POST-ARTHROSCOPY REHABILITATION FOR THE HIP REHAB SUMMIT 2009

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Objectives

• Understand the major limitations regarding post-operative rehabilitation post hip arthroscopic procedures as discussed in the lecture.

• Be able to discuss current evidence support for various exercises as they relate to post hip arthroscopy.

• Understand the exercise progression concept related to these surgical procedures.
Acetabulum

- Only upper margin has true circular contour
- Roundness decreases with age
- Lunate surface covered with hyaline cartilage
Pulvinar acetabuli

• Fat pad in acetabular fossa
• Covered with synovial membrane
• Function:
  – Lubrication
  – Shock absorber
  – Protects ligamentum teres
Labral tears – a starting point for degenerative changes at the acetabular rim

Damage to labrum was evident in 96% of postmortem hip joints in people 61-98 years old

74% in anterosuperior quadrant
Hip Joint Capsule and Ligaments

- Capsule strong and dense
- Capsule attached to entire periphery of acetabulum
- Iliofemoral ligament
- Pubofemoral ligament
- Ischiofemoral ligament
Hip Joint Capsule and Ligaments
Arthrokinematics

- Flexion/extension – spin movement of the head of the femur
- Abduction – head of femur glides inferior
- Adduction – head of femur glides superior
- IR – head of femur glides posterior
- ER – head of femur glides anterior
Dx. Algorithm for categorizing and treating non-arthritic hip pain

<table>
<thead>
<tr>
<th>Primary Labrum</th>
<th>Primary Chondral</th>
<th>Primary Capsule</th>
<th>Extra-articular</th>
<th>Systemic</th>
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<tbody>
<tr>
<td>Trauma</td>
<td>Lateral impact</td>
<td>Laxity</td>
<td>Snapping hip</td>
<td>Hormonal</td>
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<td>Laxity</td>
<td>Subluxation or dislocation</td>
<td>Adhesive capsulitis</td>
<td>Internal</td>
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<td>Bony</td>
<td>AVN</td>
<td>Synovitis / Inflammation</td>
<td>External</td>
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<td>impingement</td>
<td>Loose bodies</td>
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<td>Trochanteric bursitis</td>
<td>Autoimmune</td>
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<td>Dysplasia</td>
<td>Synovial chondromatositis</td>
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<td>Ischial bursitis</td>
<td>RSD</td>
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<tr>
<td>Degenerative</td>
<td>Chondrocalcinosis</td>
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<td>Psoas bursitis</td>
<td>Regional pain Sx</td>
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<td>Osteitis pubis</td>
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<td>Sports hernia</td>
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<td>Piriformis syndrome</td>
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<td>SI joint</td>
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<td>Pelvic obliquity</td>
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<td>LLD</td>
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<td>Chronic tendonitis</td>
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<td>Hip flexor</td>
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<td>Adductor</td>
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<td></td>
<td>Abductor</td>
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<td>Gluteus medius tear</td>
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<td>Referred LBP</td>
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<td>Genitourinary</td>
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<td>Endometriosis</td>
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Femoracetabular Impingement/Hip Labral Tears/Hip Arthroscopy
Acetabular Labral Tears

- Reports vary on location
- 98% of labral tears were anterior (McCarthy, et al. 1995)
- Posterior (Suzuki, et al. 1986)
- More recent reports support anterior (Mintz, et al. 2005)
**Hip acetabular labrum**

- Analogous to the meniscus of the knee and labrum of the shoulder
Acetabular Labrum

• Although first assumed devoid of nervous tissue, free nerve endings, including proprioceptors and nociceptors, have been identified within labral tissue

• May explain decreased proprioception and pain pathway in patient with a labral tear (Kim & Azusa, 1995; Lephart, et al. 2002)
Prevalence

• Arthroscopically identified in 90% of individuals with mechanical hip symptoms
In a review of 300 consecutive cases, labral tears were present in 90% of the cases.

