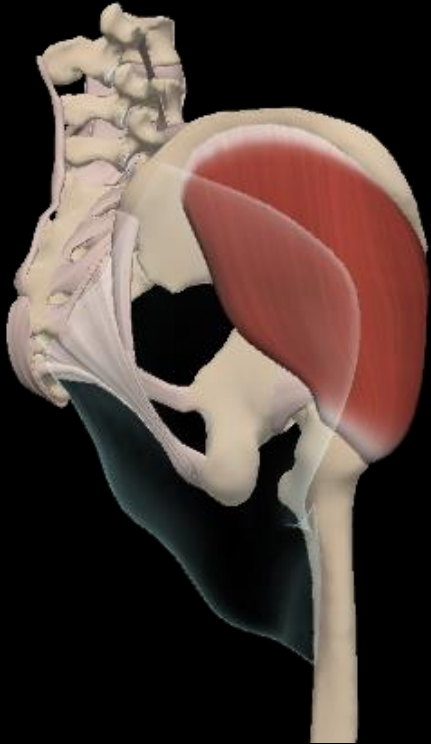


HIP MUSCLE FUNCTION AND HIP PATHOLOGY



Gluteus Medius

*Dr Adam Semciw, Senior Lecturer – Physiotherapy
La Trobe University*

Twitter: @ASemciw



Gluteus Minimus



