Heterotopic Ossification Following THR

Introductions

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Agenda

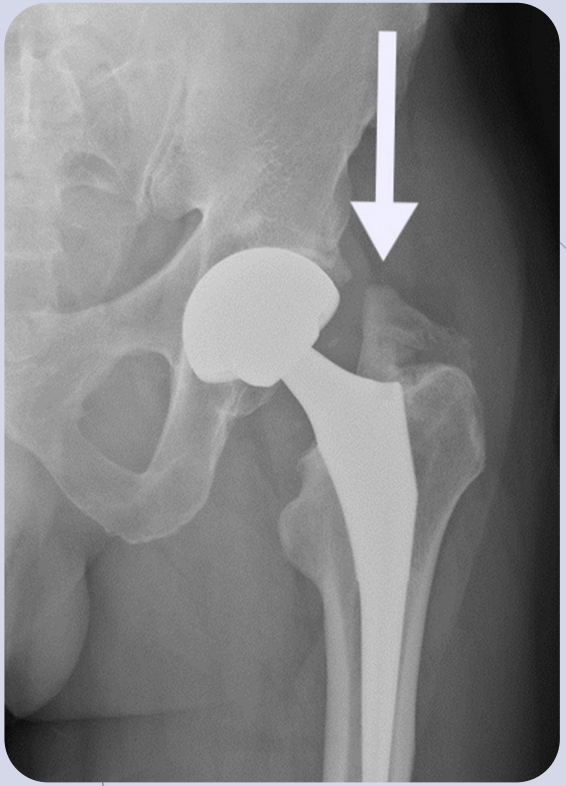
- Introduction: Understanding Heterotopic Ossification (HO)
- Clinical Presentation & Mechanism of Injury
- Common Causes & Risk Factors
- Anatomical Overview: Hip and Periarticular Structures
- Clinical Assessment
    - Range of Motion: Hip Flexion / Extension / Abduction / IR & ER
    - Muscle Testing: Hip Abductors / Extensors / Flexors, Quadriceps
- Case Study: Data Review & Clinical Reasoning
- Treatment and Rehabilitation Strategies
- Q&A

Heterotopic Ossification Following Total Hip Replacement

Understanding Heterotopic Ossification (HO)

- Heterotopic Ossification is the abnormal formation of mature lamellar bone within non-osseous soft tissues such as muscle, fascia, or connective tissue.

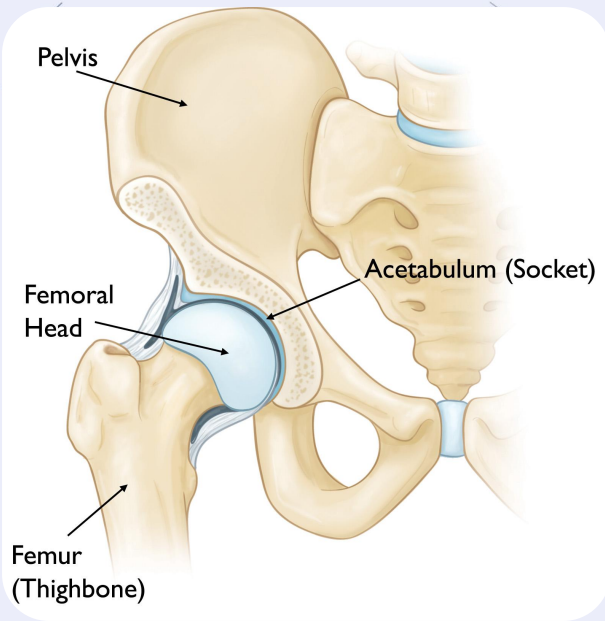
- **Relevance to Total Hip Replacement:** HO is a known complication following total hip replacement, with reported incidence rates up to ~40% post-arthroplasty, though not all cases are clinically significant.



Understanding Heterotopic Ossification (HO)

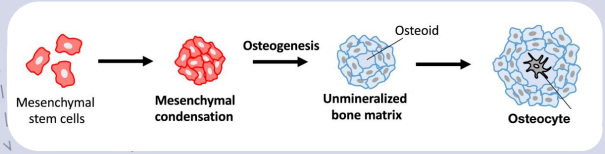
- **Why it matters for PTs:** HO can significantly restrict hip range of motion, alter biomechanics, delay rehabilitation, and impact long-term functional outcomes.