Etiology

Labral Tear Etiology (Kelly, et al. 2005)

- At least 4 causes of labral tears:
  1. Trauma
  2. Laxity/hypermobility
  3. Bony impingement
  4. Dysplasia
Subluxation also occurs and can be subtle.

Traumatic tears usually have specific preceding event such as:
- Twisting
- Falling
- Other LE impact

(Ranwat & Kelly, 2005)
Trauma

• Most common type of tears seen in high level athletes, but rare overall

Etiology - FAI

• FAI most common cause and was underlying cause in 55% of a series of 300 consecutive cases


Etiology – FAI
Cam impingement

• Femoral head has abnormally large radius
• Loss of normal spherical junction between femoral head and neck
• Abnormal contact between surfaces, especially with hip flex, adduction and IR (Ito et al., 2001; Notzli et al., 2002)
CAM Impingement
Etiology - FAI
Pincher impingement

- Abnormal acetabulum with increased overcoverage (Beck et al., 2005; Lavigne et al., 2004)
- General – coxa profunda
- Local anterior – acetabular retroversion

Pincher Impingement
“Cross-over” sign
Etiology - FAI

- Pincer – thought to be more common in middle-aged women in athletics
- Cam – more common in young athletic males (Lavigne et al., 2004)
Bony Impingement

- Combination of these bony deformities


Bony Impingement

Etiology – Capsular laxity

• **Atraumatic laxity** (Schenker ML, et al. Curr Opin Orthop. 2005)
  – Global
  – Focal rotational

• **Global** – individuals with CT disorders (Down’s, Marfans, Ehlers-Danlos syndromes)

• **Focal** – forceful ER
Acetabular Labral Tears

- Patients who have persistent hip pain for greater than 4 weeks, clinical signs, and radiographic findings consistent with a labral tear are candidates for hip arthroscopy.

Labral Tear Workup

- Begins with full history and PE
- Proper diagnostic imaging
  - Radiographs
  - MRI/MRA
Acetabular labral tear

- Arthrography has shown to identify 88% of labral tears while concurrently enabling injection of local anesthetic (Fitzgerald RH. Clin Orthop. 1995)

- MRI not always accurate or sensitive (Edwards DJ, et al. JBJS. 1995)

  - May cause irritation? (Byrd et al. JSR 2009)
Labral Tear Workup

- 94 – 95% sensitivity for detection of labral tears using noncontrast cartilage sensitive MR imaging
- Interobserver agreement – 92%
- No imaging study is entirely sensitive or specific in detection of labral tears

Labral tear - Injection

• Local anesthetic injection may be both diagnostic and therapeutic (Byrd JWT, et al. Arthroscopy. 1995)
Examination and assessment
Subjective history

- 96% (Keeney et al. Clin Orthop Relat Res. 2004) and 100% (McCarthy and Busconi, 1998) of individuals with arthroscopically identified labral tear reported groin pain
“C” – Sign
<table>
<thead>
<tr>
<th>Authors</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keeney et al. 2004</td>
<td>• Groin pain most common location (96%), anterior hip (35%), lateral hip (38%), buttock (17%)</td>
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<td>• Presence of locking or catching may not be sensitive (58% reported hip locking or catching)</td>
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<tr>
<td>McCarthy &amp; Busconi, 1995</td>
<td>• Groin pain may indicate not only labral tear, but presence of intra-articular pathologies in general (100% with labral tear reported it, 98% with intra-articular pathology reported it)</td>
</tr>
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<td>• Inguinal clicking &amp; giving way correlated ($r = 0.79$) with labral tear</td>
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<tr>
<td>Narvani et al. 2003</td>
<td>• Presence or absence of clicking in hip may provide useful diagnostic information</td>
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<tr>
<td></td>
<td>• Clicking in hip had 100% sensitivity, 85% specificity and (+) LR of 6.67 for labral tear</td>
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Objective examination

• The internal rotation-flexion-axial compression manoeuvre was sensitive (75%) but not specific (43%) – similar to Scour test

