ImpulseAdjusting TECHNIQUE®

Lower Extremity

Hip, Knee, Ankle and Foot

ImpulseAdjusting TECHNIQUE®

1

Mechanical vs. Functional Instability

Injury and various diseases may lead to two types of dysfunction: 1) mechanical instability and 2) functional instability."

1) *Mechanical instability* is made up of the "hardware" components – muscles, joints, tendons, and ligaments. This would include conditions such as ruptured tendons and ligaments, damaged bones, torn menisci, DJD, RA, etc., and diseases causing muscle weakness (polio, CVA, etc). Many of these conditions require corrective surgery and/or are permanent. Some, such as weakness from a CVA are not amenable to surgical correction.

"Tale of the tape," Jardine, *Advance for Physical Therapy and Rehab Medicine,* Jan 18, 2010

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2

Mechanical vs. Functional Instability

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mechanical INNOVATIONS

2) *Functional instability* is made up of the "software" components – the operating system or neural programming behind muscle activation and coordinated action between muscles to produce smooth movement and provide stabilization of the joint.

Conditions causing mechanical instability will always cause some functional instability.

Improvement of the functional instability will lessen the mechanical instability and improve function, but not to the degree that it was before the condition that caused the damage.

"Tale of the tape," Jardine, *Advance for Physical Therapy and Rehab Medicine,* Jan 18, 2010

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3

Frequent conditions of the ankle & foot

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mechanical INNOVATIONS

- **Plantar Fasciitis / Heel Pain**
- **Achilles Tendonitis**
- **Inversion Ankle Sprain**
- **Eversion Ankle Sprain**
- **Instep Pain**
- **Metatarsalgia**

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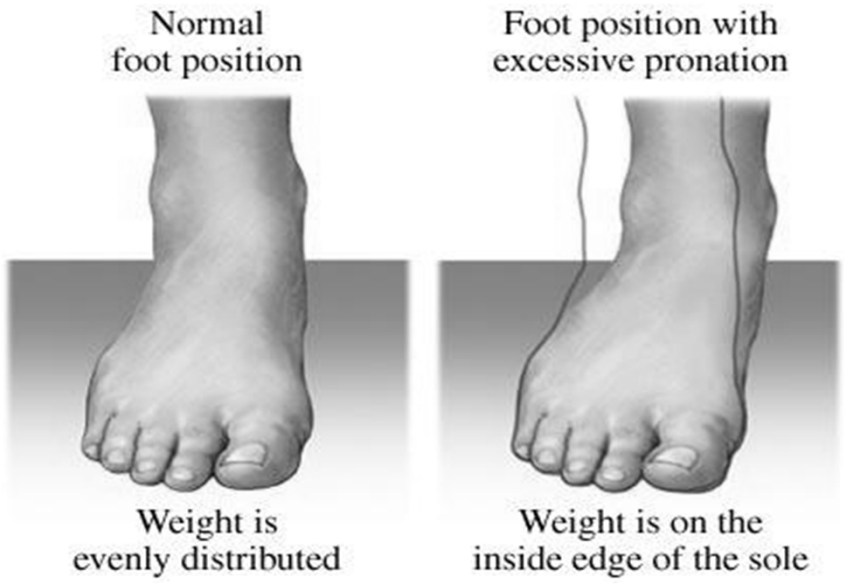
4

PATIENT HISTORY

Initial Hypotheses Based on Historical Findings

Patient Reports	Initial Hypothesis
Patient reports a traumatic incident resulting in either forced inversion or eversion	Possible ankle sprain[1,2] Possible fracture Possible peroneal nerve involvement (if mechanism of injury is inversion)[3-5]
Patient reports trauma to ankle that included tibial rotation on a planted foot	Possible syndesmotic sprain[1]
Patient notes tenderness of anterior shin and may exhibit excessive pronation. Symptoms may be exacerbated by repetitive weight-bearing activities	Possible medial tibial stress syndrome[6]
Patient reports traumatic event resulting in inability to plantarflex ankle	Possible Achilles tendon rupture
Patient reports pain with stretch of calf muscles and during gait (toe push off)	Possible Achilles tendonitis[7] Possible Sever's disease[1]
Patient reports pain at heel with first few steps out of bed after prolonged periods of walking	Possible plantar fasciitis
Patient reports pain or paresthesias in plantar surface of foot	Possible tarsal tunnel syndrome[1] Possible sciatica Possible lumbar radiculopathy
Patient reports pain on plantar surface of foot between 3rd and 4th metatarsals. Might also state that pain is worse when walking with shoes compared with barefoot	Possible Morton's neuroma[7] Possible metatarsalgia

5



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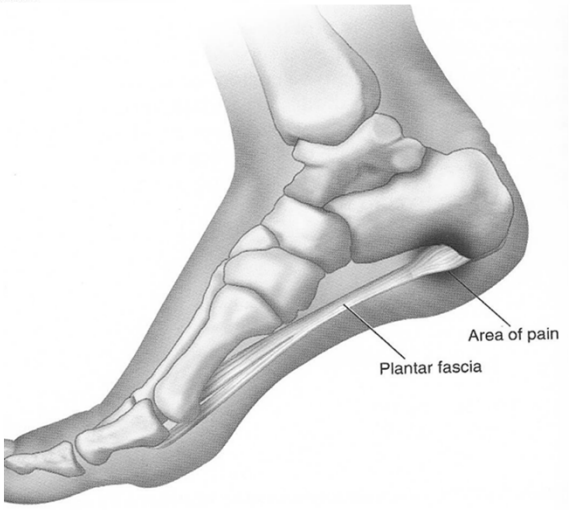
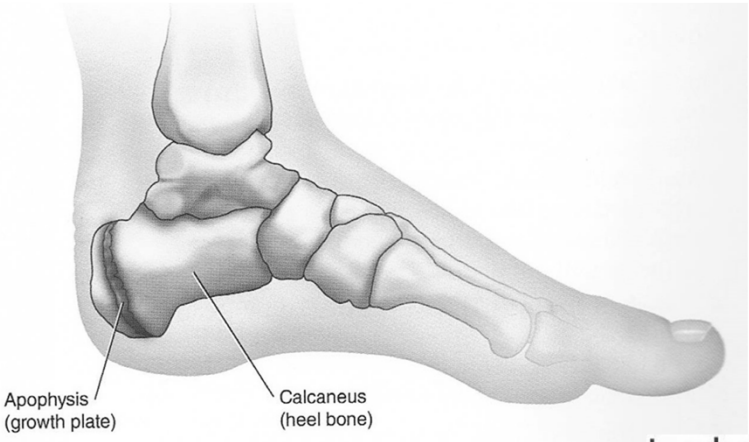
Plantar Fascitis



7

Calcaneal Apophysitis (Seer's Disease)

Most common cause of heel pain in children and teenagers:



8

Osteology of the Foot

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mechanical INNOVATIONS

Medial view

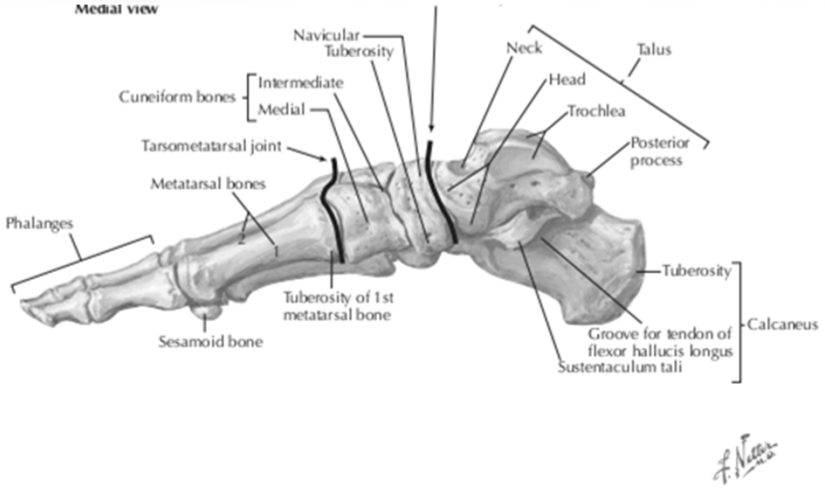

Figure 8-1

Bones of the foot

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Plantar Fasciitis

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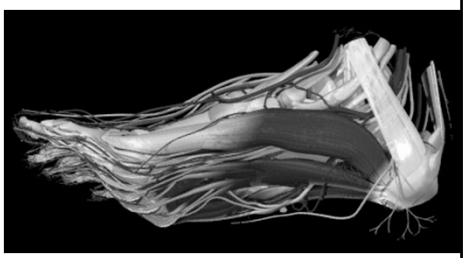
mechanical INNOVATIONS

Combination Adjustment

1. Medial Calcaneus
2. Inferior-medial Talus
3. Inferior-medial Navicular
4. Inferior Medial Cuneiform
5. Inferior 1st Metatarsal
6. Inferior Lateral Cuneiform