- **Clinical Challenge:** Early symptoms often mimic common post-operative conditions (e.g., gluteal tendinopathy, post-surgical stiffness), increasing risk of delayed diagnosis.

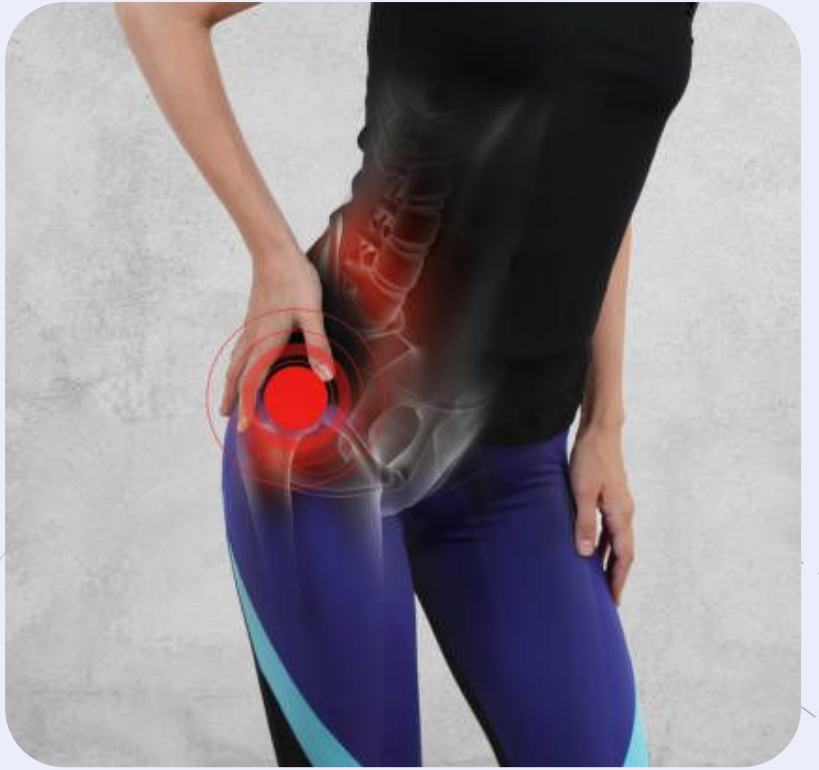


Mechanism of Injury

- Triggered by local tissue trauma (surgical dissection, muscle injury, hematoma formation)
- Inflammatory cascade → mesenchymal stem cells differentiate into osteoblasts
- Abnormal bone formation occurs within periarticular soft tissues
- In THR, risk is influenced by:
  - Surgical approach (posterior, lateral)
  - Muscle handling and soft tissue disruption
  - Post-operative inflammatory load



Clinical Presentation



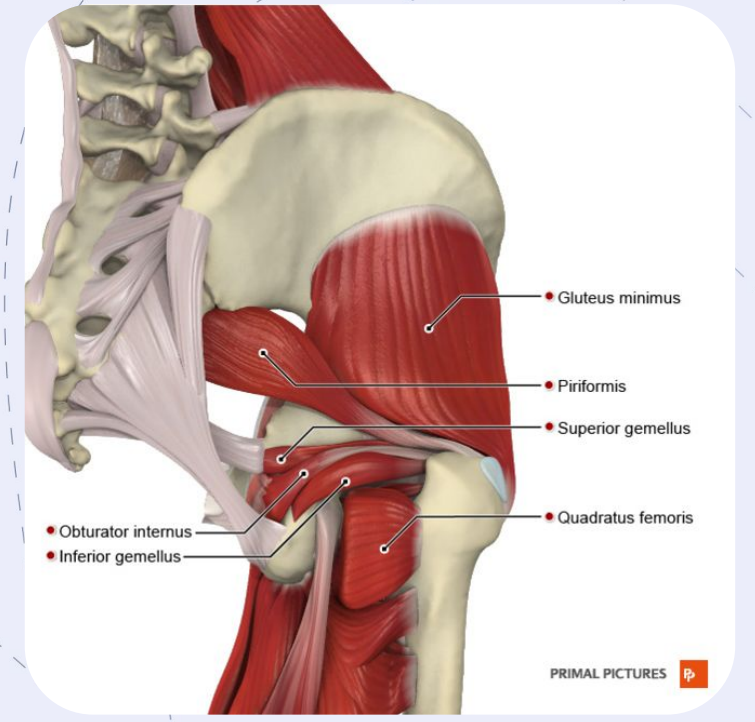
- Gradual onset of:
  - **Hip stiffness and loss of ROM (often progressive)**
  - Pain with end-range movements
  - Firm or hard end-feel on passive ROM
- Reduced tolerance to:
  - Sit-to-stand
  - Squatting
  - Gait with longer stride length
- Symptoms often emerge 6–12 weeks post-op, not immediately