Internal rotation-flexion-axial compression test
Hip Scour Test; (Quadrant) (Maitland 1986)

- Flex and adduct hip until resistance to the movement is detected or patient’s pelvis begins to lift on the bed (assesses inner quadrant). Maintain flexion into resistance and move hip into abduction (outer quadrant); bring hip through two full arcs of motion.
- If the patient reports no pain – repeat test while applying long-axis compression through the femur.
FABER’s Test (Patrick’s Test; Figure-Four Test)

• 88% sensitive for hip intra-articular pathology

Mitchell et al. 2003
Evaluate side-to-side ROM differences and clicking. A click reproduced during the test is suggestive of labral tear, while increased ER ROM may indicate iliofemoral ligament laxity.

The potential for muscle guarding and possible false-negative results must be recognized with this test.

Inter-rater reliability: ICC = 0.63 (Martin et al. 2006) \( \kappa = 0.61 \) (Martin & Sekiya 2008)
Impingement testing
Flexion-IR-Adduction impingement test

- CAM impingment
- Arthroscopy
- 19/19 pre-op patients had (+) FAI test (Beck et al. 2004)
- 24/25 patients (Ito et al. 2004)
- MRA
- Sensitivity 75% specificity 43%

Narvani et al. 2003
Maximum Flexion IR Test

- Correlated well with acetabular tears diagnosed with arthroscopic surgery
- 39% of patients experienced pain with this test
- Only 23% experienced pain with MFER

Maximum Flexion IR Test
Intervention – surgical
Acetabular Labrum

- Labral repair and preservation – maximize ability to enhance joint stability, preserve joint congruity, and maintain the sealing mechanism and joint compressive forces around hip


Fluoroscopic guided suture anchored

Surgery – Retroverted acetabulum

Surgery – CAM impingement

Capsulotomy with labral repair
Intervention – post-surgical

• General Guidelines (Dr. Marc Philippon):
  – Progression through protocol based on clinical criteria and time frames as appropriate for patient
  – Avoid “pinching” sensation in front of hip with exercise
  – NEVER use treadmill
  – Circumduction is most important PROM performed
Intervention – post surgical

- WB – FFWB (20 lb) x 2 weeks
- CPM – 2 weeks; 4 hours/day
- Lie on stomach – 2 or more hours/day
- Bledsoe brace – 0-120° x 18 days
- ROM limits:
  - Flexion: 120° x 18 days
  - Extension: as tolerated
  - ER: 0° x 3 weeks
  - IR: no limits
  - Abd: 45° x 4 weeks
Intervention – post surgical

• Considerations
  – Hip joint uses several different planes of movement for each function
  – Comes closest to being a true ball and socket joint
  – Normal walking
    • $15^0$ extension, $37^0$ flexion, $7^0$ abduction, $5^0$ adduction, $4^0$ IR, $9^0$ ER, stairs $67^0$ flexion (Gould & Davies 1985)

Intervention – post surgical

• Considerations:
  – Unilateral standing – 2.5x BW
  – Ascending stairs – 3x BW
  – Running – 5x BW
  – Normal healthy hip – can tolerate 12-15x BW

Other considerations:

- Capsular pattern
- Close packed position
  - Capsular
  - Bony
- Loose packed position
• Dependent on pathology
  – Removal of loose bodies, excision of isolated displaced labral tear – ‘can be quite prompt’
  – Debridement of arthritic disorders can be much slower
  – Abrasion arthroplasty – ‘longer, more deliberate period of recuperation’

Post-arthroscopy Rehab

- Phase progression:
  - Based on pathology at time of surgery
  - Take into account patients ability to perform previous maneuvers in relatively pain-free fashion
  - Largely dictated by patient’s symptoms
  - Functionally based progression scheme
Post-arthroscopy Rehab

• Gait training:
  – WB dependent on findings with arthroscopy
  – Typically WBAT and DC crutches within 1\textsuperscript{st} week
  – Normal gait sequence
  – Abrasion arthroplasty – most difficult and individualized