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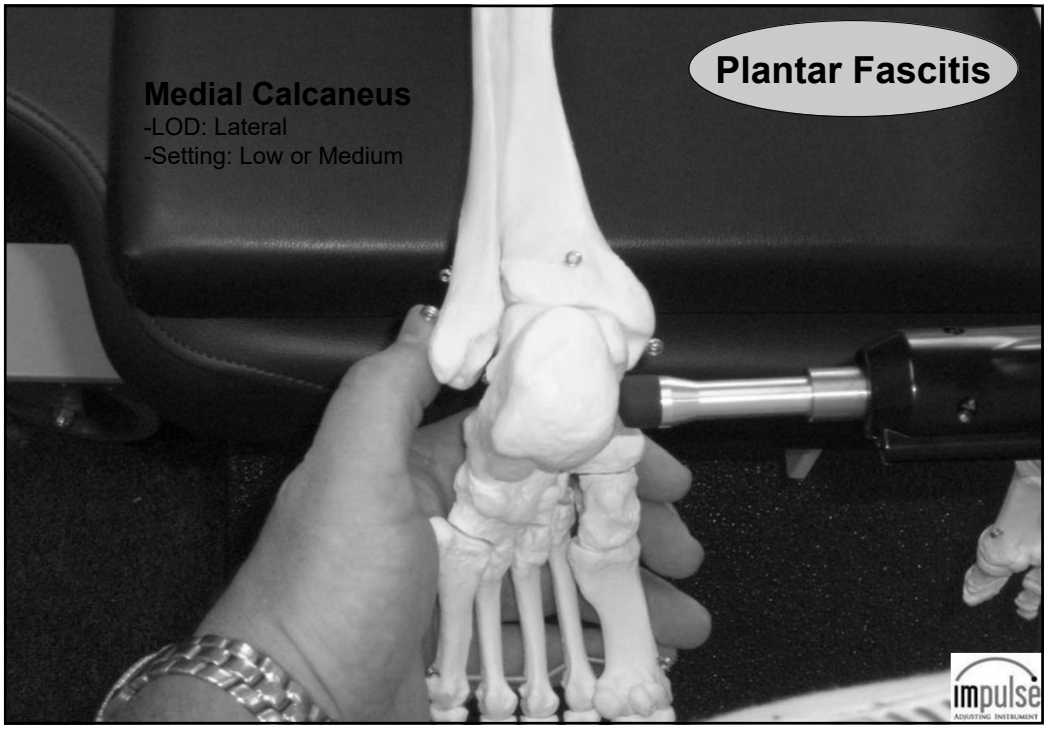
Plantar Fascitis
Medial Calcaneus
-LOD: Lateral
-Setting: Low or Medium
impulse
ADJUSTING INSTRUMENT

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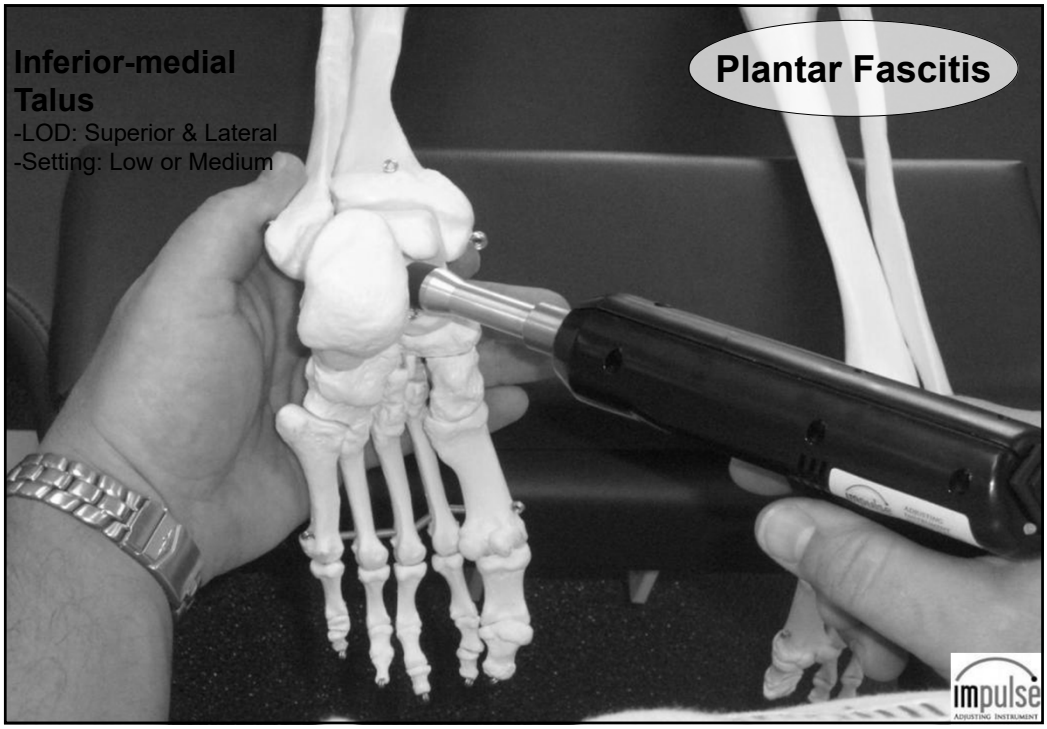
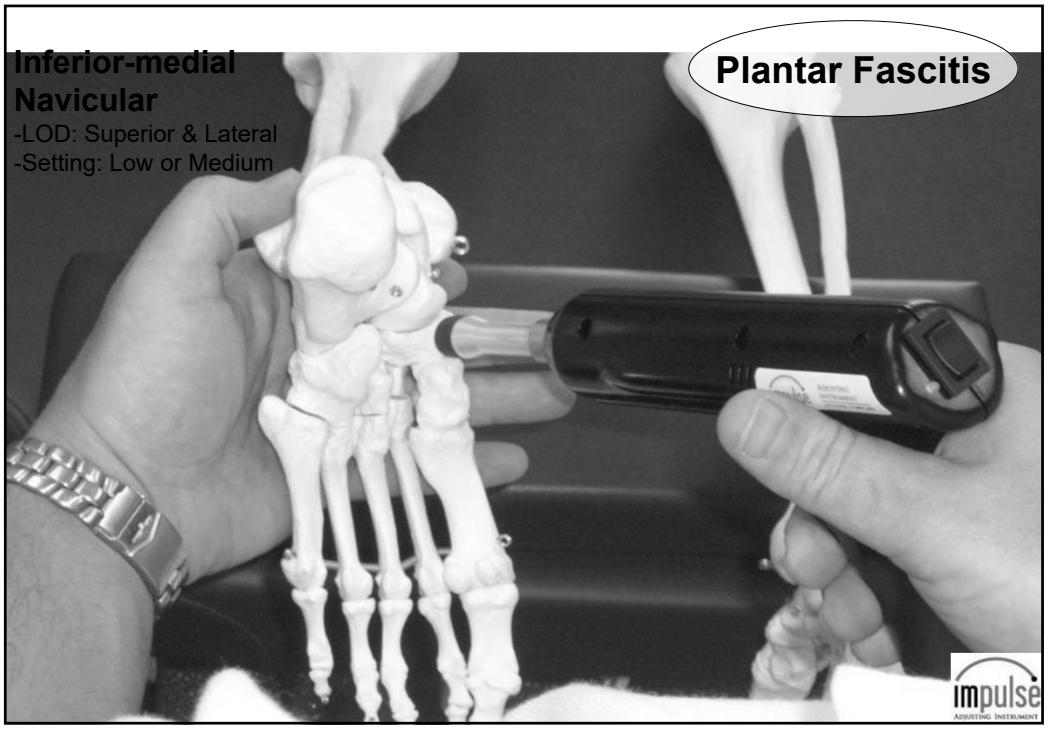
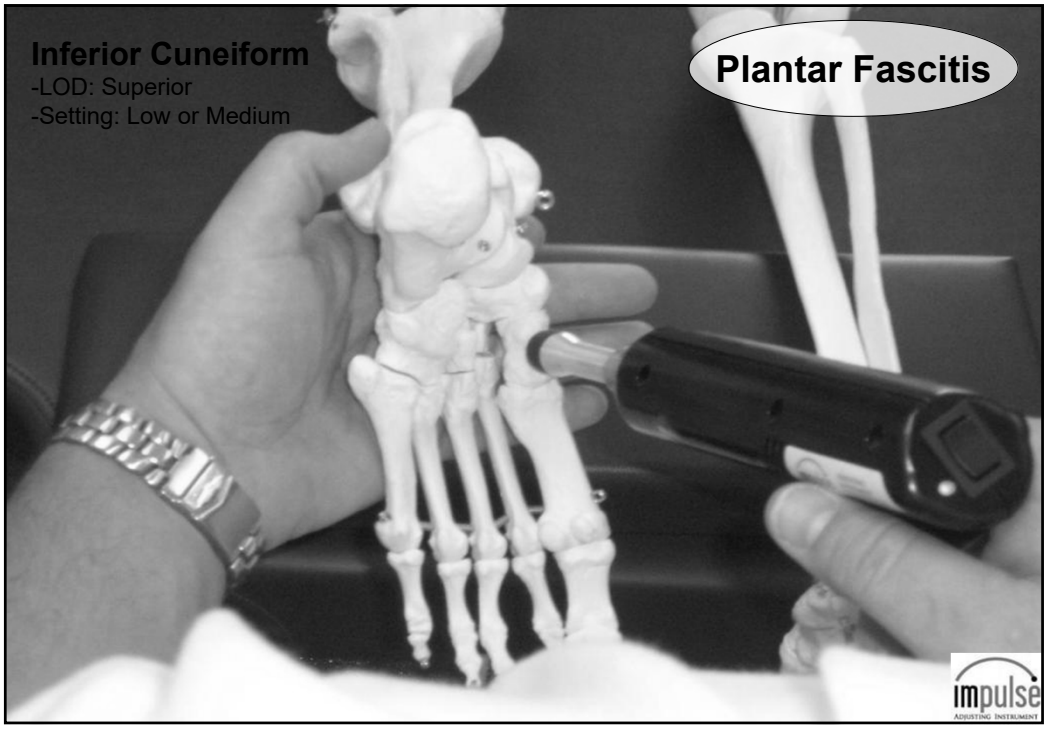

Plantar Fascitis
Inferior-medial Talus
-LOD: Superior & Lateral
-Setting: Low or Medium
impulse
ADJUSTING INSTRUMENT

