The Use of Spinal Mobilizations as an Adjunct to Treatment for a Woman with Patellofemoral Pain: A Case Report

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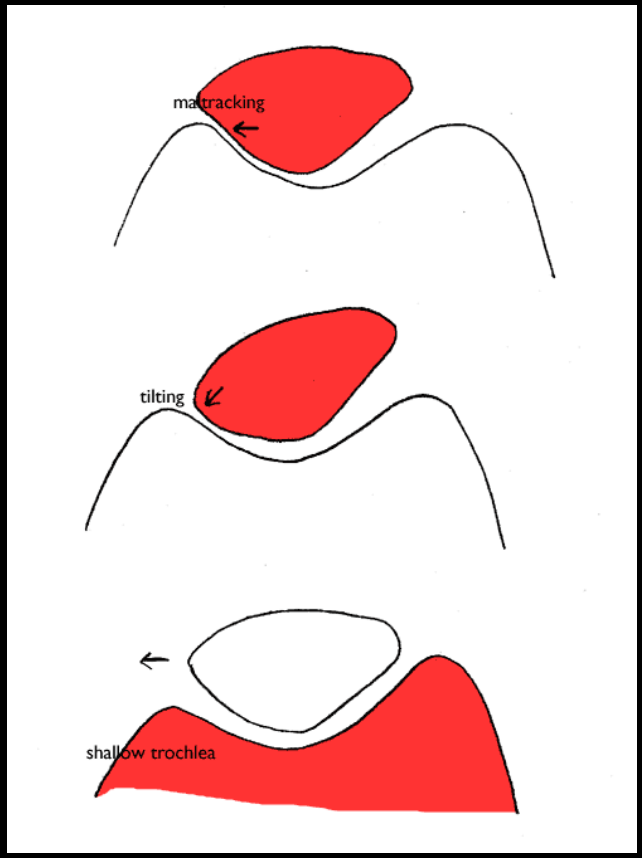
Introduction: Clinical Problem

- Patellofemoral pain syndrome (PFPS) is one of the most prevalent orthopedic conditions afflicting the lower extremity.
  - 25% of knee pain referrals (Baquie 1997)
- Unclear etiology
- Multiple treatment approaches
- Role of lumbar dysfunction poorly understood

Etiology and Treatment of PFPS

- Patellar tracking dysfunction
  - Static patellar misalignment
  - ⇑ Q-angle and genu valgus
- Treatment strategies
  - Patellar mobilizations
  - Taping
  - Quadriceps strengthening
  - Stretching of tight lateral structures



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Effectiveness of Common Treatment Strategies

- Patellar taping, bracing, and quadriceps strengthening
  - Short-term improvements in pain and function (Whitingham 2004, Herrington 2007)
  - Insufficient amount of quality research and follow-up to establish treatment recommendations (Crossley 2001, Bizzini 2003)

Current concepts:
Proximal Hip Weakness and PFPS

- Femoral internal rotation contributes significantly to PFJ kinematics
  (Powers 2005)
- ⇑ dynamic Q-angle
- “Medial collapse”

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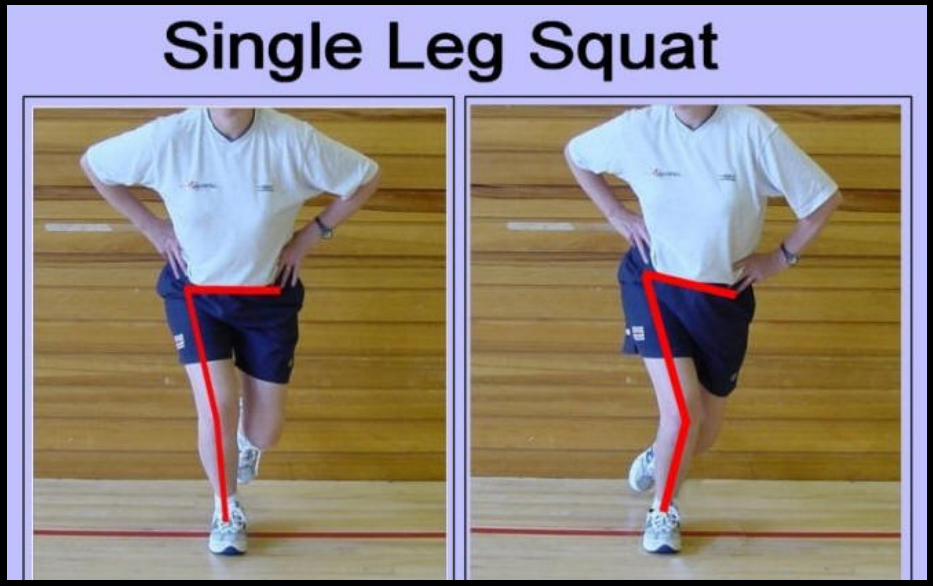
Proximal Hip Weakness and PFPS

