsevier, 2010.

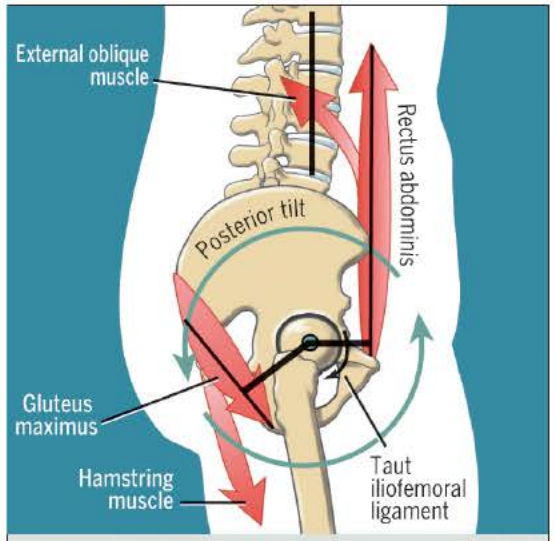
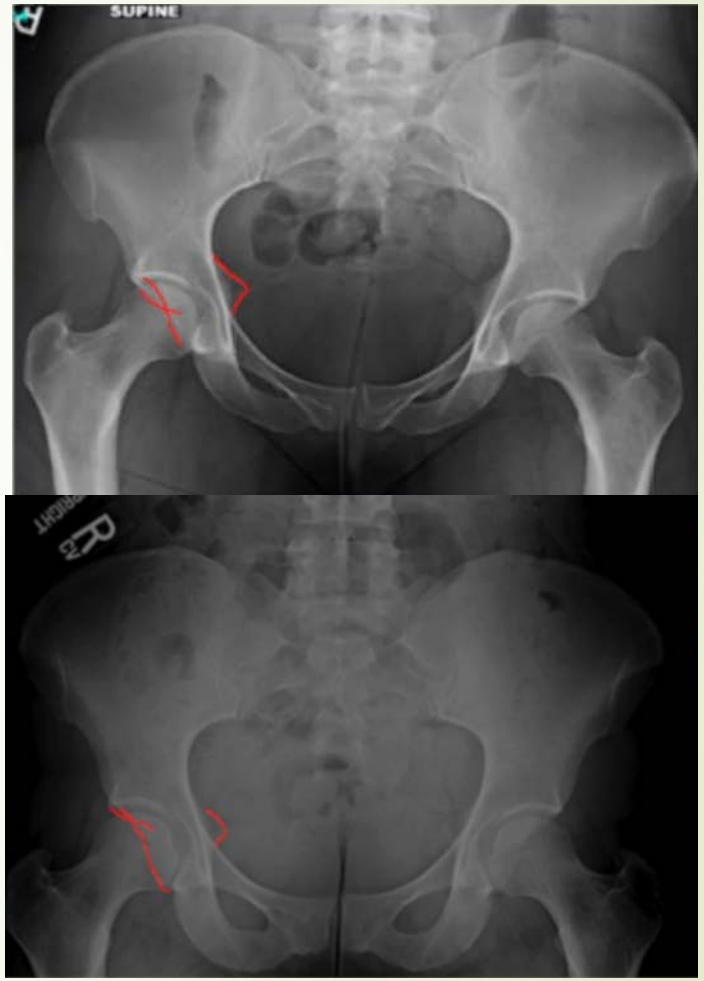


FIGURE 4. The force-couple between representative hip extensors (gluteus maximus and hamstrings) and abdominal muscles (rectus abdominis and obliquus externus abdominis) is shown posteriorly tilting the pelvis while standing upright. The moment arms for each muscle group are indicated by the dark black lines. The extension at the hip stretches the iliofemoral ligament (shown as a short, curved arrow just anterior to the femoral head). Reproduced with permission from Neumann DA, Kinesiology of the Musculoskeletal System: Foundations for Rehabilitation, 2nd ed, Elsevier, 2010.