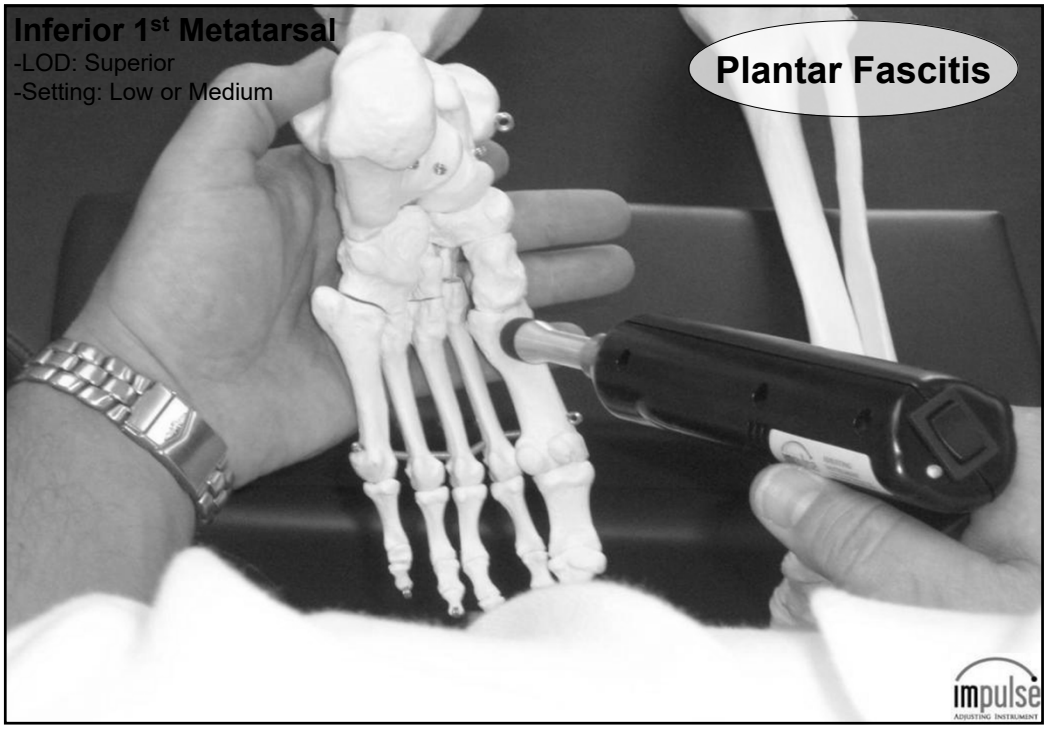
12


Inferior-medial
Navicular
-LOD: Superior & Lateral
-Setting: Low or Medium
Plantar Fascitis
impulse
ADJUSTING INSTRUMENT

13


Inferior Cuneiform
-LOD: Superior
-Setting: Low or Medium
Plantar Fascitis
impulse
ADJUSTING INSTRUMENT

14


Inferior 1st Metatarsal
-LOD: Superior
-Setting: Low or Medium
Plantar Fascitis
impulse
ADJUSTING INSTRUMENT

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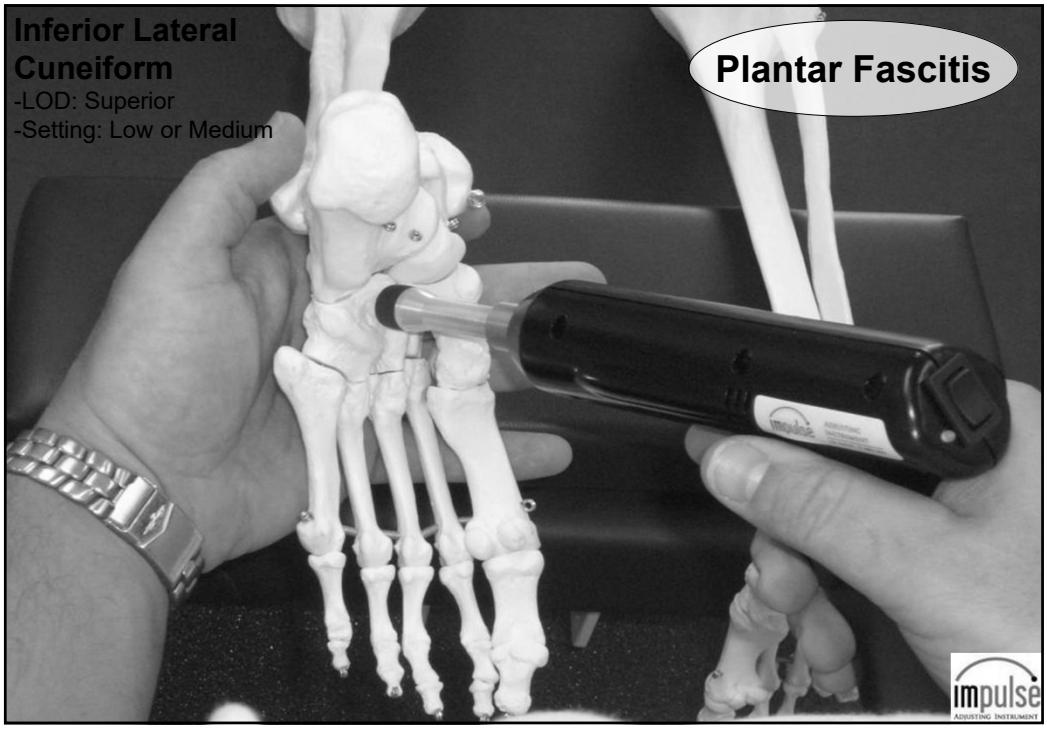
Inferior Lateral Cuneiform
-LOD: Superior
-Setting: Low or Medium
Plantar Fascitis
impulse
ADJUSTING INSTRUMENT

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Plantar Fasciitis

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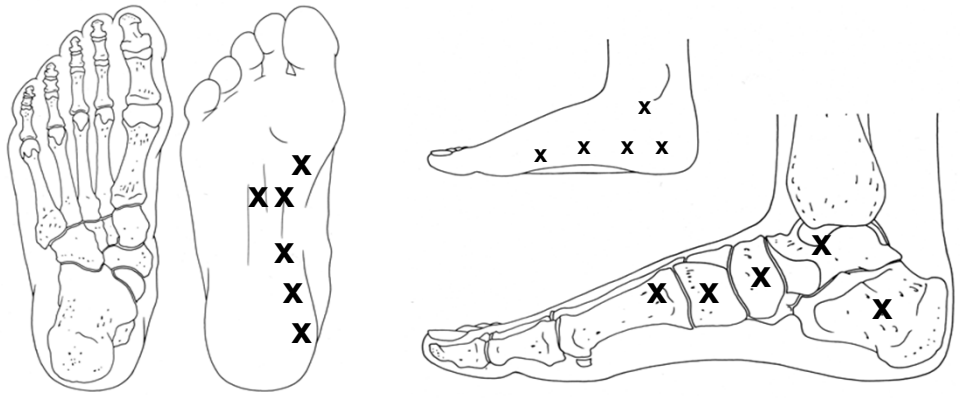
mechanical INNOVATIONS

Segmental Contact Points



ImpulseAdjusting TECHNIQUE

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Achilles Tendinitis

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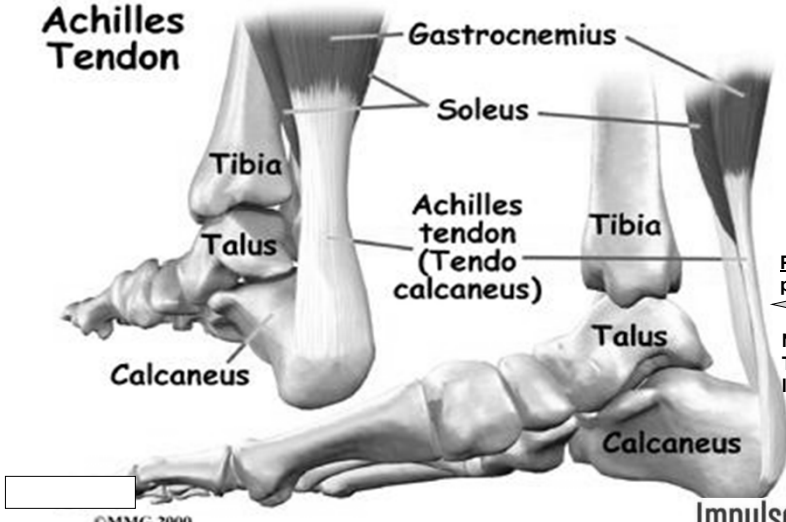
mechanical INNOVATIONS



Paratenonitis: palpable lump

Non-insertional Tendonitis (no lump)

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Achilles Tendon Injury

ImpulseAdjusting TECHNIQUE

mechanical INNOVATIONS

Must rule out complete rupture

Thompson Test

1) The patient lies in a supine position.

2) The examiner applies a squeeze to the calf of the patient's affected leg.

3) A positive test is a nonresponse during the squeeze test.

UTILITY SCORE ?

Study	Reliability	Sensitivity	Specificity	LR+	LR−	QUADAS Score (0–14)
Thompson & Doherty[29]	NT	40	NT	NA	NA	7
Comments: The test has surprisingly low sensitivity. Concurrent patient history is essential when performing this test.						