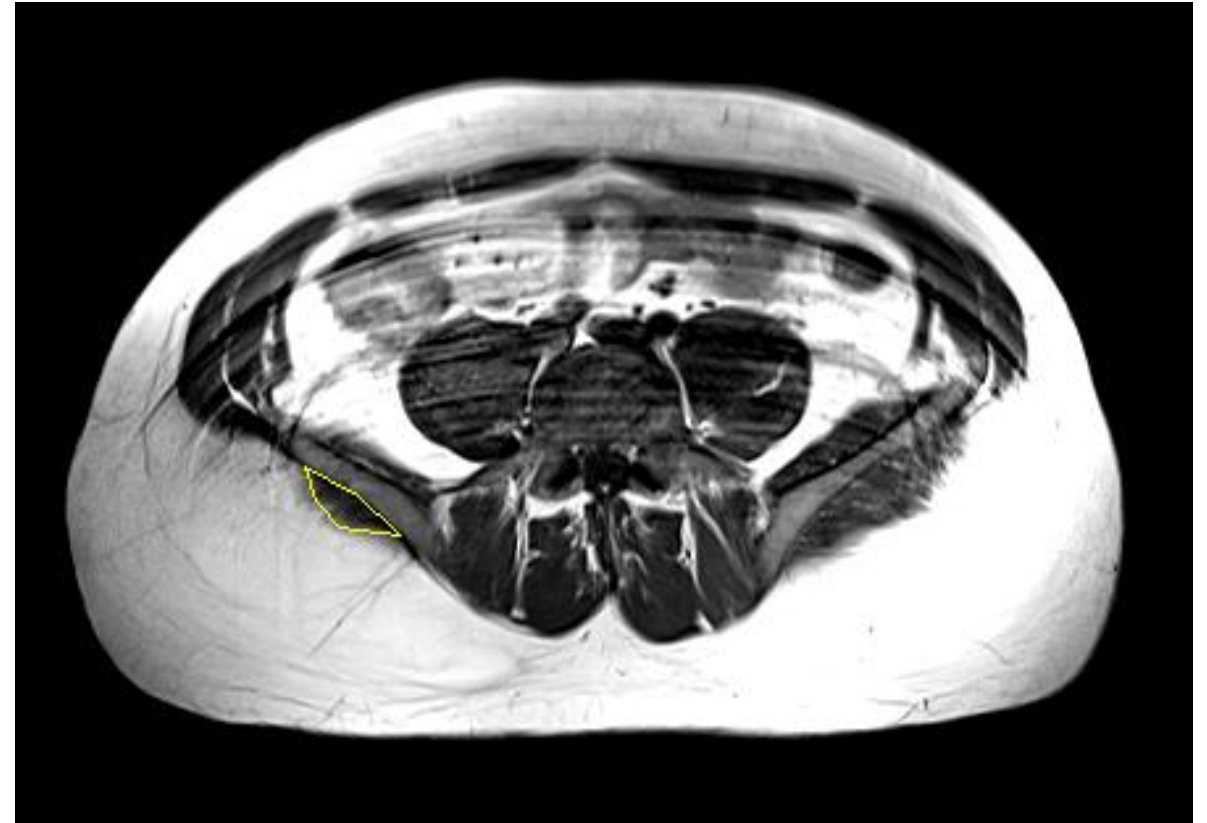
LA TROBE
UNIVERSITY

Sport and Exercise Medicine
Research Centre

MEASUREMENT OF MUSCLE FUNCTION

MUSCLE SIZE

Quantitative measures-> MRI

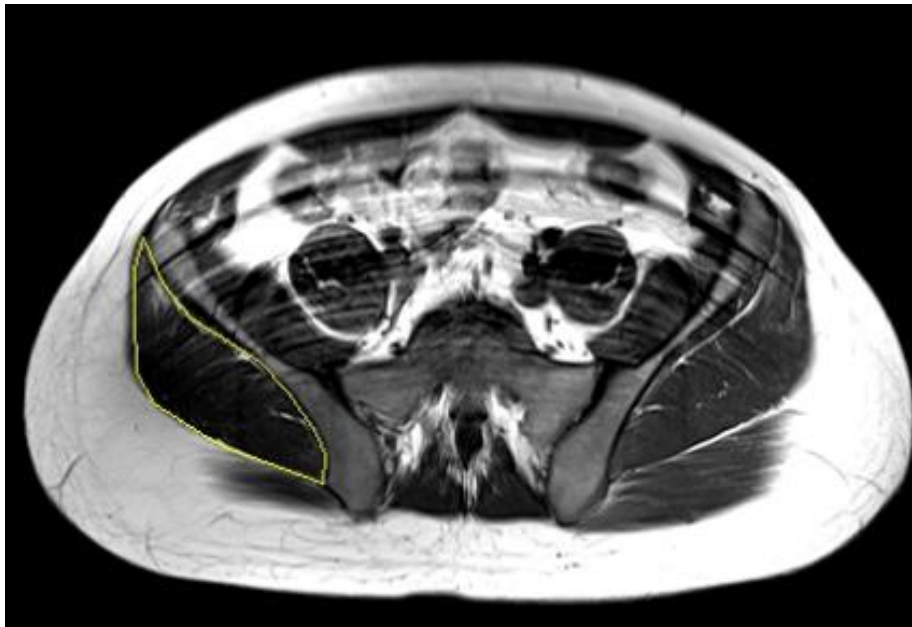