  • Ideal – unloading joint and only PROM x 2 months
    – Usually impractical

Post-arthroscopy Rehab

• Gait:
  – Neutralizing compressive forces on hip
    • Best achieved with resting weight of LE on ground
    • NWB – dynamic forces are required to suspend LE off ground

• AAROM
  – Directed in all planes of motion (dependent on restrictions)
  – Pushed only to tolerance
  – Principal rule – reduction of discomfort; not pushing to extremes of ROM
    • Exception – excision of large bony osteophyte – significant mechanical block had been created

Distraction mobilization techniques:

- Reduces compressive forces across articular cartilage
  
- Reduces discomfort and can enhance cartilage healing (Salter et al. J Bone Joint Surg. 1980)

- Address axial motion (joint separation/compression), translational motion (horizontal movement of articular surfaces in relation to each other) and rotational techniques

- 3 methods
  
  - Straight-plane distraction; Inferior glide; Posterior glide

Distraction mobilizations
Post-arthroscopy Rehab

- Isometric exercises
  - Quads, hams, gluteal, add/abductor groups
- Closed chain/proprioceptive/balancing
  - Double-leg to single-leg support (bridges, stance, etc.)
  - Proprioception/balance important long-term protective features of hip joint

Post-arthroscopy Rehab

• Basic functional exercises
  – Progressed within patient’s tolerance
  – Stationary bicycle – can enhance smooth, fluid motion of joint – low resistance and seat high to start
    • 5 minutes 2x/day ----max of 20 min 2x/day
  – Nordic Trac – excellent device for gradually enhancing endurance and strength with low impact
  – Pool exercises – excellent – early compression drills while reducing BW
  – Stair master and leg-press – judiciously used

Pool Exercises

• Water-resisted cuff weights, all directions
• Flutter-kick swimming
• Fast walking drills
• Weight shifts
• Mini squats
• Toe walking
• Heel walking
• Bounding and bouncing
• Deep-water running
Advanced Functional Exercises

- Higher compressive and shear forces across joint with open chain exercise
- Advanced T-band exercises; various weight machines
- Individualize to patient’s goals
- Keep within restraints of hip pathology
- Controlled environment and progressed to simulate activity or sport-specific demands

Post-Arthroscopy (Stalzer et al. Clin Sport Med. 2006)

- Prolonged immobilization deleterious effects
  - Muscle atrophy
  - Articular cartilage degeneration
  - Ligament strength loss
  - Excessive adverse collagen formation


- Consideration of soft tissue healing constraints
- Control of swelling & pain to limit muscular inhibition & atrophy
- Early ROM
- Limitations on WB
- Early initiation of muscle activity & neuromuscular control
- PRE’s
- CV training
- Sport specific/activity specific training

- Goals
  - Protect integrity of repaired tissue
  - Restore ROM within restrictions
  - Diminish pain and inflammation
  - Prevent muscular inhibition

• Precautions
  – Do not push through hip flexor pain
  – Specific ROM restrictions (surgery dependent)
  – WB restrictions

• Criteria for progression to Phase II
  – Minimal pain with all phase I exercises
  – ROM ≥ 75% of NI side
  – Proper muscle firing patterns for initial exercises
  – Do not progress to Phase II until FWB is allowed

- Brace used to maintain ROM restrictions and protect joint x 10 days
- Swelling and pain control
- CPM – typically 6-12 hours/day for 4-6 weeks
  - Emphasis on IR and flexion – prevent adhesions between labrum and capsule
- Progressive stretching of iliopsoas and piriformis
- Posterior capsule – quadruped rocking
- Stationary cycling – 20 min/day
Quadruped Rocking
Phase I – Immediate Rehab  
(Stalzer et al. Clin Sport Med. 2006)

- Aquatic walking – can be initiated post-op day 1
- Early exercises
  - Hip adduction/abduction/prone IR & ER isometrics
  - 3-way leg raises (abduction, adduction, extension)
  - Leg press – very light weight
  - Short lever hip flexion
Phase II – Intermediate Rehab
(Stalzer et al. Clin Sport Med. 2006)