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Achilles Tendinitis

ImpulseAdjusting TECHNIQUE

mechanical INNOVATIONS

Combination Adjustment Protocol

1. Posterior-Superior Calcaneus
2. Posterior Distal Femur
3. Posterior Proximal Tibia

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Achilles Tendinitis

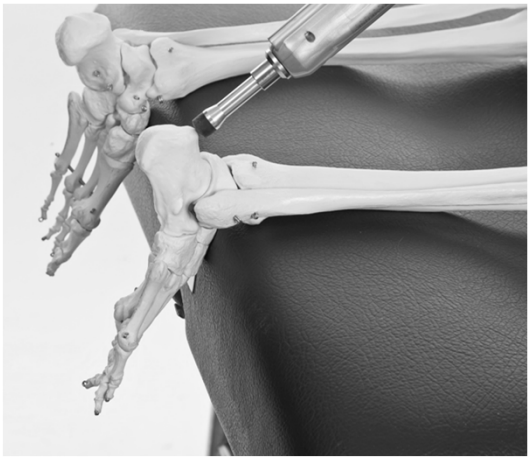
Adjustment Directive

Posterior Superior Calcaneus

Stylus: Single

LOD: Inferior & Anterior

Setting: Medium



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Achilles Tendinitis

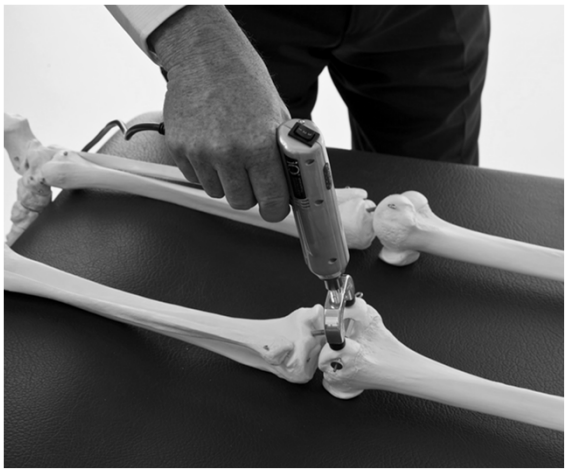
Adjustment Directive

Posterior Distal Femur

Stylus: Large Dual

LOD: Anterior

Setting: Medium



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Achilles Tendinitis

ImpulseAdjusting TECHNIQUE

mechanical INNOVATIONS

Adjustment Directive

Posterior Proximal Tibia

Stylus: Large Dual

LOD: Anterior

Setting: Medium

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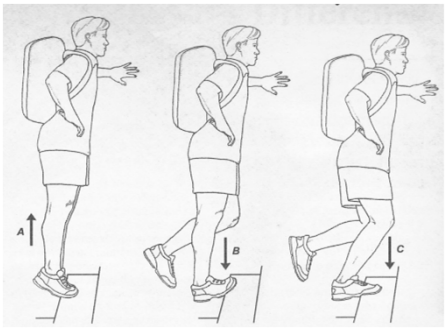
"Continued sports activity using a pain-monitoring model during rehabilitation in patients with achilles tendinopathy," Silbernagel et al, *American Journal of Sports Medicine,* 2007:35

- **Rehab for both conditions involves "heavy-load eccentric" exercises**
- **Have been shown repeatedly to be highly effective.**
- **Cortisone injections have been shown to be ineffective, dangerous, and weaken the tendon making rupture more likely.**



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Ankle Kinematics

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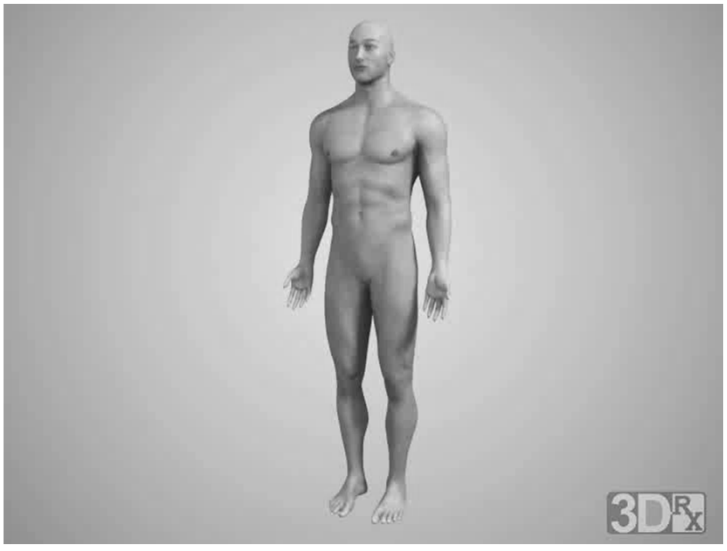
Inversion Ankle Sprain



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Inversion Ankle Sprain

- Up to 40% of all athletic injuries are related to ankle sprains.
- Ankle injury rates reach as high as 50% in basketball players and 29% in soccer players.

Smith & Reischl. Treatment of ankle sprains in young athletes. The American Journal of Sports Medicine, 1986:14

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Inversion Ankle Sprain

- **Must rule out:**
  - **Dislocation of talus out of the mortise**
  - **Fractures (including distal end of the fibula)**
  - **Complete ligament ruptures**

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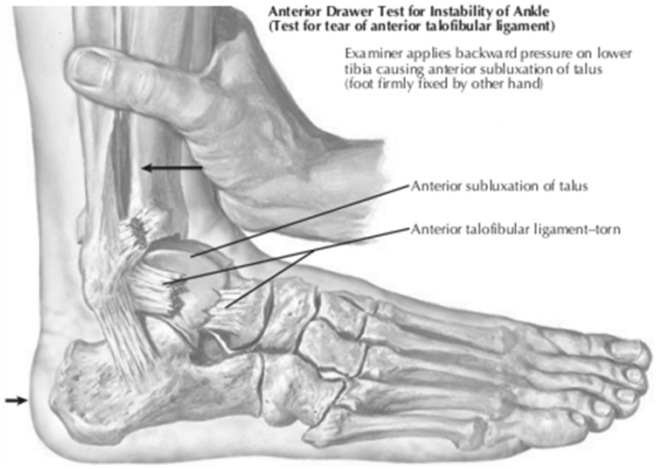
Inversion Ankle Sprain

ImpulseAdjusting TECHNIQUE

mechanical INNOVATIONS



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Anterior Drawer Test

1) The patient lies in a supine position. The ankle is prepositioned into slight plantarflexion.

2) The examiner provides an anterior glide of the calcaneus and talus on the stabilized tibia.

3) A positive test is excessive translation of one side in comparison to the opposite extremity.

UTILITY SCORE 2

Study	Reliability	Sensitivity	Specificity	LR+	LR−	QUADAS Score (0–14)
Hertel et al.[13]	NT	78	75	3.1	0.29	8
Phisitkul et al.[22]	NT	100	100	Inf	Inf	7
Comments: The test is designed to measure damage to the anterior talofibular ligament. The examiner should observe the presence of a dimple or sulcus sign near the region of the anterior talofibular ligament. Phistikul's study used cadavers and was poorly performed.						

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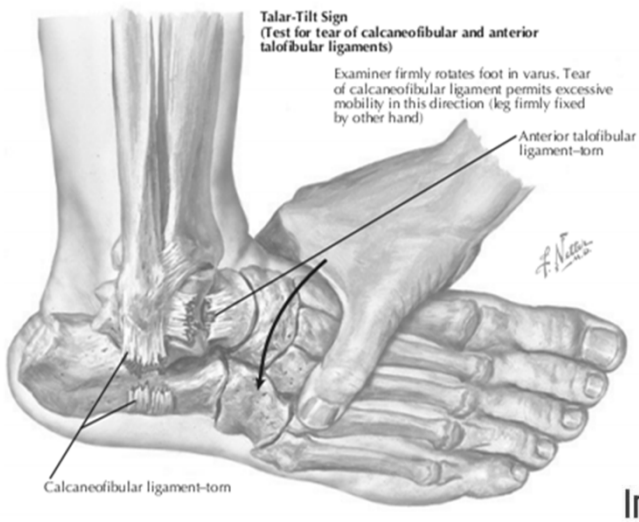
Inversion Ankle Sprain

ImpulseAdjusting TECHNIQUE

mechanical INNOVATIONS



ImpulseAdjusting TECHNIQUE

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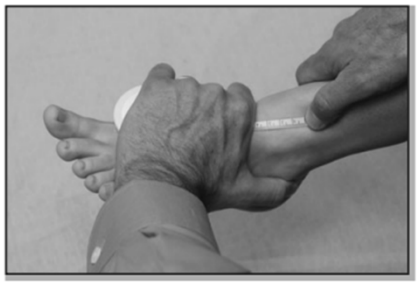
Anterior Lateral Drawer Test



1. The patient assumes a sitting position.
2. The examiner stabilizes the lower leg just above the ankle. The other hand provides an anterior directed force, measurement of talar translation, and control of ankle plantarflexion.
3. A positive test is 3 millimeters or more of translation.

UTILITY SCORE 3

Study	Reliability	Sensitivity	Specificity	LR+	LR−	QUADAS Score (0–14)
Phisitkul et al. [22]	NT	75	50	1.5	0.50	7
Comments: The study used cadavers and was poorly performed.						

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Figure 9. Illustration depicting the talar tilt test to assess stability of the calcaneofibular ligament. (Reprinted with permission from Hoppenfeld S, Hutton R. Physical examination of the spine and extremities. New York: Appleton-Century-Crofts; 1976:227.)

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Medial Talar Tilt Stress Test

1. The patient is placed in a sitting or supine position.
2. The examiner grasps the ankle of the patient at the malleoli.
3. The examiner applies a quick medial thrust to the calcaneus.
4. A positive test is excessive laxity when compared to the opposite side.

UTILITY SCORE 2

Study	Reliability	Sensitivity	Specificity	LR+	LR−	QUADAS Score (0–14)
Hertel et al.[13]	NT	67	75	2.7	0.44	8
Comments: Expect positive findings after inversion sprains.						

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Fibular Translation Test

1. The patient lies in a sidelying position.
2. The examiner applies anterior and posterior forces on the fibula at the level of the syndesmosis.
3. A positive test is pain during translation and more displacement to the fibula than the compared side.