MEASUREMENT OF MUSCLE FUNCTION

MUSCLE SIZE

Quantitative measures-> MRI

- *Quantify muscle size and adiposity*

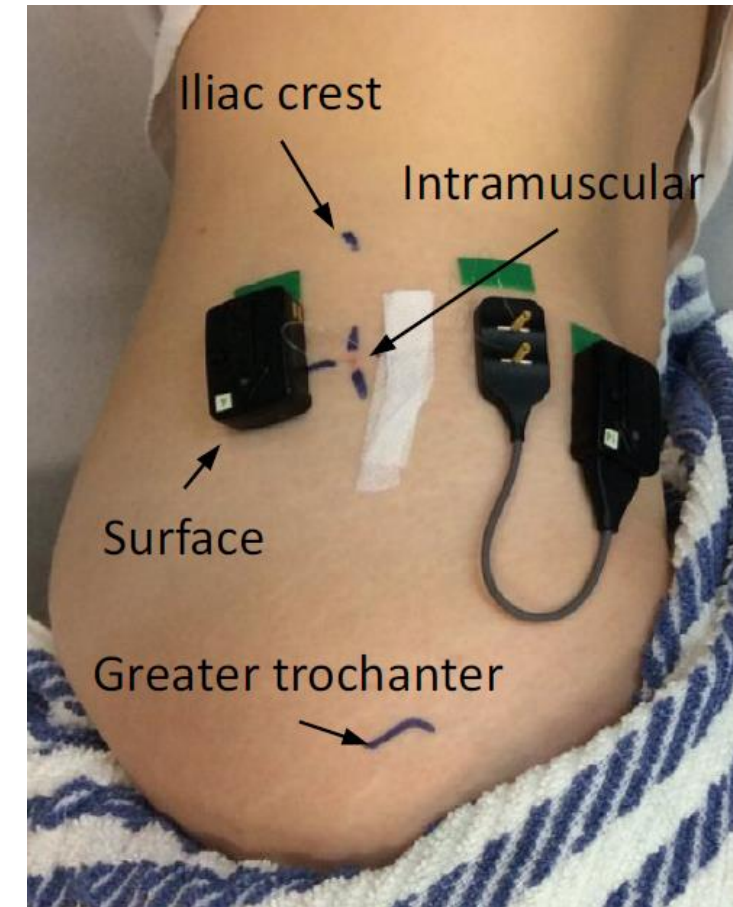
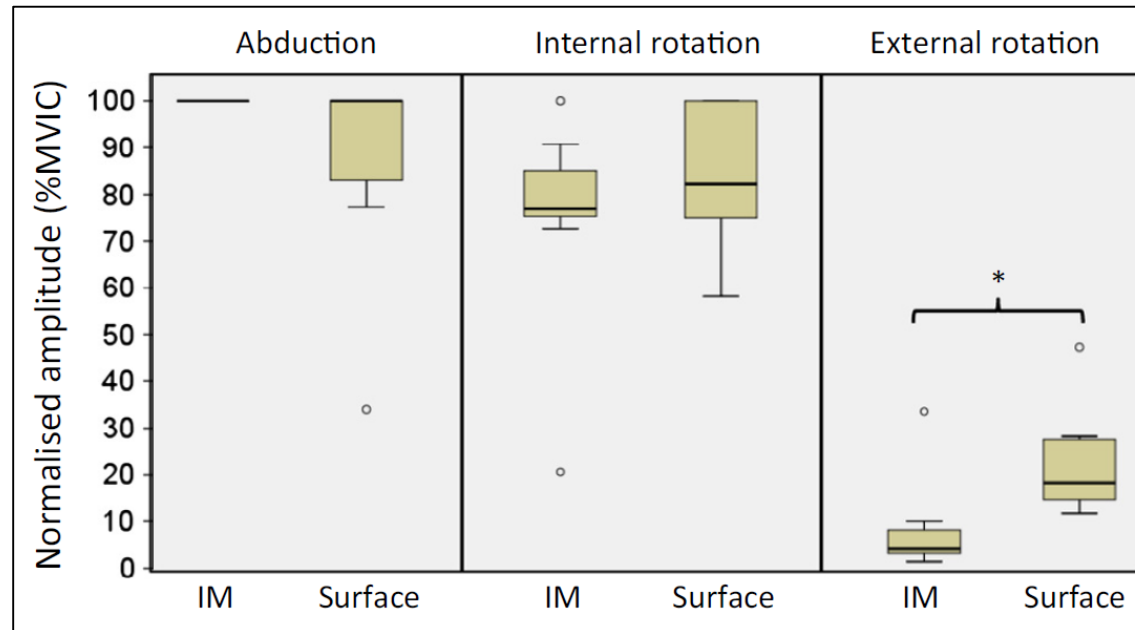