- Female with PFPS have significant weakness in:
  - gluteus medius
  - gluteus maximus
  - hip ER's (Robinson 2007, Schmitt 2007, Rowe 2007, Ireland 2003)



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Lumbar Spine Dysfunction and PFPS

- Coexistence of lumbar spine dysfunction and PFPS likely in a subset of patients
- Optimal performance of knee joint influenced by integrity of kinetic chain (Nadler 2000, Kobayashi 2007)
- Lumbar spine dysfunction may compromise output of nearby nerve roots and lead to muscular weakness (Pickar 2002, Cavanaugh 2007, Budgell 1995)

Purposes

- Describe the use of spinal mobilization techniques as an adjunct to treatment for a female patient presenting with unilateral patallofemoral pain.
- Describe the changes in patellofemoral pain, hip weakness, and function observed in response to treatment.

Case Description

- 32 y.o. female, drafter/hair-stylist
- Reason for referral: unresolved left knee pain
- History of present condition:
  - Idiopathic onset of left knee pain 7 months ago while running
- Prior management:
  - 4 sessions of PT over 1 month for patellar mobilizations and quadriceps strengthening without relief

Case Description

- Current episode:
  - 6 weeks of progressive left knee pain following participation in boot-camp class
- Presenting symptoms:
  - Intermittent, sharp pain “behind the knee cap”
  - Occasional deep ache with swelling
- Aggravating Factors:
  - Running, descending stairs > ascending, squats and lunges, sit to stand transitions

Case Description

- Medical History
  - Episodic left-sided low back pain and stiffness
    - 4-5 episodes within past year
    - Provoked by prolonged standing
- Patient signed HIPAA documentation and provided informed consent

Examination

- Pain
  - Numeric Pain Rating Scale (NPRS)
  - 0-10 scale
  - Good test-retest reliability (ICC = 0.76) (Price 1983)
  - 8/10 after running > 1/2 mile or descending a flight of stairs
  - 5/10 with descending 1 step or squatting
  - 0/10 at rest

Examination

- Functional Assessment
  - Kujala questionnaire for patellofemoral pain
  - 13-item questionnaire, weighted responses for functional limitations
  - 0-100 scale
  - Good reliability (ICC = .81) (Crossley 2004)
  - Patient initial score 72/100

Examination

- Patellar alignment and mobility
  - McConnell components
  - Poor intra-rater reliability (k= .35)

    (Watson 1999)
  - No significant anomalies

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Examination: Knee and Hip Strength

- Manual muscle testing (Kendall 1993)
- Good reliability (ICC > .90) (Cuthbert 2007)

	Left	Right
Quadriceps	4+/5	5/5
Gluteus Medius	3+/5	4+/5
Hip ER	3+/5	4+/5
Gluteus Maximus	4/5	5/5

Examination

- Gait
  - Observational analysis (Perry 1992)
  - Level surface, with and without shoes
  - Fair intra-rater reliability (ICC = .63)
    (Krukkerkreff 2005)
  - Increased femoral adduction/IR during stance phase (L > R)

Examination

- Functional Tests
  - Observational analysis of squat and step-down
  - Low/Moderate intra-rater reliability (kappa = .38-.68) (Chmielewsi 2007)
- Squat
  - Bilateral to 90°
  - Excessive femoral Add/IR, + PFP
- Step-down test
  - 3 second step-down from 6-inch step
  - Medial collapse, contralateral pelvic drop, + PFP

Lumbar Spine Exam

- Occurred at visit 3
- Onset of left-sided LBP (“stiff/sore”)
  - 3-4/10 on NPRS
- Standing posture
  - Sagittal and front observation of “normal posture” without shoes
  - Low intra-rater reliability (k = 0.50)