UTILITY SCORE 2

Study	Reliability	Sensitivity	Specificity	LR+	LR−	QUADAS Score (0–14)
Beumer et al.[3]	NT	82	88	6.8	0.2	8
Comments: Beumer et al.[3] only found increased translation when all ligaments were removed in cadavers.						

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Inversion Ankle Sprain

ImpulseAdjusting TECHNIQUE

mechanical INNOVATIONS

Combination Adjustment

1. Anterior Lateral Superior Talus
2. Posterior Distal Fibula

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Inversion Ankle Sprain

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mechanical INNOVATIONS

Adjustment Directive

Anterior Lateral Talus

Stylus: Single

LOD: Posterior Medial

Setting: Medium

ImpulseAdjusting TECHNIQUE

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Inversion Ankle Sprain

ImpulseAdjusting TECHNIQUE

mechanical INNOVATIONS

Adjustment Directive

Anterior Lateral Talus

Stylus: Single

LOD: Posterior Medial

Setting: Medium

ImpulseAdjusting TECHNIQUE

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Inversion Ankle Sprain

ImpulseAdjusting TECHNIQUE

mechanical INNOVATIONS

Adjustment Directive

Posterior Distal Fibula

Stylus: Single

LOD: Anterior

Setting: Medium

ImpulseAdjusting TECHNIQUE

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Inversion Ankle Sprain

ImpulseAdjusting TECHNIQUE

mechanical INNOVATIONS

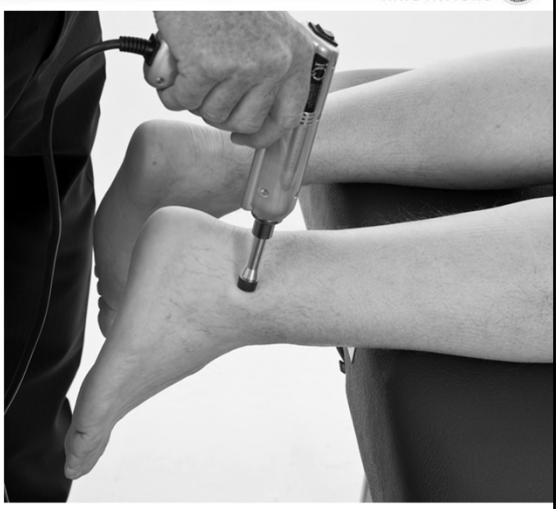
Adjustment Directive

Posterior Distal Fibula

Stylus: Single

LOD: Anterior

Setting: Medium



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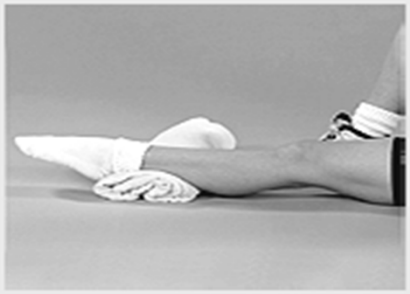
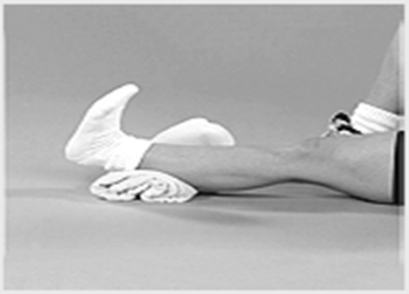
Inversion Ankle Sprain Rehab

Alphabet Ankle

Seated with leg out in front.
Place towel under lower leg and relax ankle.
Move ankle so as to draw the letters of the alphabet A,B,C...
Try drawing both upright figure 8's and side lying 'lazy 8's in both directions.

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Inversion Ankle Sprain Rehab

Step Down


Standing on a low step. Step down with the unaffected leg. Raise body weight back up onto step and repeat.

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Hotmail Print Message http://by171w.bay171.mail.live.com/mail/PrintMessages.aspx?cpids=

Exercises

From: **norespond@3drx.com**
Sent: Thu 10/04/12 9:09 AM
To: docjim47@live.com

Chiro-Plus
Has generated a report on 10/4/2012

You can also view report in details, Click
view report

Rehab Section

Step Down - FLO206
Standing on a low step, step down slowly with one leg. Control the lowering with upper leg. Upper leg then lifts body weight back up, foot returns to step. Repeat. Maintain an abdominal hollow. Stop if the exercise causes pain.

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Proprioceptive Training

A-P Rock

Keeping finger tips on wall or chair for support, step onto rocker board with one foot.
Keeping eyes looking straight forward, raise opposite foot onto board.
Maintain a short foot and readiness position while on the board.
With control, slowly rock board forward and back.

NeuroMechanics

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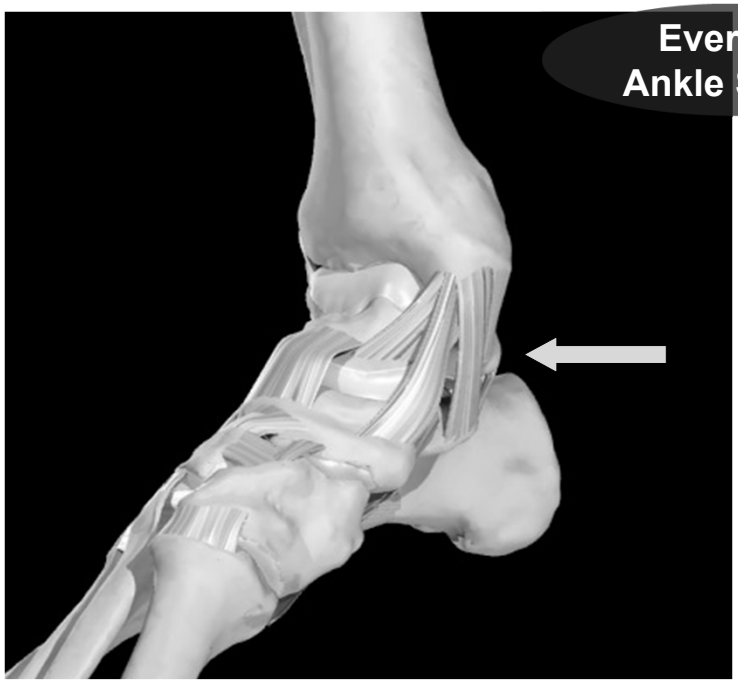

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Eversion Ankle Sprain

ImpulseAdjusting TECHNIQUE

mechanical INNOVATIONS

Combination Adjustment

1. Inferior Medial Talus
2. Inferior Medial Navicular
3. Inferior Medial Tibia

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Eversion
Ankle Sprain

Common Associated Ankle/Leg Subluxations

- Inferior-medial Talus
- Inferior-medial Navicular
- Inferior medial Tibia

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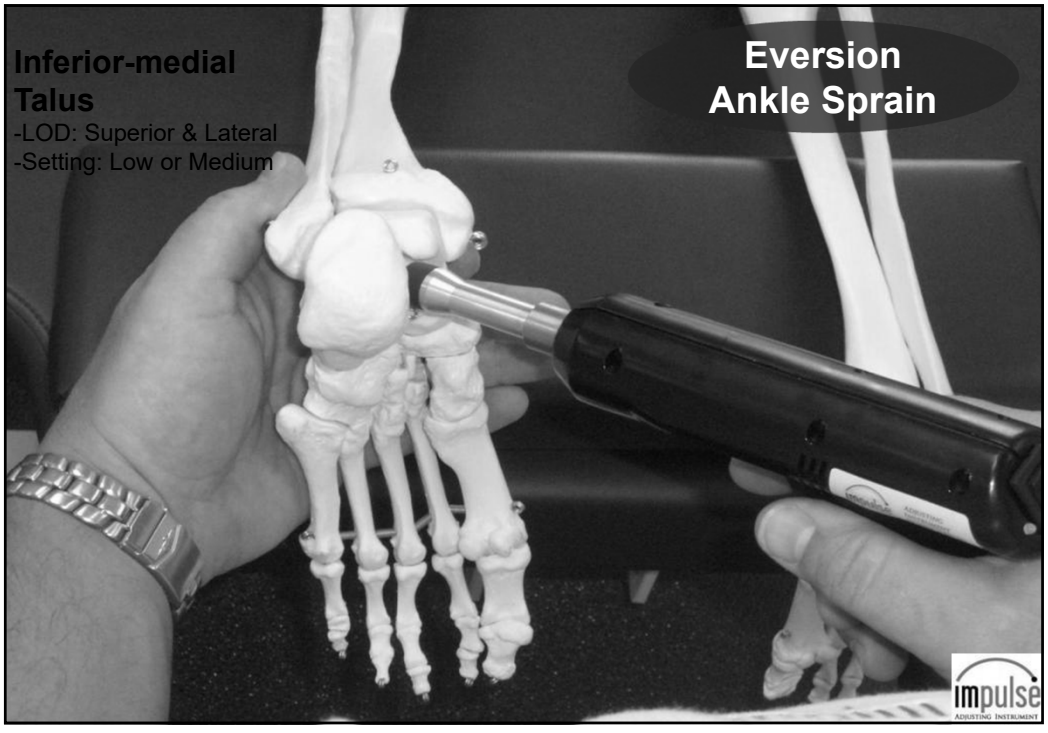