MEASUREMENT OF MUSCLE FUNCTION

EMG

Surface electrodes

Fine wire electrodes



MEASUREMENT OF MUSCLE FUNCTION

EMG

Surface electrodes

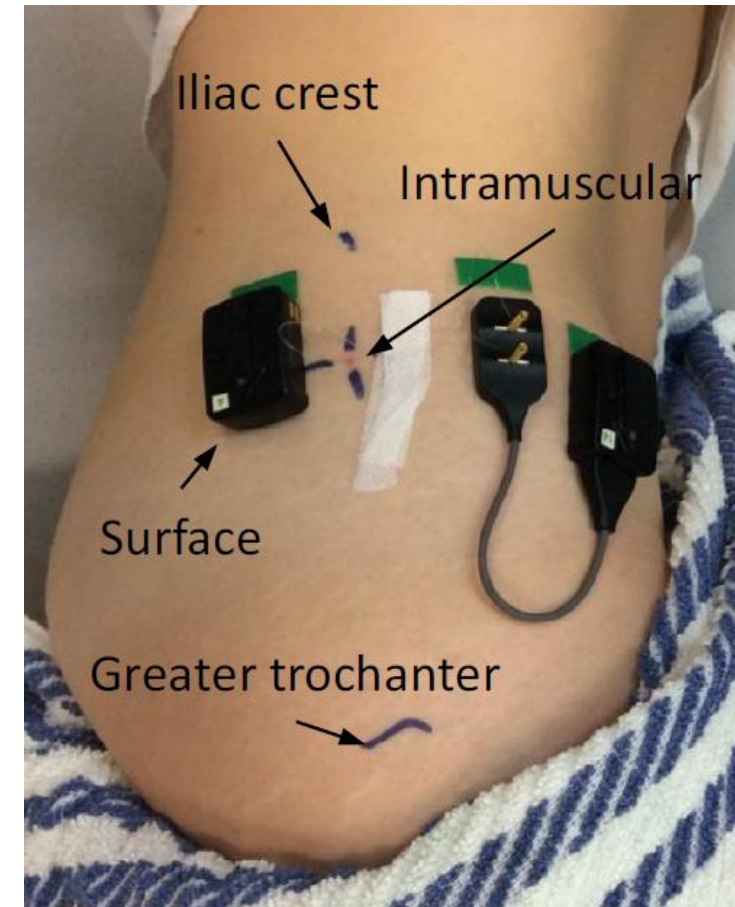
Fine wire electrodes

Records Myoelectric activity

Recorded as Volts

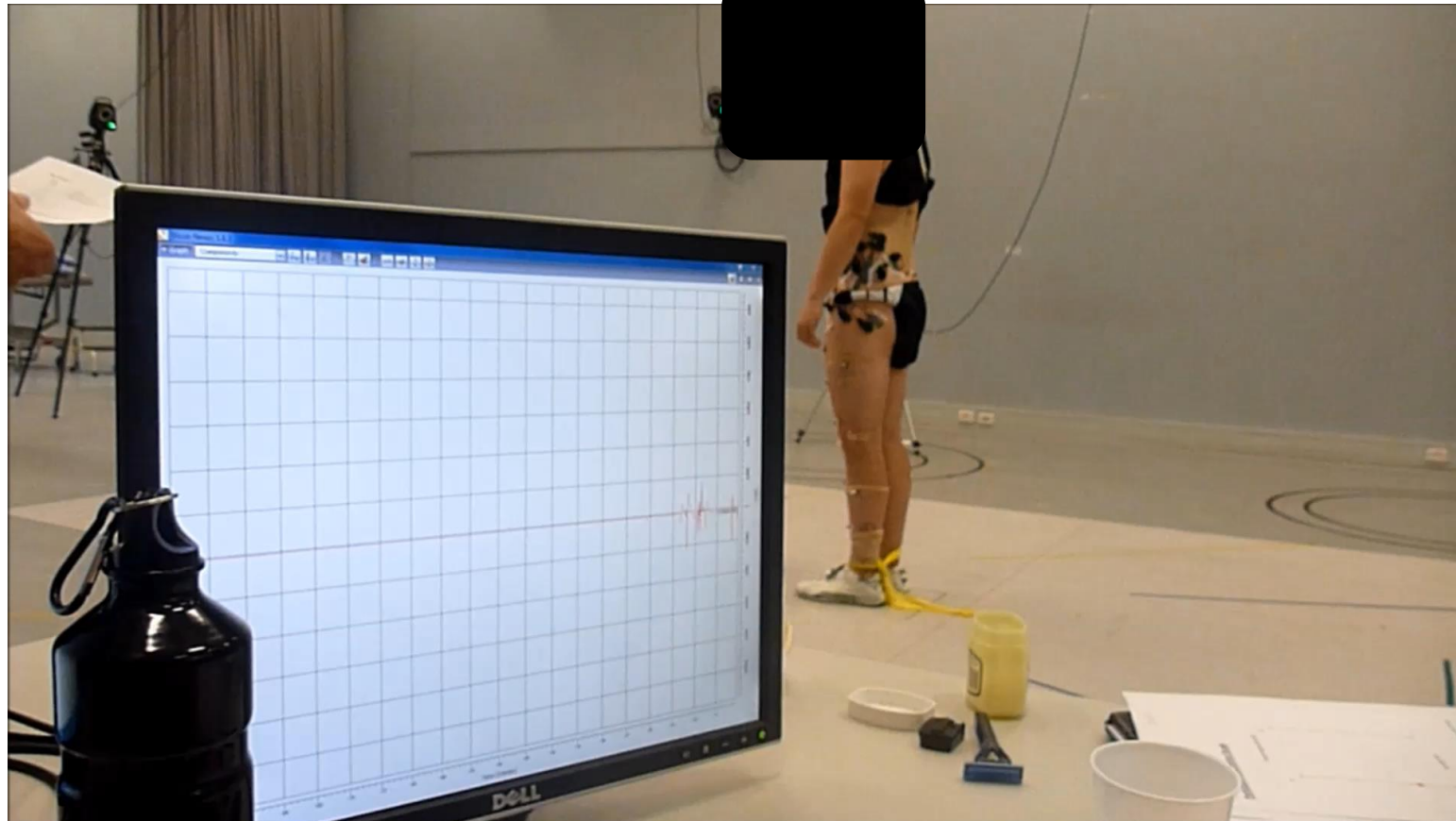
Generally expressed relative to another task (e.g. %MVIC)

Can provide real-time information about muscle function



MEASUREMENT OF MUSCLE FUNCTION

EMG



MEASUREMENT OF MUSCLE FUNCTION



How clear is our understanding of hip muscle function in young adults with hip pain?