• Goals
  – Protect integrity of repaired tissue
  – Restore full ROM
  – Restore normal gait pattern
  – Progressively increase muscle strength
Phase II – Intermediate Rehab
(Stalzer et al. Clin Sport Med. 2006)

• Precautions
  – No ballistic or forced stretching
  – No treadmill use
  – Avoid hip flexor/joint inflammation
Phase II – Intermediate Rehab
(Stalzer et al. Clin Sport Med. 2006)

• Criteria for progression to Phase III
  – Full ROM
  – Pain-free/normal gait pattern
  – Hip flexion strength > 60% of NI side
  – Hip add/abd/ext/IR/ER strength > 70% on NI side
Phase II (Stalzer et al. Clin Sport Med. 2006)

- Typically started between 4-6 weeks post-op
  - Dependent on surgical procedure
- Progression of phase I
  - 1/3 bilateral squats
  - Side planks
  - Stationary bike with resistance
  - Swimming with fins
  - Single-leg proprioception
  - Side-stepping with resistance
  - Single knee bends
  - CV training – elliptical and/or stairclimber
Phase III (Stalzer et al. Clin Sport Med. 2006)

• Goals
  – Restoration of muscular endurance/strength
  – Restoration of CV endurance
  – Optimize neuromuscular control/balance/proprioception
Phase III (Stalzer et al. Clin Sport Med. 2006)

• Precautions
  – Avoid hip flexor/joint inflammation
  – No ballistic or forced stretching/strengthening
  – No treadmill use
  – No contact activities
Phase III (Stalzer et al. Clin Sport Med. 2006)

• Criteria for progression to Phase IV
  – Hip flexion strength > 70% of NI side
  – Hip add/abd/ext/IR/ER strength > 80% of NI side
  – CV fitness equal to pre-injury level
  – Demonstration of initial agility drills with proper body mechanics
Phase III (Stalzer et al. Clin Sport Med. 2006)

- Typically started between 6-8 weeks post-op
- Focus on restoration to pre-injury levels
- Advanced exercises
  - Lunges
  - Water bounding
  - Lateral agility
  - Forward/back running with cord
  - Initial agility drills
  - Progress CV training
Specific surgical procedures – Rehab Concerns

• Labral resection
• Labral repair
• Osteoplasty
• Microfracture
• Capsular plication/capsulorrhaphy
<table>
<thead>
<tr>
<th>Rehab concerns</th>
<th>WB Precautions</th>
<th>ROM Precautions</th>
<th>Strength issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoiding initiation of joint inflammation</td>
<td>PWB for 10-14 days</td>
<td>Avoid excessive early flexion and abduction to prevent inflammation of affected tissue; full PROM by week 2</td>
<td>Gentle isometrics day 2; AROM at week 2; WB progressive resistive ex’s after FWB</td>
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# Labral Repair

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<tr>
<th>Rehab concerns</th>
<th>WB precautions</th>
<th>ROM precautions</th>
<th>Strength issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoid initiation of joint inflammation (Enseki K, et al. JOSPT. 2006)</td>
<td>PWB x 10-28 days</td>
<td>Avoid excessive early flexion and abduction to prevent inflammation; full PROM by week 2</td>
<td>Gentle isometrics on day 2; AROM at week 2; WB PRE’s as tolerated after full WB</td>
</tr>
<tr>
<td>Location &amp; size of repair (Stalzer S, et al. Clin Sport Med. 2006)</td>
<td>FFWB x 2 weeks</td>
<td>Do not stress anterior-superior labrum: 0-90° flexion, 0-25° abduction; 0-25° ER</td>
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Labral Repair  