    (Fedorak 2003)
  - Increased lumbar lordosis
- AROM
  - Observed motion via landmarks (Magee 1997)
  - All motions = WNL
  - ⇑ pain near end-range extension

Lumbar Spine Examination

- Passive Accessory Motions
  - Prone, central + unilateral P/A pressures T10-sacrum
  - Good inter-rater reliability for determining segmental hypomobility (k = .71) (Landel 2008)
  - Hypomobility, +TTP at left L4/5 and L5/S1 facet joints

Interventions

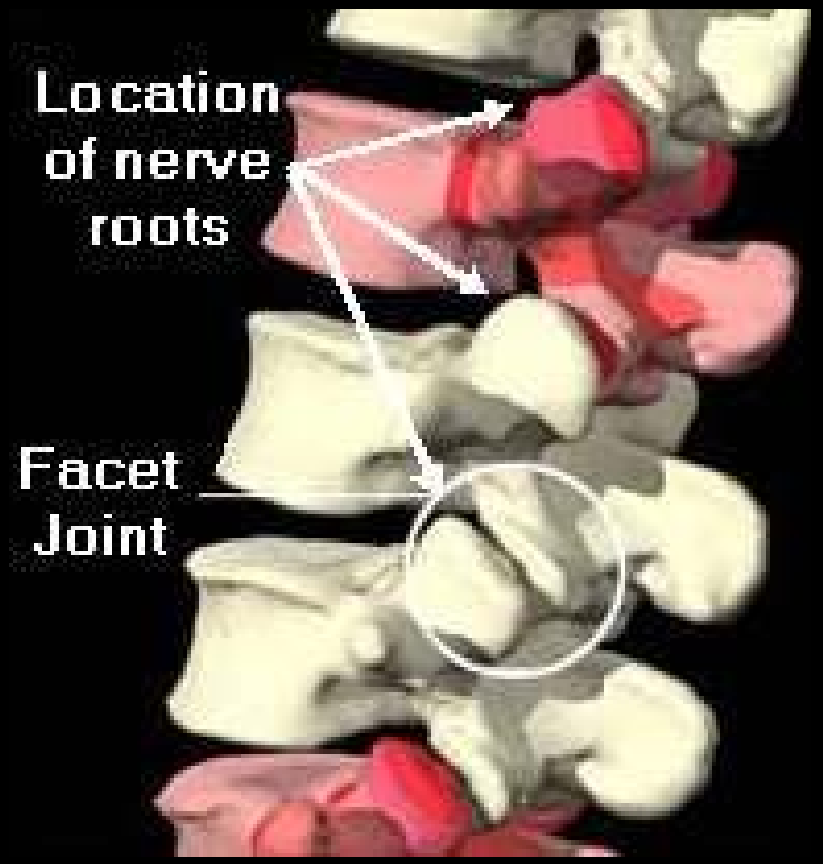
- Patient seen for 10 visits over 12 weeks
- Goals focused on the patient’s impairments and functional limitations

Goals

Impairments/Functional Limitations	Therapy Goals
Impaired proximal hip strength	Increase strength of proximal hip muscles to 5/5
Impaired neuromuscular control during squatting and step-down task	Improved lower extremity alignment during a step-down task from an 8” step
LBP during standing and climbing stairs	0/10 LBP during performance of all IADL’s
Left knee pain with running and ascent/descent of stairs	Ascend/descend 20 stairs and run 1+ mile with 0/10 knee pain

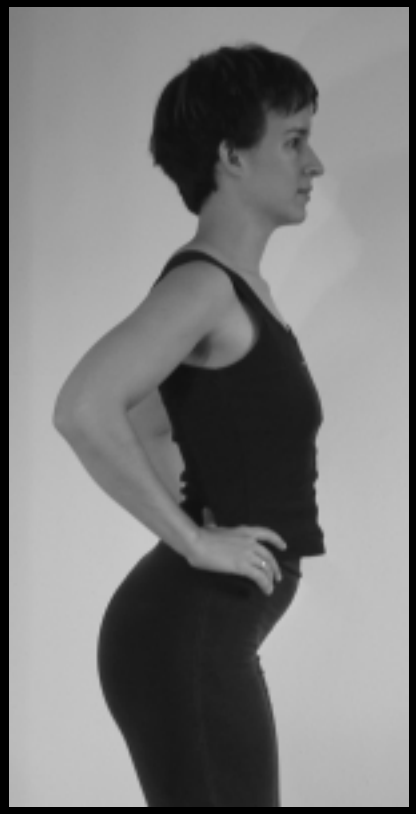
Interventions: Lumbar Spine Joint Mobilizations