MEASUREMENT OF MUSCLE FUNCTION



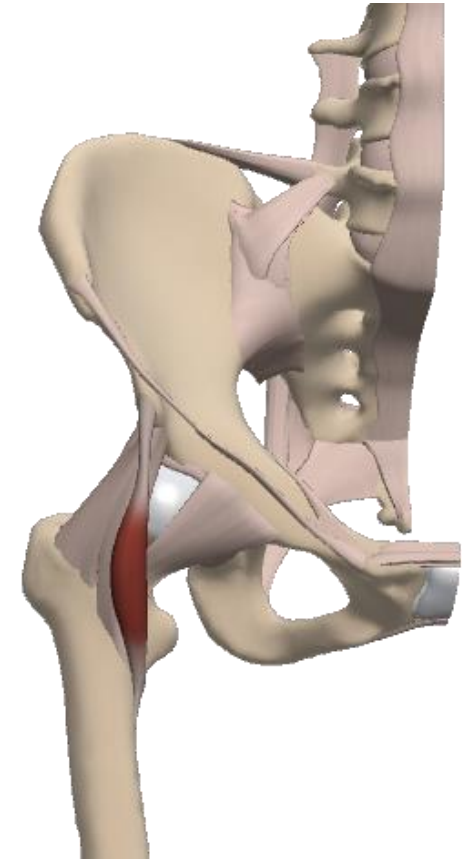
How clear is our understanding of hip muscle function in young adults with hip pain?

Not clear at all!!!

HIP DYSPLASIA

ILIOCAPSULARIS¹

- *Small muscle of the anterior hip-> large capsular attachment*
- *Role?*
 - *Anterior hip stability*
 - *Minimise capsular impingement*



Gait & Posture 54 (2017) 300–303



ELSEVIER

Contents lists available at ScienceDirect

Gait & Posture

journal homepage: www.elsevier.com/locate/gaitpost

Short communication

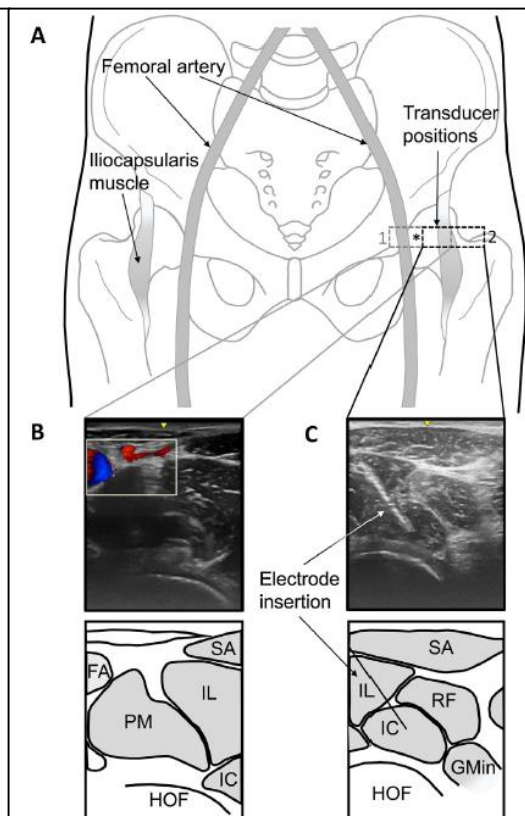
Iliocapsularis: Technical application of fine-wire electromyography, and direction specific action during maximum voluntary isometric contractions

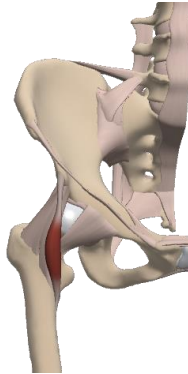
Peter Lawrenson^a, Alison Grimaldi^{a,b}, Kay Crossley^{a,c}, Paul Hodges^a, Bill Vicenzino^a, Adam Ivan Semciw^{a,c,*}

^aThe University of Queensland, School of Health & Rehabilitation Sciences, Brisbane, QLD, 4072, Australia

^bPhysiotec Physiotherapy, 23 Weller Rd, Tarragindi, QLD, 4121, Australia

^cCollege of Science, Health and Engineering, School of Allied Health, La Trobe University, Melbourne, Victoria, Australia





HIP DYSPLASIA

ILIOCAPSULARIS

Hip dysplasia vs control

- *Retrospective imaging audit*
- *Age*
 - *Dysplasia = 34 ± 10 years*
 - *Control = 54 ± 12 years*