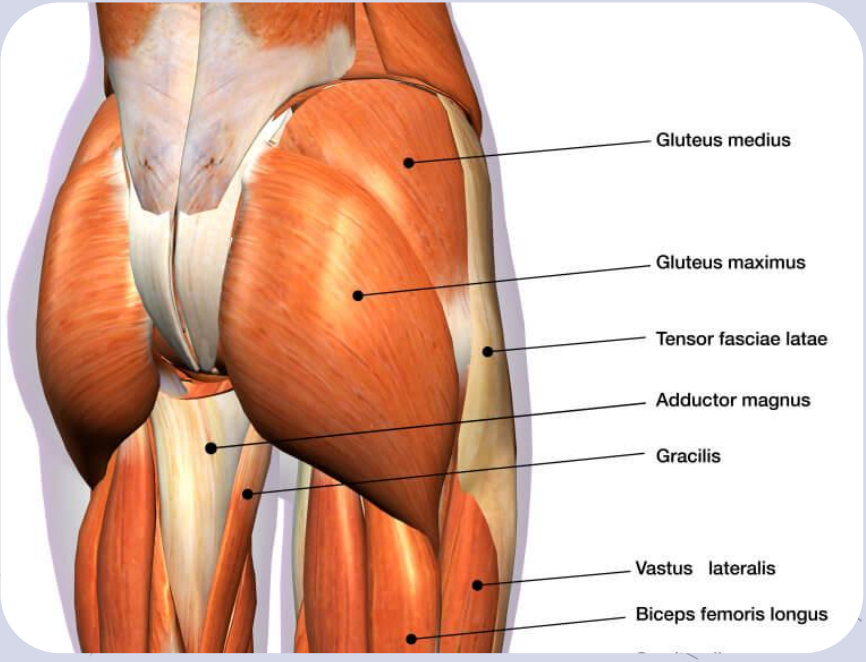
Common Causes & Risk Factors

- General Risk Factors
  - Trauma or orthopedic surgery
  - Male sex (approx. 3:2 male-to-female ratio)
  - Previous history of HO
  - Neurological injury (TBI, SCI)
  - Severe burns
- THR-Specific Risk Factors
  - Total hip arthroplasty (≈40% of HO cases)
  - Surgical approach with greater muscle disruption
  - Delayed mobilization or excessive early loading
  - Lack of prophylactic management in high-risk patients

Anatomical Overview: Hip and Periarticular Structures

- Hip joint (Acetabulofemoral joint)
  - Primary motions affected: flexion, extension, abduction, internal & external rotation
- Common Soft Tissue Sites of HO Formation
  - Gluteus medius & minimus
  - Iliopsoas
  - Vastus lateralis
  - Joint capsule and periarticular fascia