- Grade III and IV PA joint mobilizations
  - Left L4/5 and L5/S1 facet joints



Interventions: Lumbar Spine

- Neutral spine awareness
- Recruitment of transverse abdominus
- Lumbar stabilization ther-ex



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Interventions: Patient education

- Influence of hip strength on function of knee
- Lower extremity alignment (knees over 2nd/3rd toes)
- Activity modifications to avoid pain provocation
- Maintenance of cardiovascular fitness

Interventions: Hip Strength Progressions

- Open kinetic chain exercises
- Closed kinetic chain exercises
- Single leg exercises
- Functional Exercises
- Low-level plyometrics

QuickTime™ and a
TIFF (LZW) decompressor
are needed to see this picture.

Outcomes: Pain

- Baseline
  - 8/10 pain with running > 1/2 mile
  - 8/10 pain with descending 1 flight of stairs
  - 5/10 pain with step-down
  - 5/10 pain with partial squat or lunge
- Discharge
  - 0/10 pain with running 1 mile
  - 0/10 pain with descending stairs
  - 0/10 pain with step-down
  - 0/10 pain with 90° squat and partial lunge

Outcomes: Functional Assessment

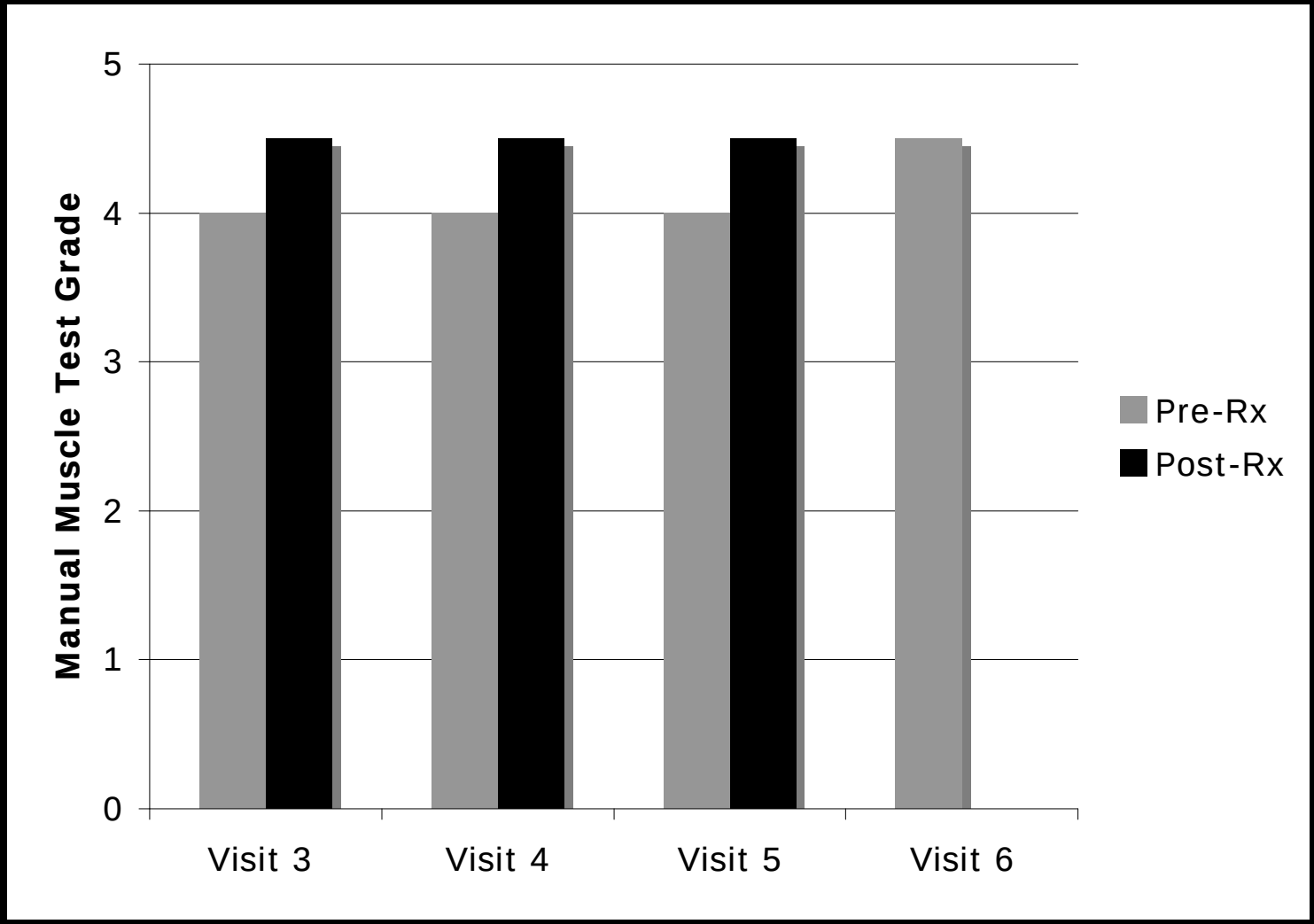
- Kujala knee pain score = 72/100

- Kujala knee pain score = 92/100
- ≥ 10 point improvement is clinically significant (Crossley et al., 2007)