Note: not matched for age

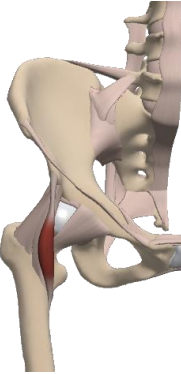
HIP DYSPLASIA

ILIOCAPSULARIS

Hip dysplasia vs control

- *Iliocap to Rec fem ratio*
 - *Width*
 - *Length*
 - *Circumference*
 - *CSA*





HIP DYSPLASIA

ILIOCAPSULARIS

Hip dysplasia vs control

**Significantly greater IC to RF ratio
in dysplasia**

**↓ Passive stability ≈ ↑ active
stability**

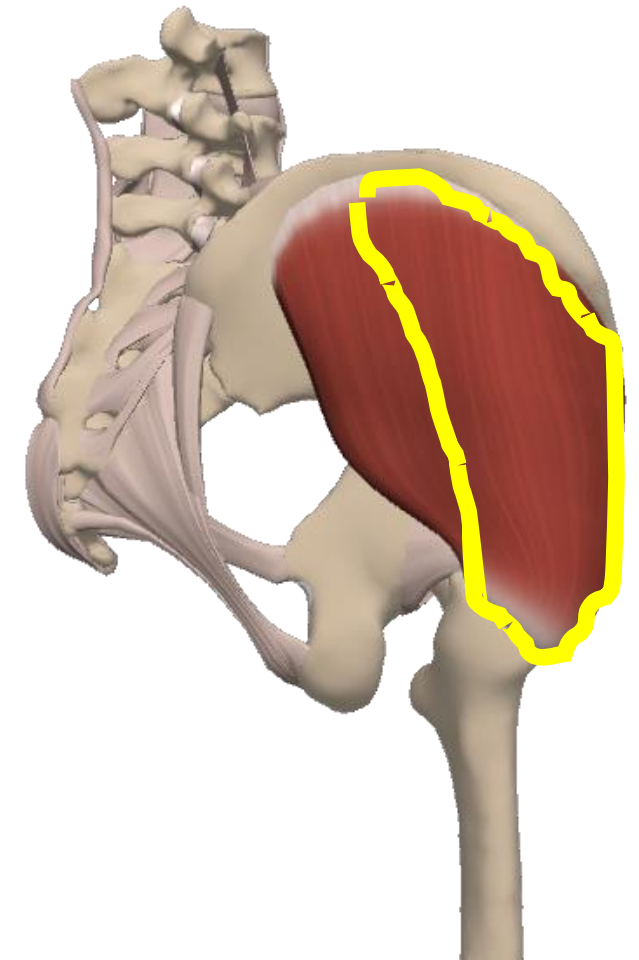
**Caution: controls were older. Is this
an association with age?**

HIP DYSPLASIA

GLUTEUS MEDIUS

Anterior and middle segments

- *Large torque producers*
- *Control of coronal plane motion*



HIP DYSPLASIA

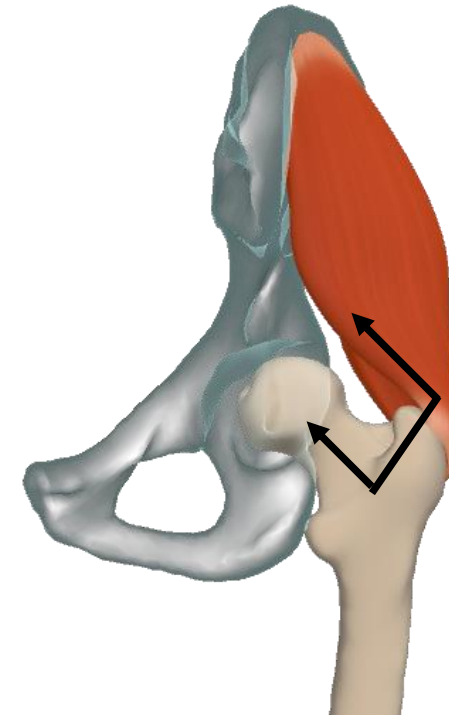
GLUTEUS MEDIUS

Anterior and middle segments

- *Large torque producers*
- *Control of coronal plane motion*

Posterior segment

- *Small*
- *Hip joint stability*

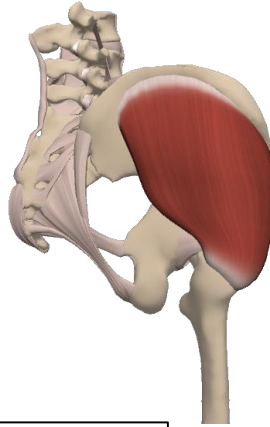


HIP DYSPLASIA

GLUTEUS MEDIUS¹

Asymptomatic vs symptomatic limb

- *Retrospective imaging audit (CT scans)*
- *Unilateral dysplastic hips (19 participants)*
- *Age 47 years (range 35–61 years)*



Liu et al. *BMC Musculoskeletal Disorders* 2012, **13**:101
<http://www.biomedcentral.com/1471-2474/13/1/101>