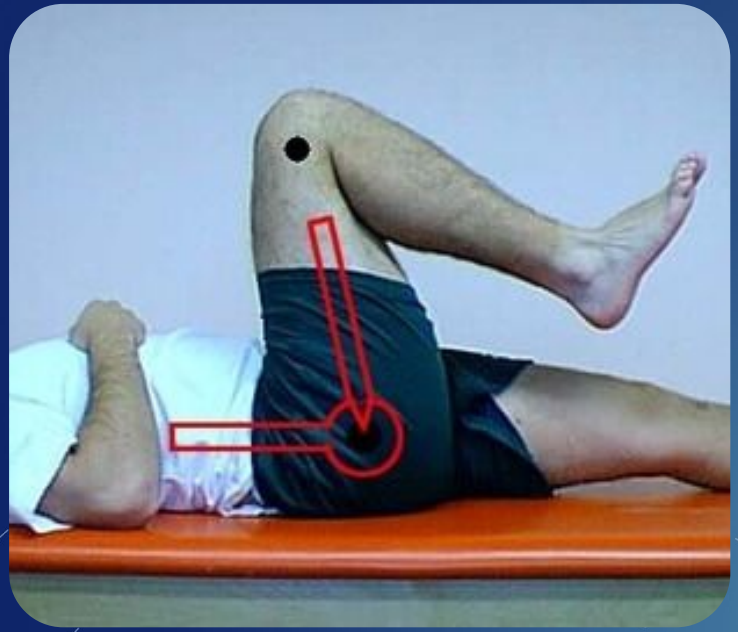




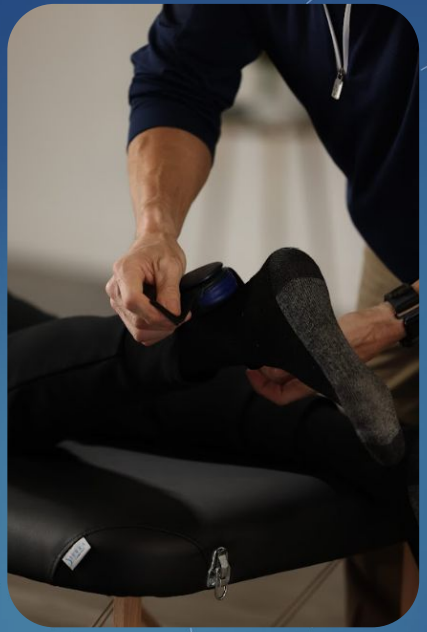
- Common Soft Tissue Sites of HO Formation
  - Gluteus medius & minimus
  - Iliopsoas
  - Vastus lateralis
  - Joint capsule and periarticular fascia

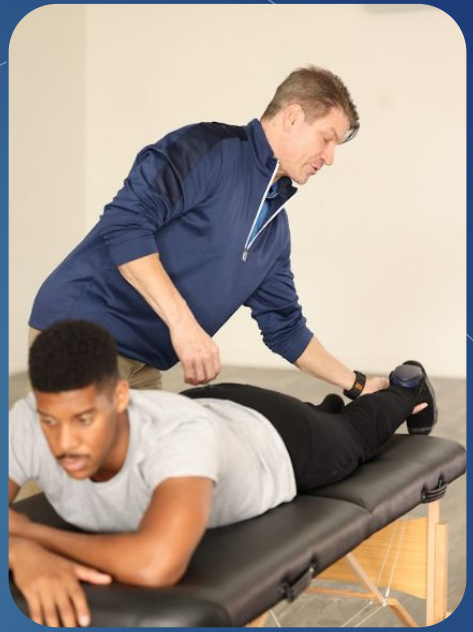
Clinical Assessment: Range of Motion

Hip Flexion:



Hip Extension:

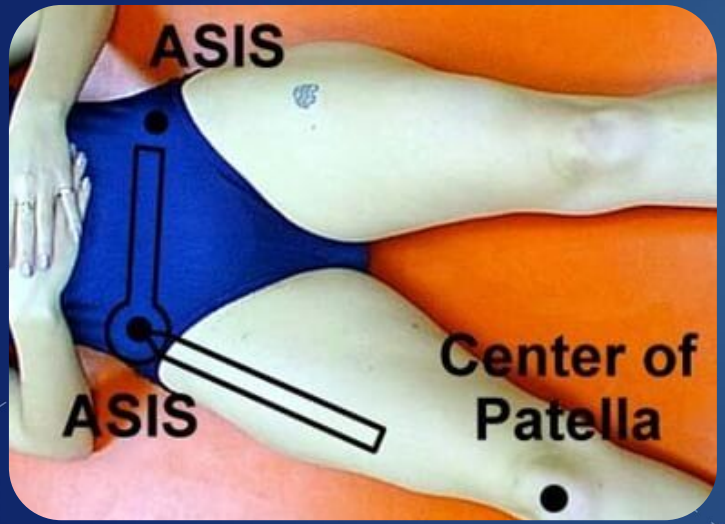


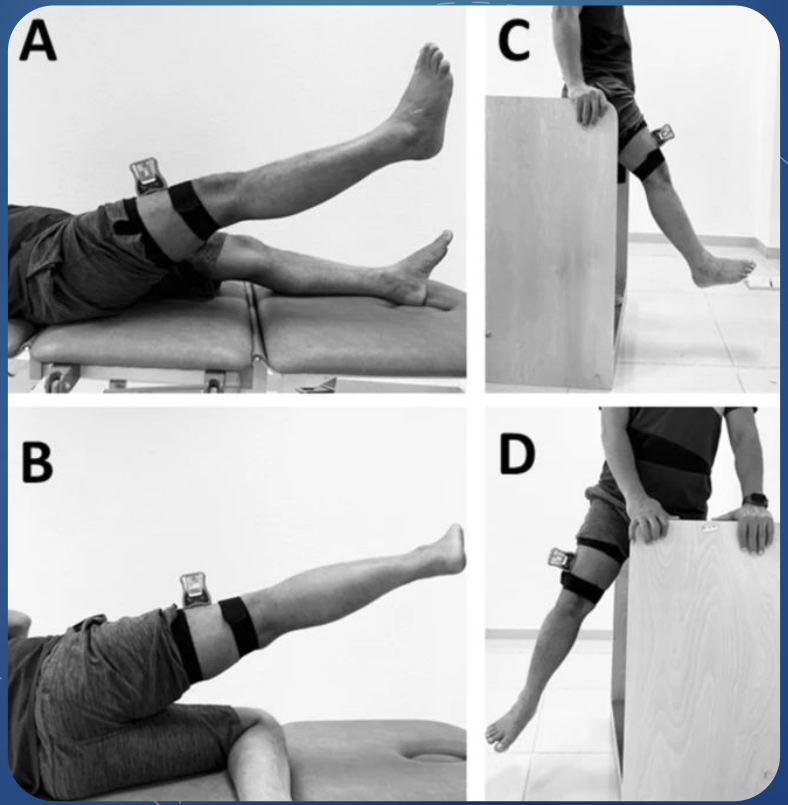


- Best done with device strapped on the ankle.

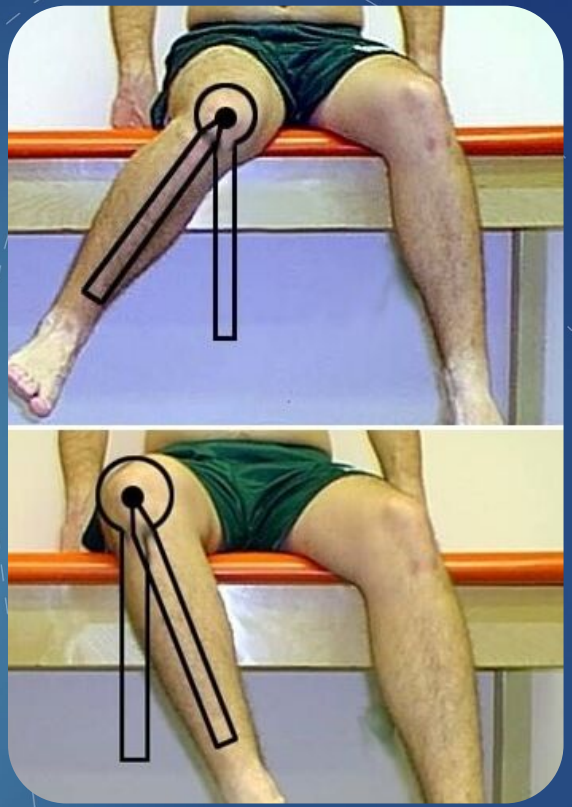
ROM: Hip Abduction

- Usually done in supine or sidely with the device strapped





ROM: Hip Internal & External Rotation



- Can be done in supine, prone, and sitting with the device strapped on the ankle

Clinical Assessment: Muscle Testing

Hip Abductors

- Can be done with or without the device strapped

Hip Flexors:

Hip Extensors:

- Can be done with or without the device strapped on the treatment table

Quadriceps

- Can be done with or without the device strapped on the treatment table

Case Study: Ice Breaker

Context:

- Age: 37
- Gender: M
- Attending for left shoulder pain. Has not seen other professionals about this.

Subject:

- PC: Left shoulder pain
- HOPC:
  - Approx 3/12 ago, chased son (3 years old) upstairs, picked up son and noticed left shoulder pain
  - No history of left shoulder pain reported
  - Did not notice any onset or swelling or fell/hear anything unusual at the time.
- Aggs: Running and the mechanism discussed above
- Eases: Avoids agg's. Has not required pain relief.
- Pattern: Nil pain at rest. Symptom Distribution: Demonstration by Matt

Subject:

- PMHx: HTN
  - Previous smoker.
  - Otherwise fit and well
- DH:
  - HTN is currently managed by Ramipril
  - Has not trialled pain relief.
- SH:
  - Works in an office job.
  - Lives with wife and 2 children.
  - Enjoys short distance recreational runs
- Exp: His friend told him a massage would fix it.