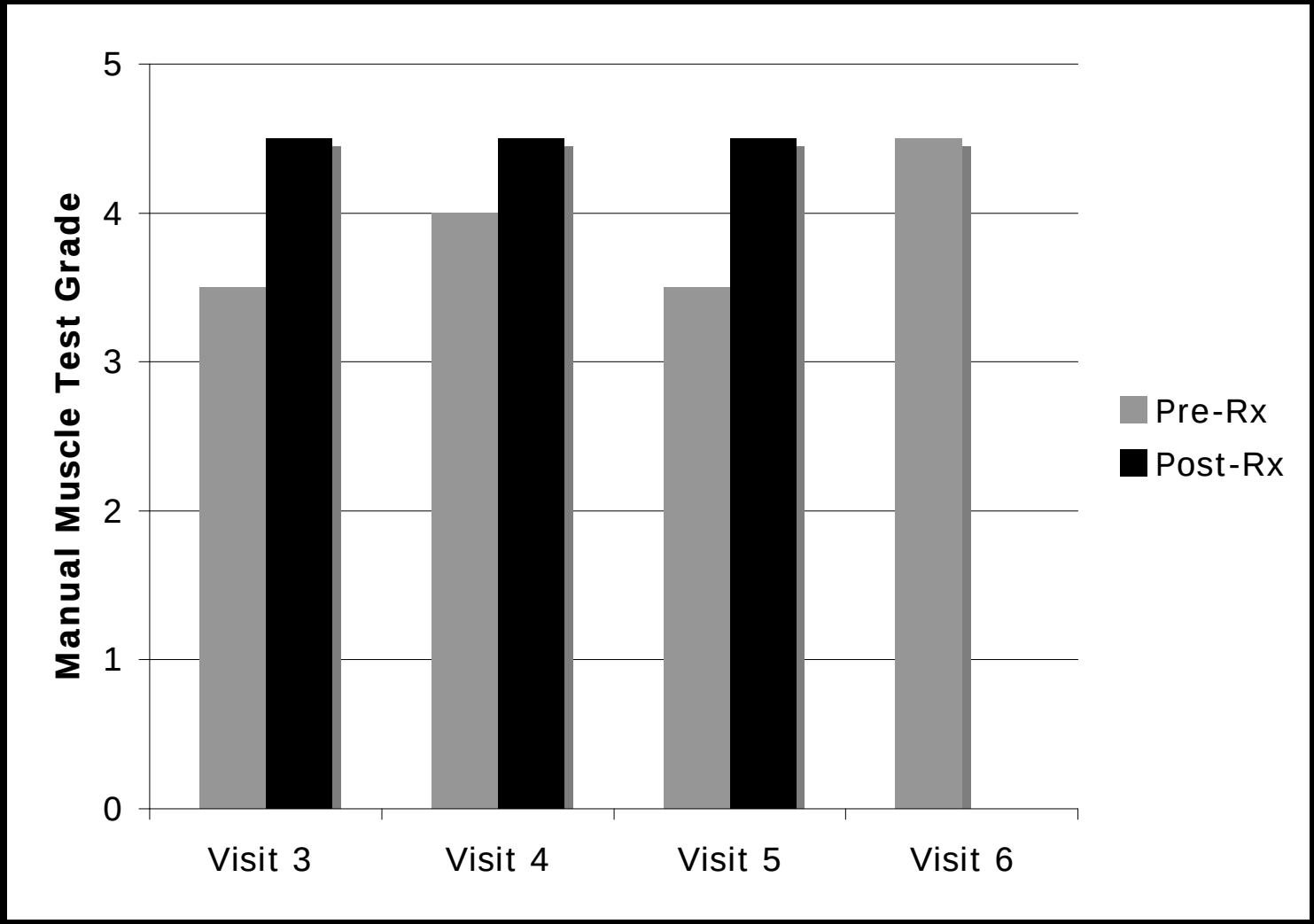
Outcomes: Lumbar Spine

- Reassessment of objective findings following unilateral joint mobilizations at L4/L5 and L5/S1 facet joints
  - Decreased local TTP
  - Decreased pain at end-range lumbar extension
  - Increased ipsilateral MMT scores for proximal hip muscles
  - Improved lower extremity kinematics during step-down test