 **BMC**
Musculoskeletal Disorders

RESEARCH ARTICLE

Open Access

Changes of gluteus medius muscle in the adult patients with unilateral developmental dysplasia of the hip

RuiYu Liu¹, XiaoDong Wen¹, ZhiQin Tong², KunZheng Wang^{1*} and ChunSheng Wang¹

HIP DYSPLASIA

GLUTEUS MEDIUS

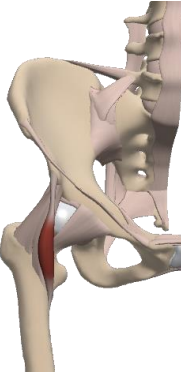
Asymptomatic vs symptomatic limb

- CSA

≈20% less CSA of GMed on symptomatic side

Implications for strength training in this populations?

**Caution: Cross-sectional study
Need prospective research**



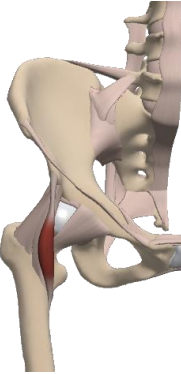
PINCER MORPHOLOGY

ILIOCAPSULARIS

Pincer vs control¹

- *Retrospective imaging audit*
- *Age*
 - *Pincer = 33 ± 11 years*
 - *Control = 54 ± 12 years*

Note: not matched for age!



PINCER MORPHOLOGY

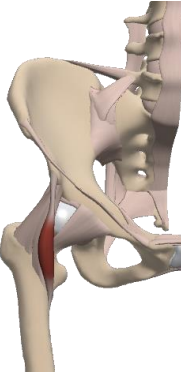
ILIOCAPSULARIS

*Pincer vs control*¹

Significantly less IC to RF ratio in Pincer

↑ Passive stability ≈ ↓ active stability

Caution: controls were older. Is this an association with age?



PINCER vs DYSPLASIA

ILIOCAPSULARIS

Pincer vs Dysplasia^{1,2}

- Retrospective imaging audit (CT scans)
- Matched in Age
 - *Dysplasia* = 34 ± 10 years
 - *Pincer* = 33 ± 11 years



PINCER vs DYSPLASIA

ILIOCAPSULARIS

Pincer vs Dysplasia^{1,2}

Pincer = ↓ IC thickness, width, CSA

↑ Passive stability ≈ ↓ active stability

PINCER vs DYSPLASIA

EMG STUDIES

0

LABRAL TEARS

ANTERIOR HIP MUSCLES

Labral tears vs control¹

- *MRI diagnosed labral tear*
- *Pre-surgical: hip arthroscopy*
- *Age 35 years (20-53)*

No difference in anterior hip muscle size

Note: less hip flexion strength in symptomatic group

Muscle quality may not be as good??

LABRAL TEARS

EMG STUDY

Labral tears vs control¹

- *Clinical symptoms*
- *MRI confirmation*
- *Age 33 (\pm 9) years*
- *Lunge task*
 - *EMG recorded during descent and ascent*

Do Neuromuscular Alterations Exist for Patients With
Acetabular Labral Tears During Function?



Maureen K. Dwyer, Ph.D., A.T.C., Cara L. Lewis, P.T., Ph.D., Alfred W. Hanmer, M.D., and
Joseph C. McCarthy, M.D.

LABRAL TEARS

EMG STUDY

Labral tears vs control¹

GMax = less activity compared to control

No difference with

- Adductor longus
- Gluteus medius
- Rectus femoris

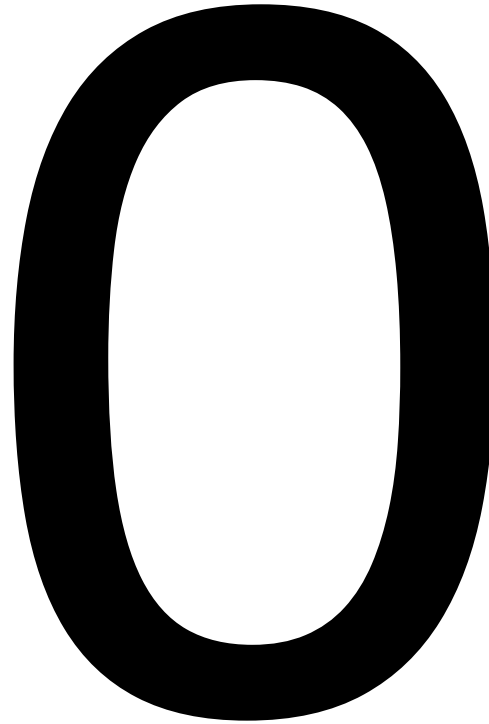
Do Neuromuscular Alterations Exist for Patients With
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Joseph C. McCarthy, M.D.