- Phase I – immediately post surgery
- Phase II – week 4
- Phase III – week 7
- Phase IV – week 9
<table>
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<tr>
<td>Avoid excessive compressive and tensile forces to femoral neck and head-neck junction; protect exposed bone (Enseki K, et al. JOSPT. 2006)</td>
<td>PWB x 4-6 weeks</td>
<td>Avoid excessive early flexion and abduction to prevent inflammation of involved tissue; full ROM by week 2</td>
<td>Gentle isometrics on day 2; AROM at 2 wk; caution with sagittal plane SLR secondary to increased compressive forces; gentle WB PREs by 4-6 wk</td>
</tr>
<tr>
<td>Avoid impingement of hip and inflammation of iliopsoas (Stalzer S, et al. Clin Sport Med. 2006)</td>
<td>FFWB x 4 weeks Limit impact activities that may increase risk of femoral neck fracture for first 8 weeks</td>
<td>Flexion limited to 90° for 10 days to protect joint from impingement. CPM used for 4 weeks</td>
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• Phase I – immediately post-surgery
• Phase II – week 5
• Phase III – week 9
• Phase IV – week 13
<table>
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<tr>
<td>Avoid capsular inflammation &amp; excessive tension (usually anterior) (Enseki K, et al. JOSPT. 2006)</td>
<td>PWB x 10-14 days</td>
<td>Avoid excessive early flexion and abduction; avoid forced ER and extension for 3-4 wk to protect anterior capsule; progress ER and extension after 3 wk; full PROM by 4 wk</td>
<td>Gentle isometrics on day 2; limited AROM at 3 wk; WB PREs as tolerated after FWB</td>
</tr>
<tr>
<td>Protect integrity following repair; limit capsule stress; motion restrictions per repair (Stalzer S, et al. Clin Sport Med. 2006)</td>
<td>FFWB x 10 days CPM x 4 weeks</td>
<td>Extension and ER limited to neutral x 3 weeks; flexion limited to 900 x 10 days</td>
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- Phase I – immediately post-surgery
- Phase II – week 5
- Phase III – week 9
- Phase IV – week 13
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<td>(Enseki K, et al. JOSPT. 2006)</td>
<td>PWB x 4-6 wk</td>
<td>Avoid excessive early flexion and abduction to prevent inflammation of affected tissue; full PROM by 2 wk</td>
<td>Gentle isometrics on day2; AROM at 2 weeks; caution with sagittal plane SLR secondary to increased compressive forces; gentle WB PREs by 4-6 wk</td>
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</tbody>
</table>
| Promote articular cartilage repair; avoid compressive and shear forces (Stalzer S, et al. Clin Sport Med. 2006) | FFWB x 6-8 weeks  
CPM x 6-8 weeks | Flexion limited to $90^\circ$ x 10 days; focus on all motions; progress flexion as tolerated after 10 days | |

- Phase I – immediately post-surgery
- Phase II – week 7
- Phase III – week 9
- Phase IV – week 17
Hip Joint Mobilizations
Inferior Glide (Long Axis Distraction)
Dynamic Warm-up

Select Exercises
Toy Soldiers
Opposite Toe Touch Walking Lunge --- Spiderman
Inchworm
Leg Swings – Frontal Plane
Selected core exercises

LT: 35±13
LM: 38±14
Ekstrom R, et al. 2008

GMax: 20±14
Ham: 35±14
LT: 42±13
LM: 44±12
Ekstrom R, et al. 2008
Bilateral Bridge

Unilateral Bridge

Ekstrom R, et al. 2007

Ekstrom R, et al. 2008

GMax: 27±13
Ham: 35±21
LT: 37±12
LM: 39±13
EO: 22±13
RA: 13±11

GMed

47±24

Ekstrom R, et al. 2007
PRONE

Prone Bride Planks

Glute Med
27±11

Glute Max
9±7

Hamstrings
4±6

GMed 42±17

Ekstrom R, et al. 2007
**Lunge**

GMed
29±12
19±12 (%RVC)