Objective

- Nil abnormal on observation.
- Cx screen, Spurling's NAD.
- Neuro NAD. ULTT cluster NAD
- Full pain free range in all planes of the L shoulder. Nil pain with OP. Combined motions NAD
- Str: <5% deficit L>R throughout. Ax inclusive of inner, mid and outer range. Nil pain.
- Hegedus cluster NAD: HK, Arc and Resisted ER
- Palpation: NAD

Provisional Dx:

- Why?
- Differential Dx:
- Why?

Subject:

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- HOPC:
  - Approx 3/12 ago, chased son (3 years old) upstairs, picked up son and noticed left shoulder pain
  - No history of left shoulder pain reported
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- Aggs: Running and the mechanism discussed above
- Eases: Avoids agg's. Has not required pain relief.
- Pattern: Nil pain at rest.
- Symptom Distribution: Demonstration by Matt

Subject Cont. - Review

- PMHx:
  - HTN, Previous smoker.
  - Otherwise fit and well
- DH:
  - HTN is currently managed by Ramipril
  - Has not trialled pain relief.
- SH:
  - Works in an office job.
  - Lives with wife and 2 children.
  - Enjoys short distance recreational runs?
- Exp: His friend told him a massage would fix it.

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- Palpation: NAD

Dx:

- Pre Myocardial Infarction

- Hypothetico-deductive clinical reasoning
- Pattern recognition clinical reasoning
- Framing / Hierarchical bias

Case Study:

Heterotopic Ossification – Case Study

- Age: 52
- Gender: Female
- Former elite cyclist.
- Right total hip replacement. **Posterior approach**
- No post op restrictions
- PMHx: **Gout**
- OA L hip
- ?Long Covid symptoms

Week 0-6

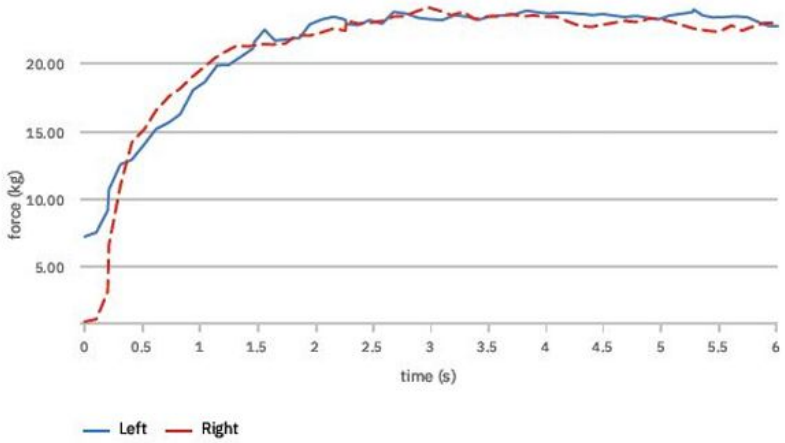
- Day 2: discharge from ward.
- Discharged home with 2 x E/C.
- Progressed to 1 x W/S at 2 week physio review.
- Pain well managed, including self directed wean.
- Walking tolerance up to 1 mile. Compliant with rehab regime.
- Volume and periodization addressed during 2 week physio review.
- No wound concerns. No circulatory concerns

Week 6-12

- D/C from ortho week 6
- Reported lateral hip symptoms in R side during a subsequent physiotherapy R/V (week 12)
- Dx Gluteal tendinopathy (?in degenerative tendon cohort, proximity to incision site and confounding symptoms)
- (Mechanism, pain geography, palpation and pain on resisted abd)
- Main agg squat patterns (STS etc), lateral symptoms on forward lean / hip flex
- Rx as tendinopathy with PT (Considerations for adjuncts ESWT and possible contraindications to adjuncts post THR)
- DDx: DVT, cellulitis, abscess haemotoma, tumour (osteosarcoma), infection/scar complications