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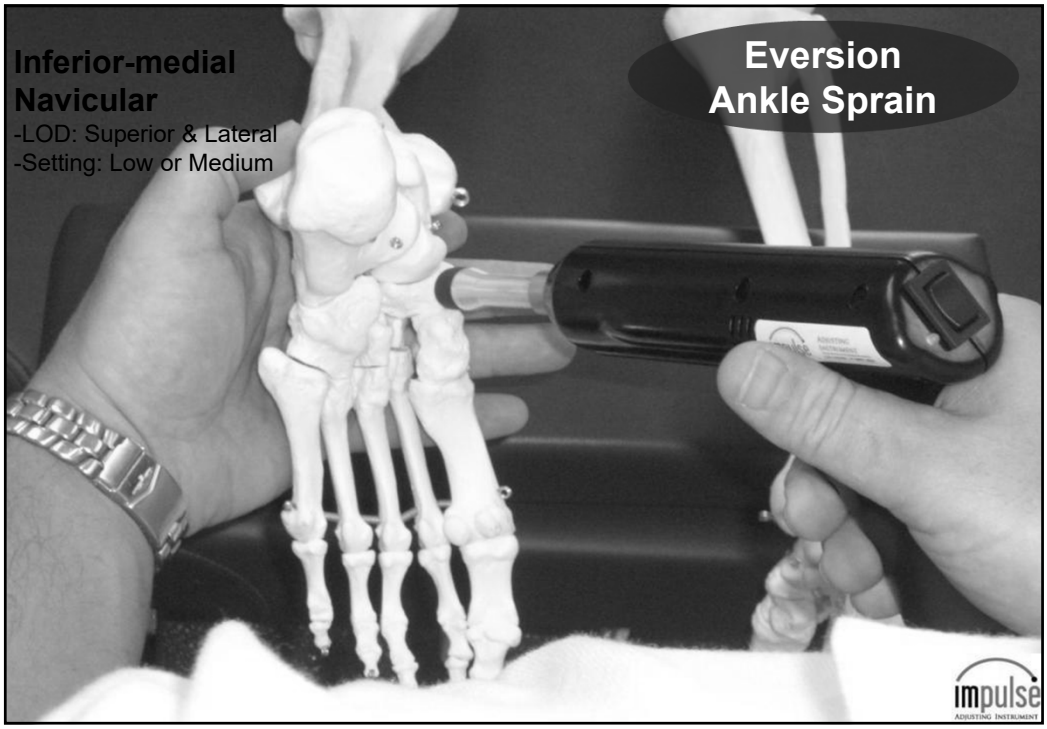
Inferior-medial
Navicular
-LOD: Superior & Lateral
-Setting: Low or Medium
Eversion
Ankle Sprain
impulse
ADJUSTING INSTRUMENT

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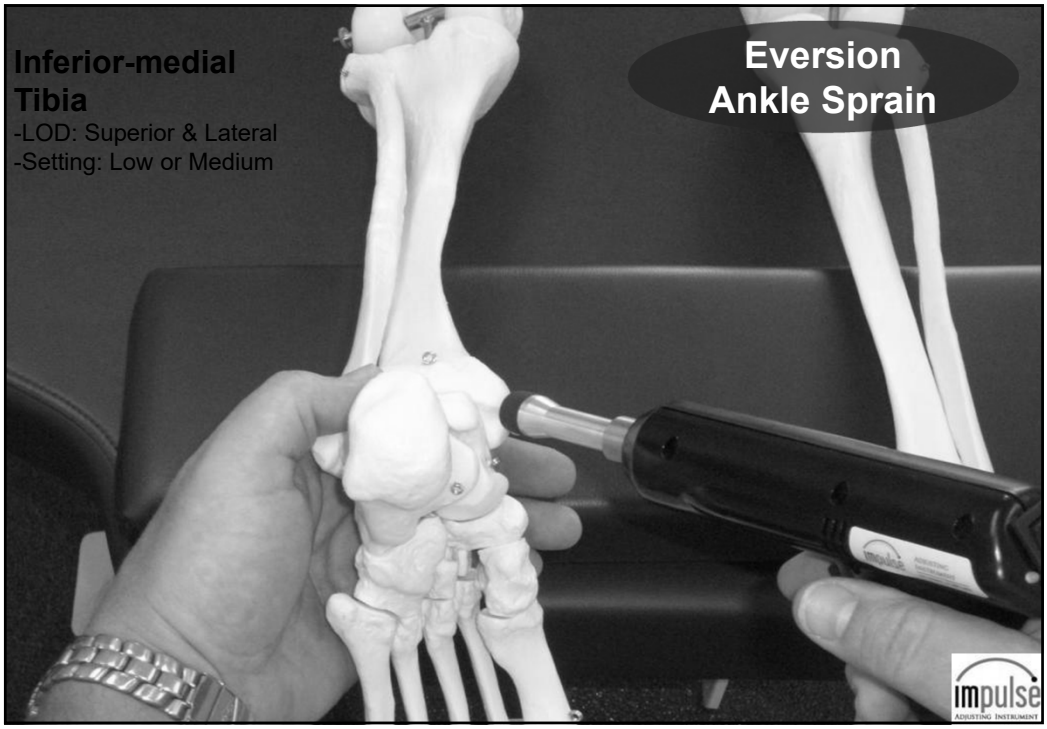
Inferior-medial
Tibia
-LOD: Superior & Lateral
-Setting: Low or Medium
Eversion
Ankle Sprain
impulse
ADJUSTING INSTRUMENT

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Ankle Impingement

ImpulseAdjusting TECHNIQUE

mechanical INNOVATIONS

Forced Dorsiflexion Test

1) The patient assumes a sitting position.
2) The examiner stabilizes the distal aspect of the tibia and places his or her thumb on the anterolateral aspect of the talus near the lateral gutter. Pressure is applied.
3) The examiner applies a forceful dorsiflexion movement.
4) A positive test is reproduction of pain at the anterolateral aspect of the foot during forced dorsiflexion.

UTILITY SCORE 2

Study	Reliability	Sensitivity	Specificity	LR+	LR−	QUADAS Score (0–14)
Alonso et al.[1]	0.36 kappa	NT	NT	NA	NA	NA
Molloy et al.[17]	NT	95	88	7.9	0.06	8

Comments: Alonso et al.[1] tested for a syndesmosis injury. Although the diagnostic values for the test are strong, the quality of the study and the reliability among examiners is poor.

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Ankle Impingement

ImpulseAdjusting TECHNIQUE

mechanical INNOVATIONS

Clinical Prediction Rule of Impingement

Five of six symptoms below are considered positive for anterior ankle impingement:

1) Anterolateral ankle joint tenderness.
2) Anterolateral ankle joint swelling.
3) Pain with forced dorsiflexion.
4) Pain with single-leg squat on the affected side.
5) Pain with activities.
6) Absence of ankle instability.

UTILITY SCORE 2

Study	Reliability	Sensitivity	Specificity	LR+	LR−	QUADAS Score (0–14)
Liu et al.[15]	NT	94	75	3.8	0.08	7

Comments: Some disagreement exists whether absence of ankle instability should be a rule for impingement. The quality of the single study is suspect.

ImpulseAdjusting TECHNIQUE

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Ankle Impingement

ImpulseAdjusting TECHNIQUE

mechanical INNOVATIONS

Combination Adjustment

1. Anterior-Superior Talus
2. Superior Navicular
3. Superior Medial Cuneiform
4. Anterior Distal Tibia

ImpulseAdjusting TECHNIQUE

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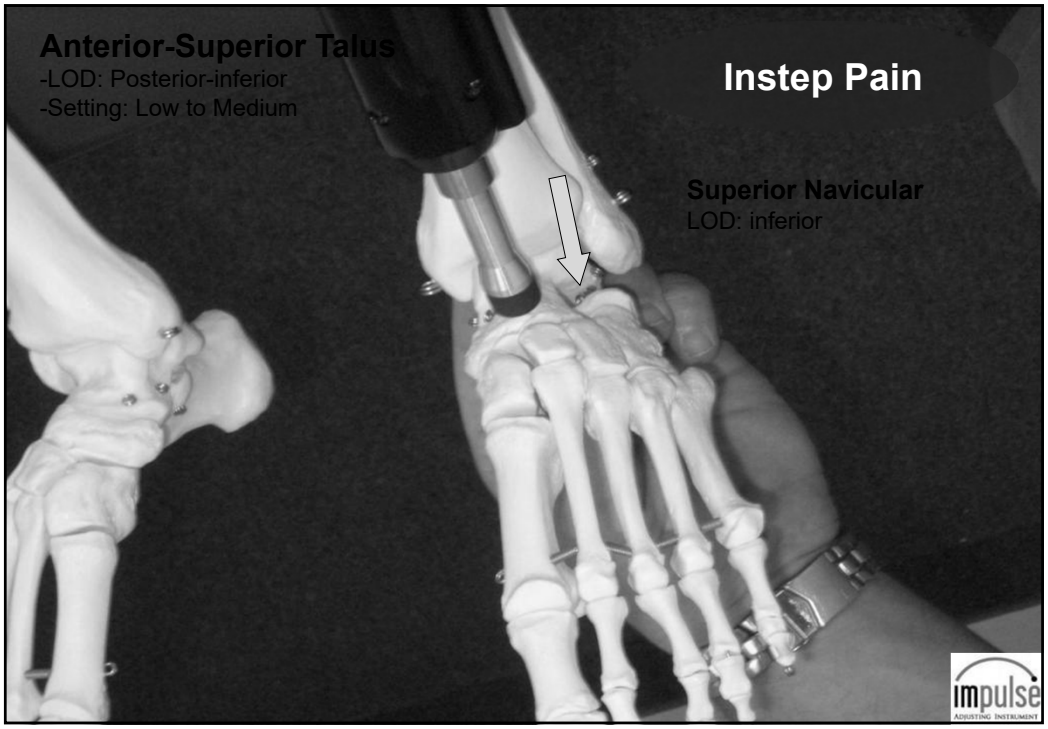