SOBRESOLICITACION

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SCIENTIFIC ARTICLE

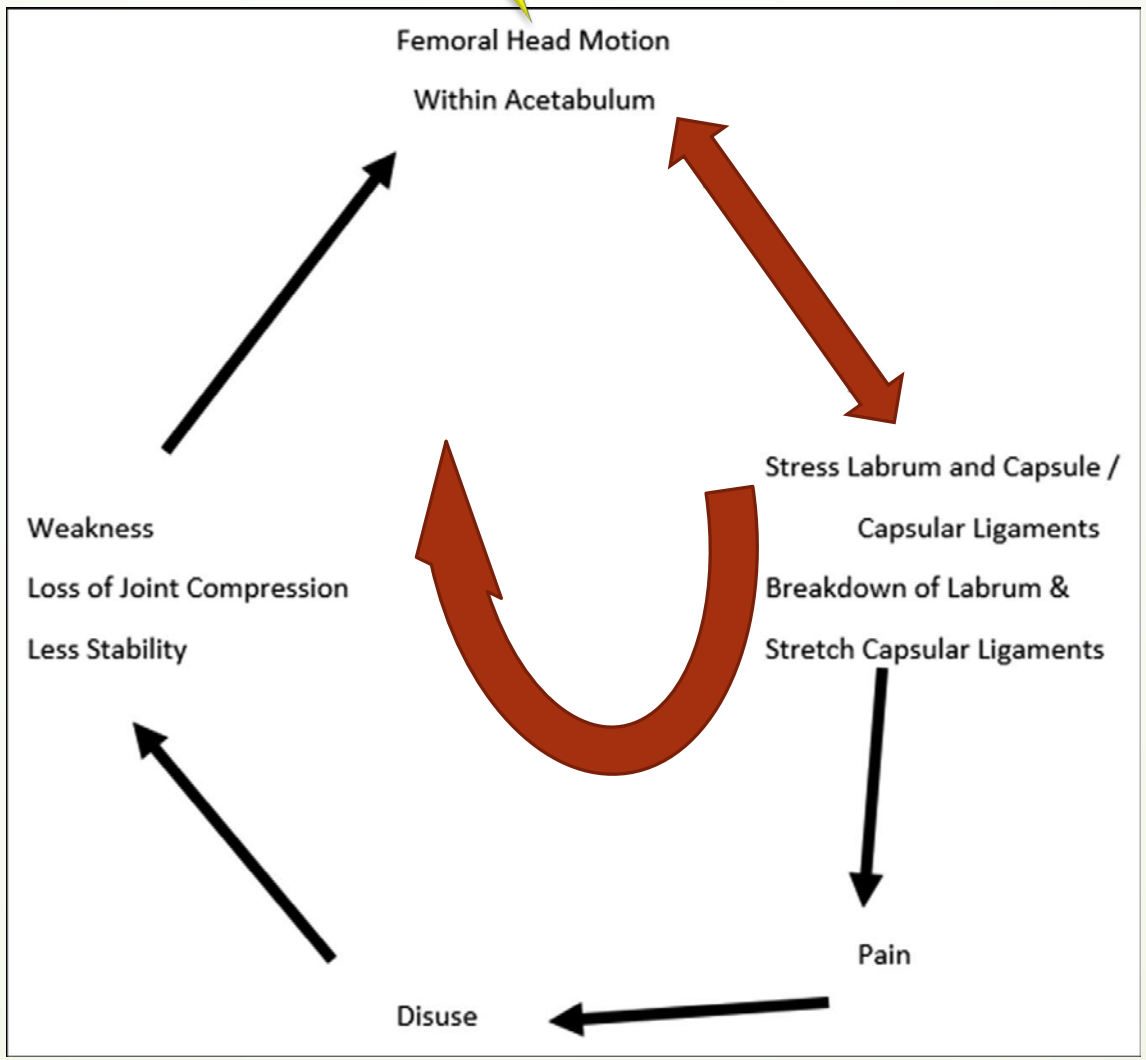
Extreme hip motion in professional ballet dancers: dynamic and morphological evaluation based on magnetic resonance imaging

Frank C. Kolo · Caecilia Charbonnier · Christian W. A. Pfirrmann · Sylvain R. Duc · Anne Lubbeke · Victoria B. Duthon · Nadia Magnenat-Thalmann · Pierre Hoffmeyer · Jacques Menetrey · Christoph D. Becker

Fig. 7 Coronal intermediate-weighted image (2,180/13) with fat saturation. Note the herniation pit at the superior position of the femoral head–neck junction (*arrow*)

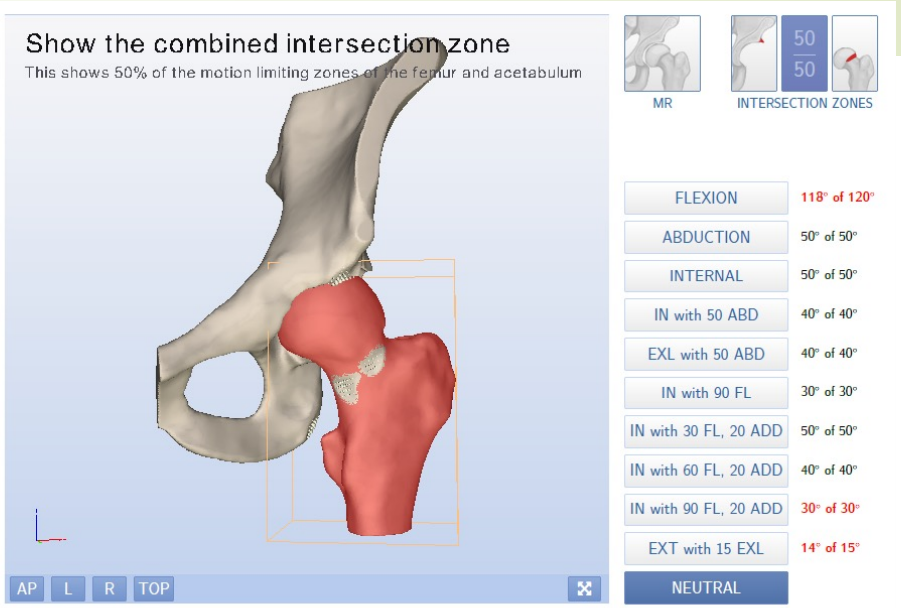
- Subluxacion de 2 en posición de spagat
- Prevalencia de CFA bajo
- Lesiones labrales y *herniation pit pincer-like* de distribución atípica (superiores en vez de superolaterales) por la subluxación en los extremos del movimiento

CIRCULO VICIOSO DE INESTABILIDAD



CONCLUSIONES

- Micro~~inestabilidad~~ → inestabilidad
- Sospecha en pacientes con factores de ries
- Exploración dirigida
- Plan terapéutico individualizado
  - Planificacion 3 D
  - Demandas del paciente



MUCHAS GRACIAS