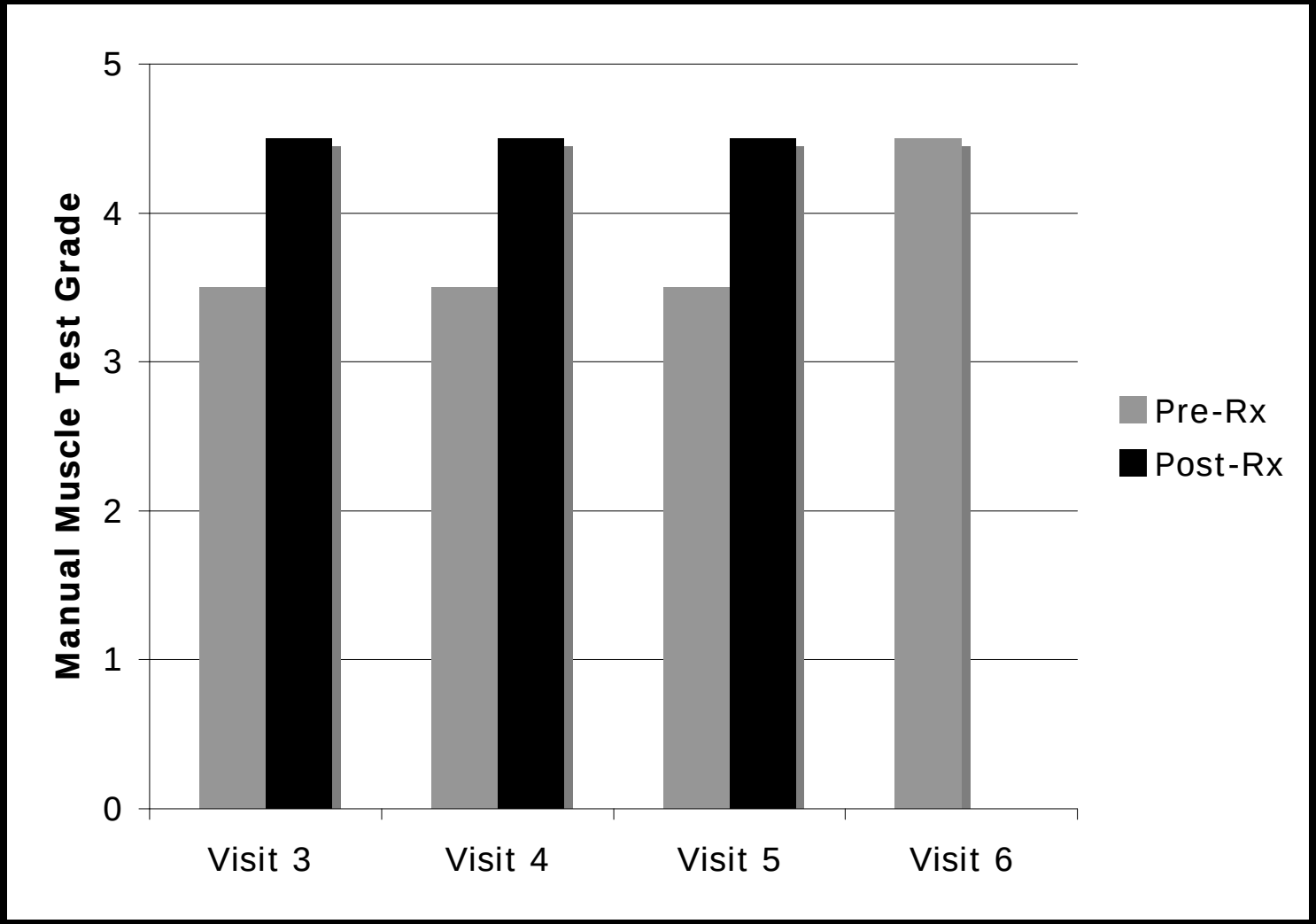
Gluteus Maximus



Gluteus Medius



Hip External Rotators



Outcomes: Lumbar Spine

- Baseline
  - 4/10 resting pain in left, low-back
  - Increased pain at end-range extension
- Discharge
  - 0/10 low back pain at rest