CAM MORPHOLOGY

MRI STUDIES



CAM MORPHOLOGY

EMG STUDIES

Walking

- *Two studies^{1,2}*

↑ GMax Activity

Control hip flexion?
Or
Weak/ inefficient?

Differences in Hip Joint Biomechanics and Muscle Activation in Individuals With Femoroacetabular Impingement Compared With Healthy, Asymptomatic Individuals

Is Level-Ground Gait Analysis Enough?

Derek J. Rutherford,^{*†‡} PT, PhD, Janice Moreside,^{†§} PT, PhD, and Ivan Wong,^{||} MD
Investigation performed at the Joint Action Research Laboratory, School of Physiotherapy, Dalhousie University, Halifax, Nova Scotia, Canada

CAM MORPHOLOGY

EMG STUDIES

Walking

- Two studies^{1,2}

↑ GMax Activity

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Minimal differences in other muscles

Need more demanding tasks!

CAM MORPHOLOGY

EMG STUDIES

*Walking*²

- *Control*

**Highly variable activity
between participants**

Coordination of Deep Hip Muscle Activity Is Altered in Symptomatic Femoroacetabular Impingement

Laura E. Diamond,¹ Wolbert Van den Hoorn,² Kim L. Bennell,¹ Tim V. Wrigley,¹ Rana S. Hinman,¹ John O'Donnell,³ Paul W. Hodges²

CAM MORPHOLOGY

EMG STUDIES

*Walking*²

- *Cam (\pm pincer)*

Less variability with deep hip rotators (esp swing)

More constrained?

Coordination of Deep Hip Muscle Activity Is Altered in Symptomatic Femoroacetabular Impingement

Laura E. Diamond,¹ Wolbert Van den Hoorn,² Kim L. Bennell,¹ Tim V. Wrigley,¹ Rana S. Hinman,¹ John O'Donnell,³ Paul W. Hodges²

YOUNG ADULTS WITH HIP PAIN

MUSCLE CONSIDERATIONS

Muscle size

- *Deep anterior hip muscle size may be associated with acetabular coverage^{1,2}*
- *Evidence of a reduction in Gmed muscle size in people with hip dysplasia³*
- *Evidence of no anterior hip muscle atrophy in people with labral tears⁴*

Limitations

- *No research in people with CAM morphology*
- *No understanding of changes over time*
- *No understanding of the association with muscle size and symptoms*

1. Haefeli, et al., *Clin. Orthop. Relat. Res.* 2015

2. Babst, et al., *Clin. Orthop. Relat. Res.* 2011

3. Liu, et al., *BMC musculoskeletal disorders* 2012

4. Mendis, et al., *Manual Ther.* 2014

YOUNG ADULTS WITH HIP PAIN

MUSCLE CONSIDERATIONS

Muscle function (EMG)

- *Symptomatic labral tears -> Evidence of reduced Gmax activity during a lunge¹*
- *Cam morphology-> Gait: evidence of increased Gmax activity² and altered deep hip muscle coordination³*

Limitations

- *No research on gluteus minimus or anterior hip muscles (e.g. iliocapsularis)*
- *Need more demanding tasks-> squat, run, kick*

1. Dwyer, et al., *Arthroscopy* 2016

2. Rutherford, et al., *Orthopaedic Journal of Sports Medicine* 2018


3. Diamond, et al., *J. Orthop. Res.* 2017

YOUNG ADULTS WITH HIP PAIN

WATCH THIS SPACE!



Journal of Physiotherapy 64 (2018) 55



Journal of
PHYSIOTHERAPY

journal homepage: www.elsevier.com/locate/jphys

Appraisal

Trial Protocol

Femoroacetabular impingement and hip Osteoarthritis Cohort (FORCE):
protocol for a prospective study

Kay M Crossley^a, Marcus G Pandey^b, Sharmila Majumdar^c, Anne J Smith^d, Rintje Agricola^e,
Adam I Semciw^{a,f}, Joanne L Kemp^a, Joshua J Heerey^a, Matthew G King^a, Peter R Lawrenson^f,
Yi-Chung Lin^b, Richard B Souza^{c,g}, Andrea B Mosler^a, Thomas M Link^c, Ramya Srinivasan^c,
Anthony G Schache^{a,b}

TAKE HOME MESSAGE

Our understanding of hip muscle function in young adults with hip pain has a long way to go

Current evidence suggests that

- *Not all muscles are affected equally over time (e.g. different grades of pathology)*
- *Muscle function varies across different pathological conditions (e.g. dysplasia vs pincer)*

Rehabilitation may require a targeted approach, depending on the type and stage of pathology