GMax
18.5±11

BF
11.9±6.4

Ekstrom R, et al. 2007
Farrokhi S, et al. 2008

**Lunge with Forward Trunk Lean**

**Lunge with Backward Trunk Lean**

GMax
19.3±11.8

BF
14.0±9.3

Farrokhi S, et al. 2008

GMax
22.3±12

BF
17.9±9.6

Farrokhi S, et al. 2008
Unilateral Squat

GMed
• 36±17
• 30±9 % RVC
• 77±64  male
• 41±30  female

Ayotte et al. 2007
Zeller et al. 2003
<table>
<thead>
<tr>
<th>Exercise</th>
<th>GMed</th>
<th>GMax</th>
<th>BF</th>
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</thead>
<tbody>
<tr>
<td>Lateral Step-up</td>
<td>•38±18</td>
<td>•56±29</td>
<td>•9±4</td>
</tr>
<tr>
<td>Retro Step-up</td>
<td>•37±18</td>
<td>•59±35</td>
<td>•10±5</td>
</tr>
<tr>
<td>Single-Leg Wall Squat</td>
<td>•52±22</td>
<td>•86±43</td>
<td>•15±8</td>
</tr>
</tbody>
</table>

Ayotte et al. 2007
Ekstrom et al. 2007
Beginner Level Side Bridge

Intermediate Level Side Bridge

EO: 69±26
RA: 34±13
GMed: 74±30

Ekstrom R, et al. 2008
Ekstrom R, et al. 2007

McGill S. 2004
Selkowitz DM, et al. Which exercises target the gluteal muscles while limiting activation of the tensor fascia lata? EMG assessment using fine wire electrodes. CSM 2009

• Looked at relative activation ratio (RAR) & gluteal index (GI)
  – Clam
  – Squat
  – Bilateral and single bridge
  – Quadruped with knee extended and flexed
  – Step-up
  – Lunge
  – Hip hike
Sidelying Clams

Superior glute max > glute med > TFL
Squat

All glutes > TFL
Squat technique
Lunge & Step-up

No significant difference between glutes and TFL
Highest Gluteal Index  *(Selkowitz et al. CSM 2009)*

- **Clam**
- **Quadruped – knee extended**
- **Single leg bridge**
- **Quadruped – knee flexed**
Ipsilateral GM muscle activity while carrying a weight in the contralateral hand

Neumann (1996, 1999) - as little as 5–15% of the athlete’s body weight

250-pound football player could strengthen his right GM by simply walking on a treadmill with a 12 to 40 pound weight in his L hand
Walk with contralateral load

(Wilson E. Strength Cond J. 2005)

• Can progress with walking speed or increasing weight

• Progress from sagittal plane activities where the GM act as stabilizers, to frontal plane activities where the GM will be forced to act as prime mover
Arc-walk exercise (Wilson E. Strength Cond J. 2005)
Walk with contralateral load

(Wilson E. Strength Cond J. 2005)

• Can progress to more dynamic and sport-specific activities:
  – frontal plane or diagonal plyometric and agility training
• Anterior GM - highest muscle activity occurred during the abduction-plus-internal-rotation (ABD-IR) position, with significantly less in the abduction-only (ABD) and abduction-plus-external-rotation (ABD-ER) positions

• Middle GM the ABD-IR position produced significantly greater muscle activity than the other 2 positions
Designing a program – variables to consider

- Type of strength needed
- Type(s) of muscle strength or endurance
- Speeds of muscle contraction
- Rest intervals
- Method of recovery – active or passive
- Sequence of exercises
- Relationship of agonists, antagonists, stabilizers, synergists
- Training history of athlete/individual
- Injury history of athlete/individual
- Proficiency level of athlete/individual
Conclusion

• We are still learning
• General parameters/precautions, etc. per specific surgical procedure
• Systematic progression with adequate challenge
• INDIVIDUALIZE !!!
* Reminder *

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- Session number 107
- Speaker – Michael P. Reiman
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Objective 2
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Objective 4
Objective 5
Objective 6

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FULLY AGREE
THANK YOU !!!

michael.reiman@wichita.edu