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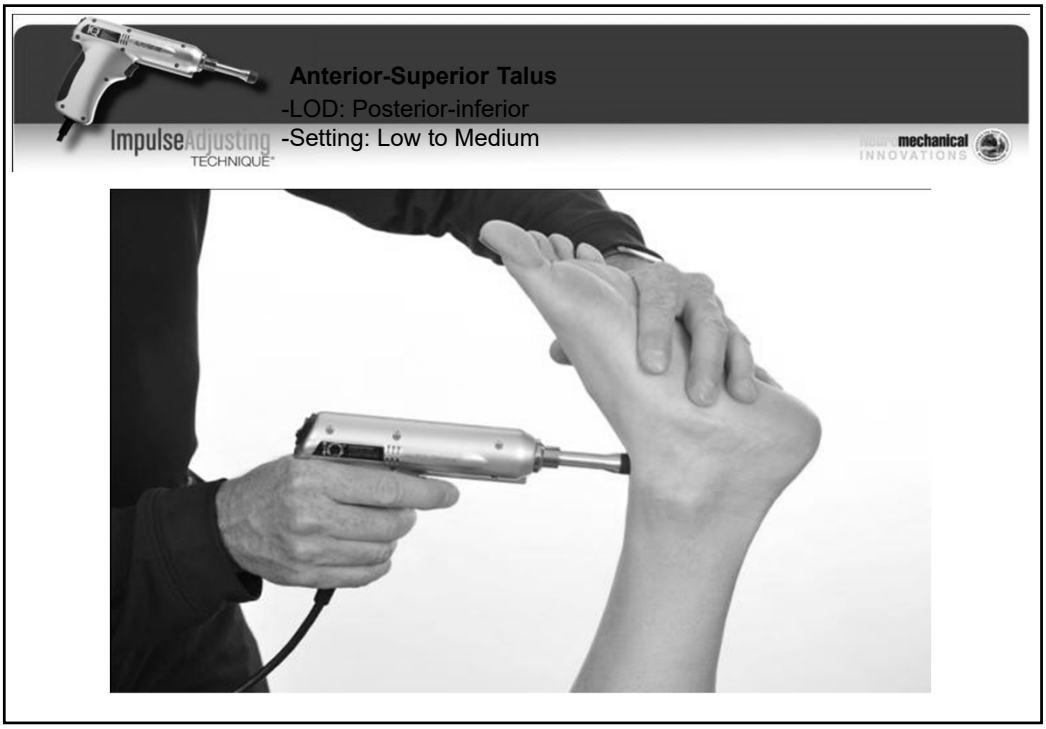
Superior Navicular
LOD: inferior
ImpulseAdjusting
TECHNIQUE
mechanical
INNOVATIONS

55


Anterior-Superior Talus
-LOD: Posterior-inferior
-Setting: Low to Medium
ImpulseAdjusting
TECHNIQUE
mechanical
INNOVATIONS

56


Superior medial Cuneiform
-LOD: Inferior & Lateral
-Setting: Low or Medium
Instep Pain
Anterior Tibia
LOD: posterior
impulse
ADJUSTING INSTRUMENT

57


Superior medial Cuneiform
ImpulseAdjusting TECHNIQUE
-LOD: Inferior & Lateral
-Setting: Low or Medium
mechanical INNOVATIONS

58

Anterior Tibia

ImpulseAdjusting TECHNIQUE

mechanical INNOVATIONS

LOD: posterior

59

Foot/Toe Conditions

- Hallux Valgus/1st MTP Sprain
- Metatarsalgia

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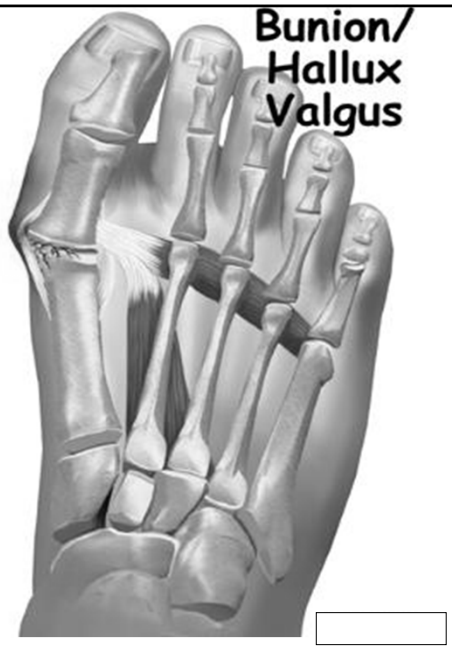
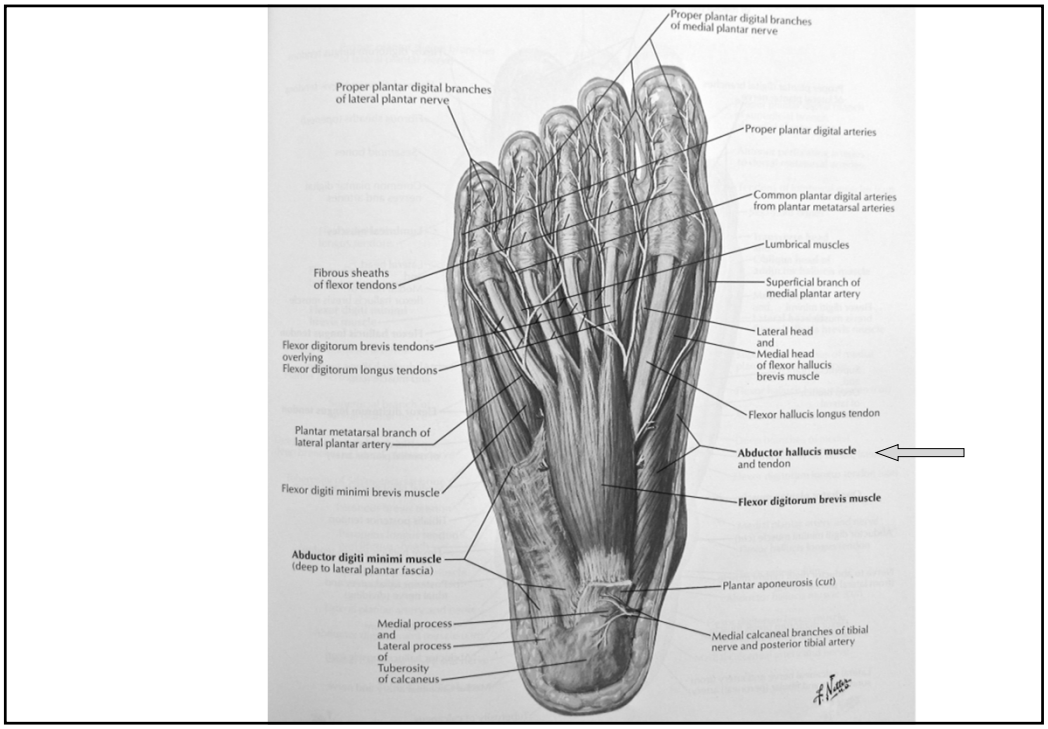
60

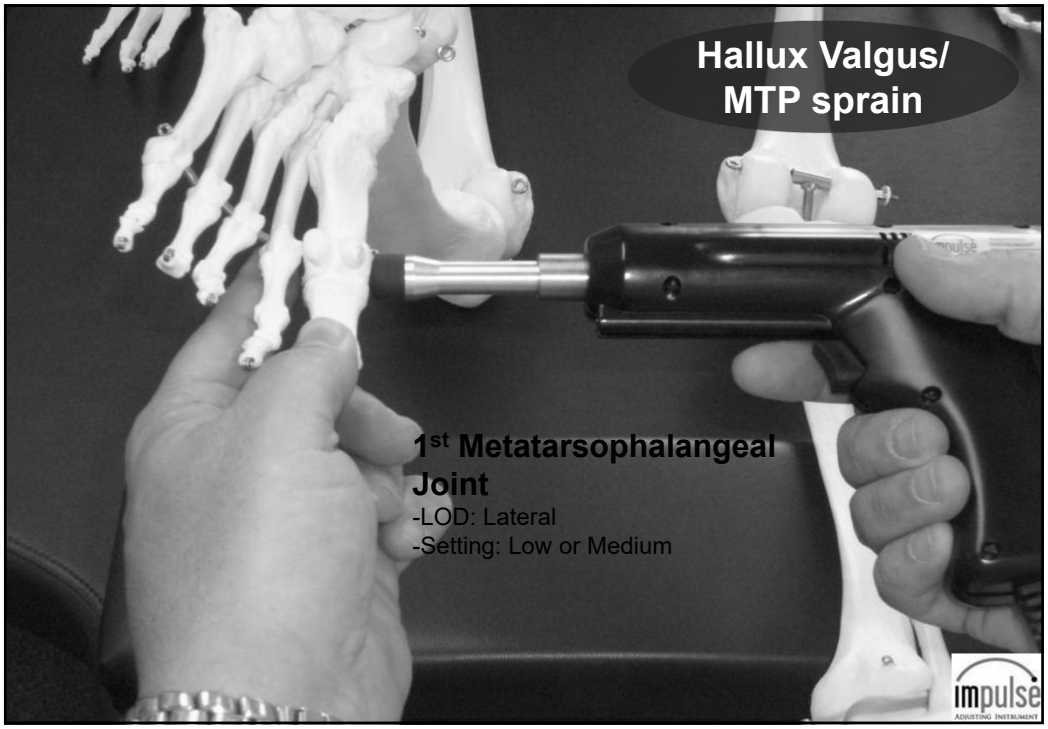


61

62


Proper plantar digital branches of medial plantar nerve
Proper plantar digital branches of lateral plantar nerve
Proper plantar digital arteries
Common plantar digital arteries from plantar metatarsal arteries
Lumbrical muscles
Fibrous sheaths of flexor tendons
Superficial branch of medial plantar artery
Lateral head and Medial head of flexor hallucis brevis muscle
Flexor digitorum brevis tendons overlying Flexor digitorum longus tendons
Flexor hallucis longus tendon
Plantar metatarsal branch of lateral plantar artery
Abductor hallucis muscle and tendon
Flexor digiti minimi brevis muscle
Flexor digitorum brevis muscle
Abductor digiti minimi muscle (deep to lateral plantar fascia)
Plantar aponeurosis (cut)
Medial process and Lateral process of Tuberosity of calcaneus
Medial calcaneal branches of tibial nerve and posterior tibial artery