6-12 Post op

- Hip Abduction Side-lying Long Lever



Average Values

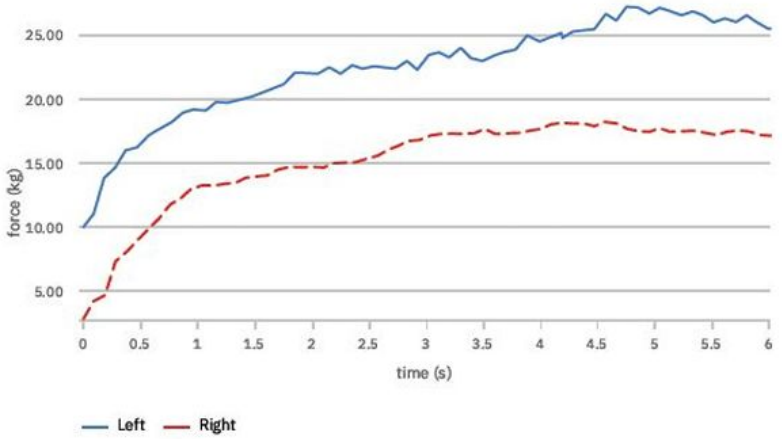
Left	21.49 kg
Right	21.21 kg

Peak Force (kg)

Left	23.98 kg
Right	24.13 kg
Strength Difference	0.15 kg
Percentage Difference	0.63%

6-12 Post op

- Hip Abduction Side-lying Short Lever



Average Values

Left	22.62 kg
Right	15.27 kg

Peak Force (kg)

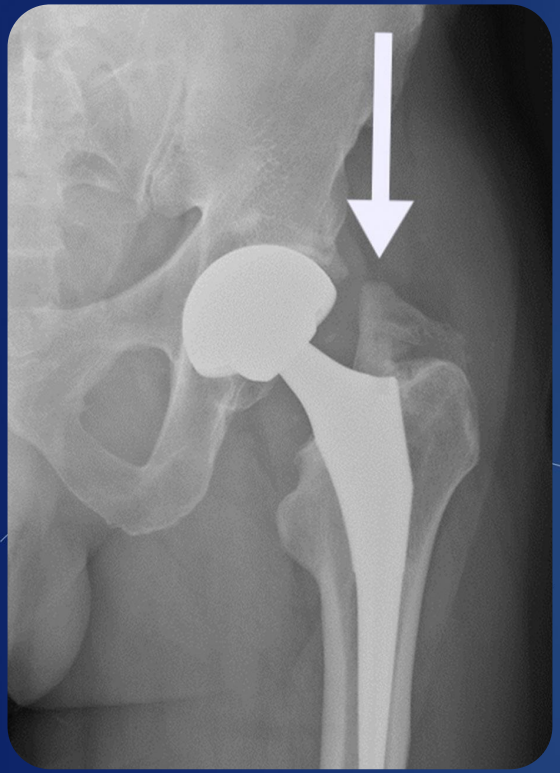
Left	27.19 kg
Right	18.19 kg
Strength Difference	9.00 kg
Percentage Difference	39.66%

Other Dynamometer Applications

- Hip flexion ROM – Record of when symptoms are elicited
- Hip abduction ROM - Record of when symptoms are elicited
- +Symptom geography - Measure and record*

Symptom pattern/trend, symptom duration and symptom predictability.

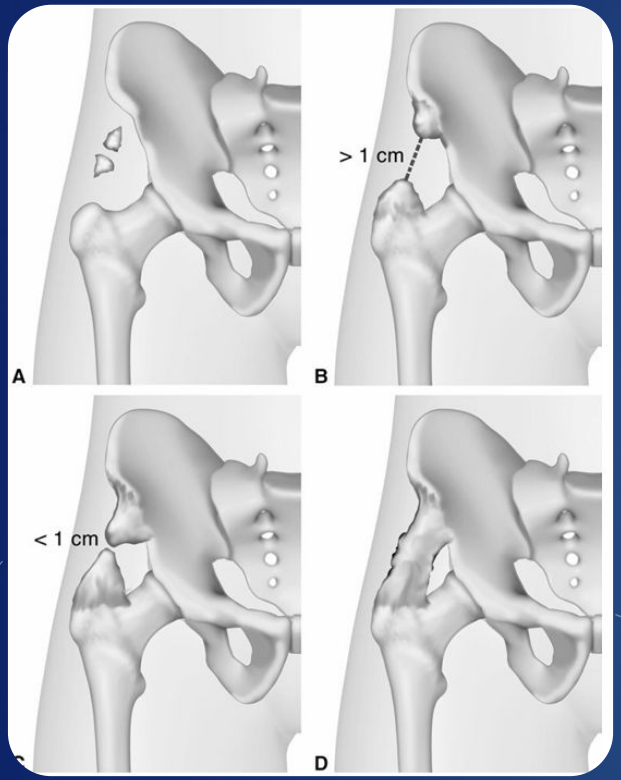
Re-referred for Ortho R/V & Imaging



- N.B Radiograph is not from the patient in this case study.