  - Extension AROM full + painless

Outcomes: Observational Gait Analysis

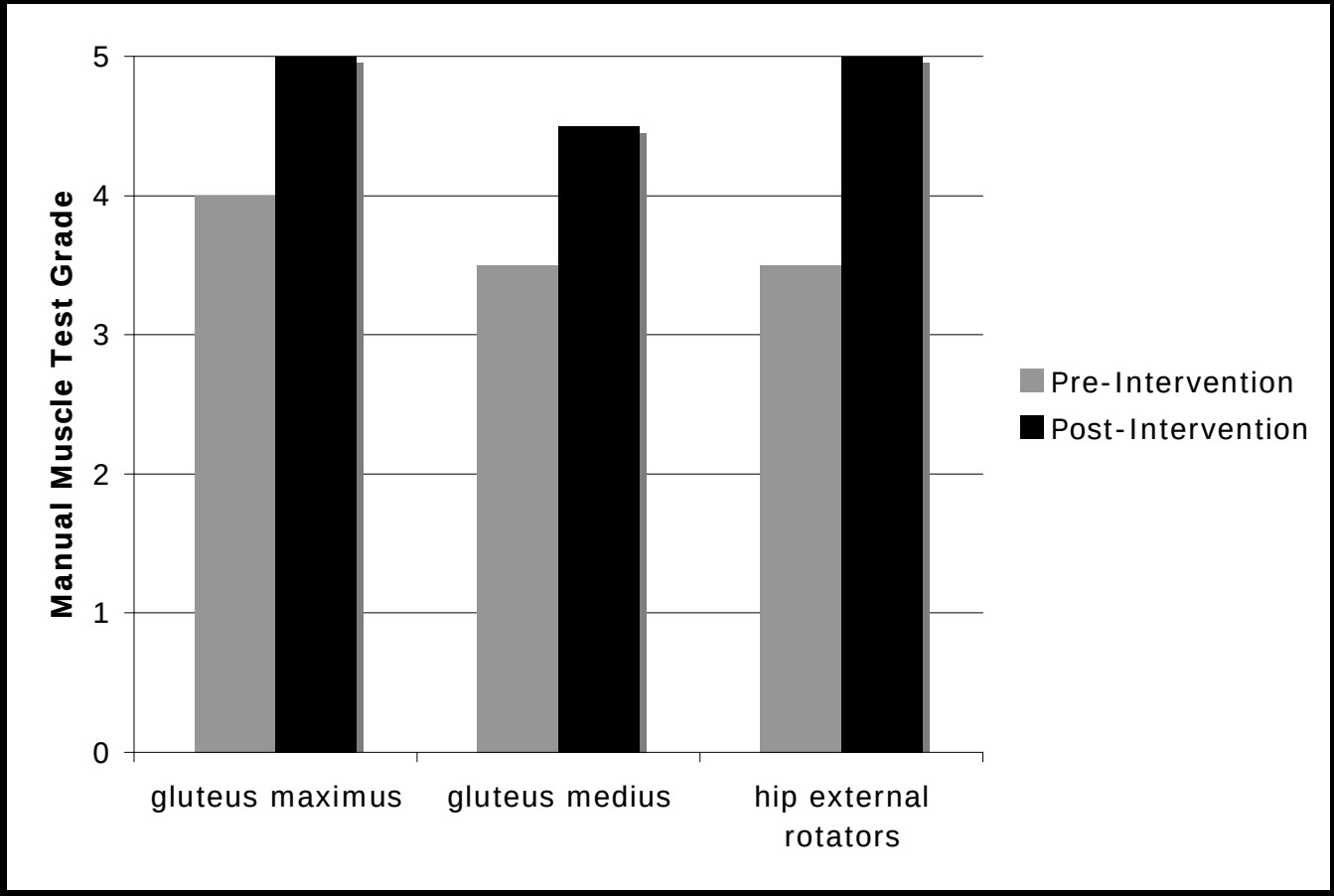
- Baseline
  - Excessive femoral adduction and IR during stance phase, L > R
- Discharge
  - Decreased femoral adduction and IR during stance phase, L = R