Source: https://orthoinfo.aaos.org/en/diseases--conditions/heterotopic-ossification-of-the-hip/

Brooker Classification



The Brooker classification divides the extent of HO formation after THA into four classes:

(A) Class 1 is described as islands of bone within the soft tissues about the hip.

(B) Class 2 includes bone spurs originating from the pelvis or proximal end of the femur, leaving at least 1 cm between opposing bone surfaces.

(C) Class 3 consists of bone spurs originating from the pelvis or proximal end of the femur, reducing the space between opposing bone surfaces to less than 1 cm..

(D) Class 4 shows apparent bone ankylosis of the hip

Hug et al 2015

Risk Factors

- Trauma or surgery
- Men-woman 3:2 (Meyers et al 2019)
- 40% of cases occur post hip arthroplasty (30% post elbow) trauma/dislocation) (Meyers et al 2019)
- Neurological injury TBI (Meyers et al 2019)
- Severe burns (Meyers et al 2019)
- Uric acid level (Bai et al 2020) – Link to Gout PMHx for case study

Preventive / Treatment Options

Preventative / Treatment Options

- Conservative Mx
- Prophylactic and early NSAID’s if risk factors identified - particularly neurogenic cohort (Indomethacin 25-50mg TDS for 7-14 days),
- Early cryotherapy (Game ready/alternative)
- Radiotherapy – Limited evidence. Appears to be seldom utilised in contemporary practice.
- A pool of disease modifying drugs with limited evidence.
- Surgical excision (arthroscopy)

Physiotherapy Intervention

- Pain modulation strategies - Isometrics, NMES (Compex), Pharmaceuticals (analgesics and NSAID’s), Psychological pain modulation strategies (inc education & engagement)
- ActivForce to quantify and teach - 40% isometrics tolerable
- Prevent ankylosing - AROM, PROM - High volume, high frequency, low intensity
- Low impact cardio - Bike variations (given patients history). Pre/post ActivForce testing demonstrated improved performance (?activation based, confidence based, pain modulation based)
- Short lever loading - single plane (particularly short lever side plank variations)
- Data driven approach resonated with the patient.
- This fed into a goal driven approach.

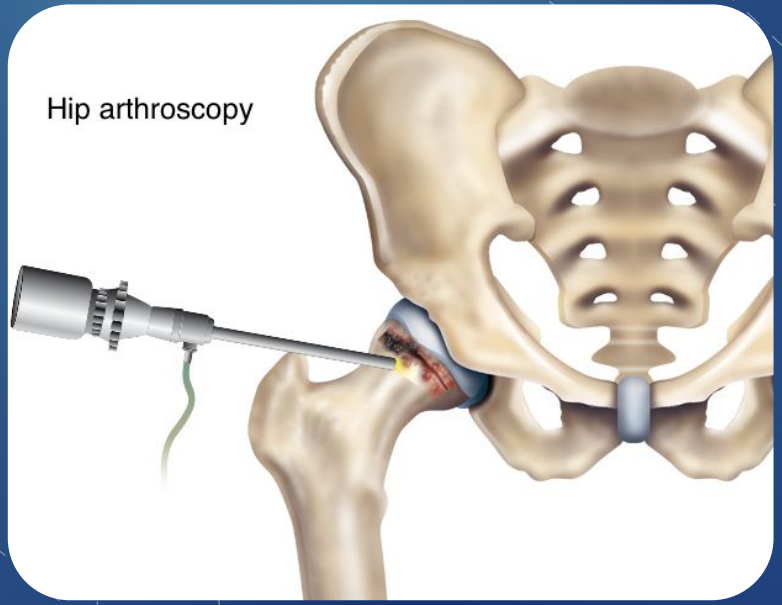
Proliferative/Stimulative Adjuncts

Shockwave - Contraindications with proximity to prosthetic and limited indications given pathophysiology.

Dry needling - Some evidence (predominantly case study based), primarily post TKR. Targeting “trigger points”. Infection risk particularly post arthroplasty and stimulative in nature. Diametrically opposed to other treatment options

Current Management

- 2 out of 4 have progressed to surgery (arthroscopy)



Further Reading

Heterotopic Ossification

Questions?

@activforce

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