Outcomes: Squat and Step-down Tests

- Baseline
  - Excessive femoral adduction/IR and dynamic valgus during squat to 90 degrees
  - Excessive femoral adduction/IR and contralateral pelvic drop during step-down test
- Discharge
  - Squat to 90 degrees with proper lower extremity alignment
  - Reduced femoral adduction/IR and no contralateral pelvic drop during step-down test

Outcomes:

Hip Strength



Discussion

- Following a treatment plan that included strengthening exercises for the proximal hip musculature and lumbar spine joint mobilizations, this patient demonstrated improvements in:
  - Left patellofemoral pain
  - Low back pain
  - Proximal hip strength
  - Functional assessment measure
  - Observed kinematics during gait, squatting and a step-down test.

Discussion:
Spinal mobilization in the treatment of lumbar dysfunction

- Common short-term effects of spinal mobilization

  (Pickar 2002, Hanrahan 2005)

  - Decreased pain
  - Improved segmental mobility
  - Improvements in muscle performance

Discussion:
Effects of Lumbar spine mobilizations

- Unexpected improvements in hip strength and lower extremity kinematics
  - Spinal dysfunction can affect efferent nerve conduction and inhibit force production (Suter et al., 2001)
  - Altered function of nerve roots via mechanical compression or neuro-active chemicals (Pickar 2002)

Discussion:
Mechanism of joint manipulative therapy on muscle performance

- Stimulation of joint mechanoreceptors

  (Sabbahi 1990, Floman 1997, Pickar 2001)
  - Increase in alpha-motor neuron excitability
  - Reduced muscle inhibition
- Improvements in altered muscle reflexes

  (Murphy 1995, Herzog 1999)
  - H-reflex
- Suter et al., 2000, 2002
  - Increased force production in biceps and quadriceps following cervical and lumbar spine manipulation

Discussion: Proximal Hip Weakness

- Altered LE kinematics ➲ distal pathology
  (Nicholas et al., 1996)
- Increased femoral ADD/IR reduces PFJ contact area
  (Salsich et al., 2007)
- Pattern of proximal hip weakness in females with PFP
  (Robinson et al., 2007)
- Unclear relationship between hip weakness and altered LE kinematics
  (Bolgla et al., 2008)

Discussion: Proximal Hip Weakness

- Weakness precedes or a consequence of pain?
- Influence of motor learning?

Limitations

- Manual muscle testing
- Observational analysis of lower extremity kinematics
- Experience of treating clinician

Directions for Future Work

- Examine effectiveness of targeted hip strengthening on lower extremity kinematics, pain, and function in PFP population
- Examine mechanisms of spinal mobilizations on function of neuromuscular system

Conclusion

- Physical therapists who treat patients with PFP presenting with proximal hip weakness and a history of low back pain should consider possible contributions of the lumbar spine and the need for its examination and treatment in their plan of care.
- Continual reassessment of objective findings important in guiding treatment plan.

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