63

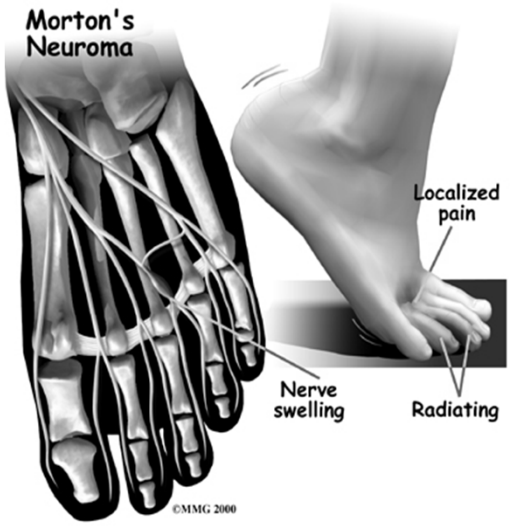

Hallux Valgus/
MTP sprain
1st Metatarsophalangeal Joint
-LOD: Lateral
-Setting: Low or Medium
impulse
ADJUSTING INSTRUMENT

64

1st MTP
-LOD: Lateral
-Setting: Low or Medium

65

Metatarsalgia/MTP sprain:



66

Inferior MTP

LOD: superior

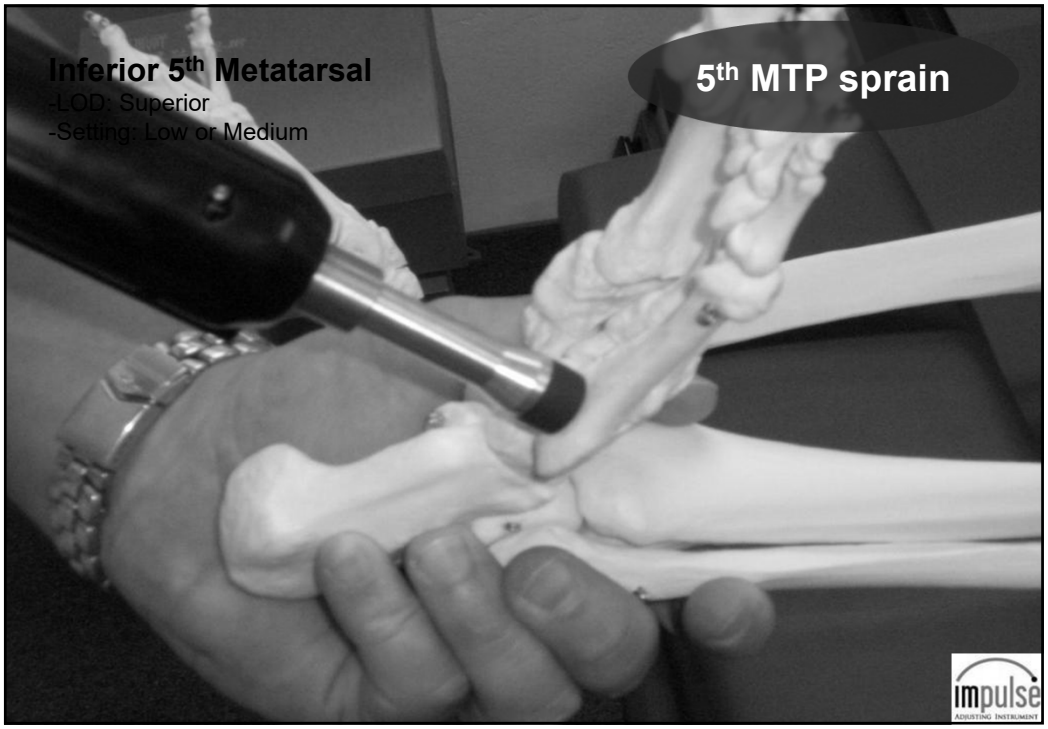
Setting: Low or medium

67

Cuboid sprain:

LOD: inferior

68


Inferior 5th Metatarsal
-LOD: Superior
-Setting: Low or Medium
5th MTP sprain
impulse
ADJUSTING INSTRUMENT

69

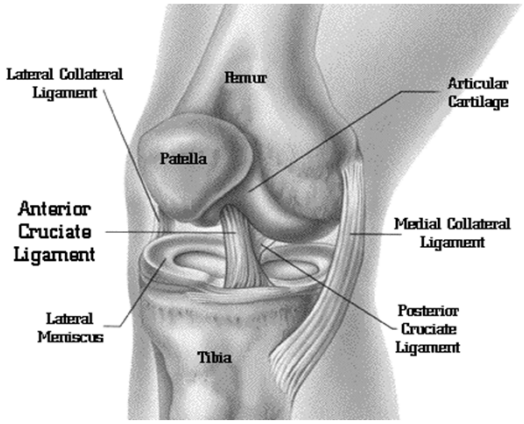

Inferior 5th Metatarsal
-LOD: Superior
-Setting: Low or Medium
ImpulseAdjusting
TECHNIQUE
mechanical
INNOVATIONS

70

Knee

Knee Articulations

1. Tibiofemoral Joint
2. Tibiofibular Joint
3. Patellofemoral Joint

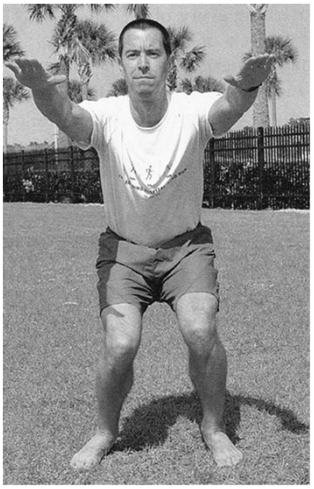


71

Knee – Tibiofemoral Joint

Physical Examination

1. Orthopedic Examination
2. Postural Assessment



72

Knee

ImpulseAdjusting TECHNIQUE

mechanical INNOVATIONS

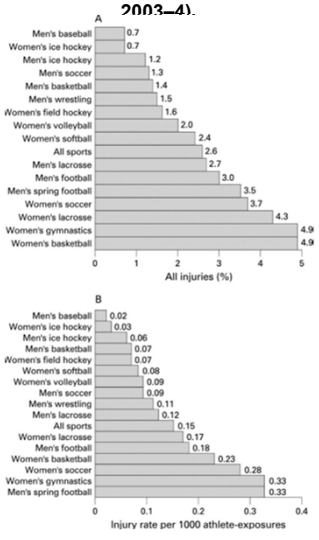
Knee Adjustment Considerations

1. Anterior
2. Tibiofibular Joint
3. Patellofemoral Joint

ImpulseAdjusting TECHNIQUE

73

Occurrence of anterior cruciate ligament (ACL) injury expressed as (A) a percentage of all injuries and (B) the rate per 1000 exposures (games and practices combined, 1988–9 through 2003–4).



P Renstrom et al. Br J Sports Med 2008;42:394-412

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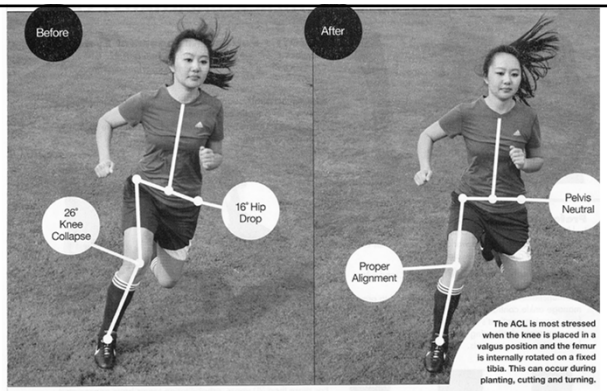
74



The ACL is most stressed when the knee is placed in a valgus position and the femur is internally rotated on a fixed tibia. This can occur during planting, cutting and turning.

The Missing ACL Link

Getting a handle on the most dangerous trend facing today's athlete

By Steve Grosserode, DPT, OCS, and Jared Vagy, DPT, OCS

It is estimated that there are over 250,000 anterior cruciate ligament (ACL) injuries per year in the United States. More than 100,000 ACL reconstructions are performed annually, costing up to $17 billion each year.[1]

ACL tears have become an epidemic. There are more young athletes suffering from this injury than ever before.[2] Over half of ACL tears occur in athletes 15-20 years old.[3]

These injuries have serious effects on the lives of young athletes. They can lead to a decreased grade point average, depression, fear about returning to their sport, and even the loss of a collegiate scholarship. Long-term risks include up to a 70% chance of early osteoarthritis 10-15 years following injury.[4-7]

Fortunately, over the last decade, an abundance of evidence has shown that ACL injuries can be prevented with a focus on proper movement technique and proximal hip strength. Mandelbaum et al. showed that up to 88% of ACL injuries can be prevented with education, stretching, strengthening, plyometrics and sports-specific agility drills with an emphasis on proper technique, including video feedback movement training.[8]

With ACL injuries occurring at alarming rates, it is essential to develop strategies to reduce them. Athletes who are predisposed to ACL injury must be identified through screenings that analyze movement patterns and test the strength of the muscles that prevent injuries. Following the screening, a physical therapist must devise an individual training program that combines the findings from the screening with the latest research.

Poor Movement and Weak Hips

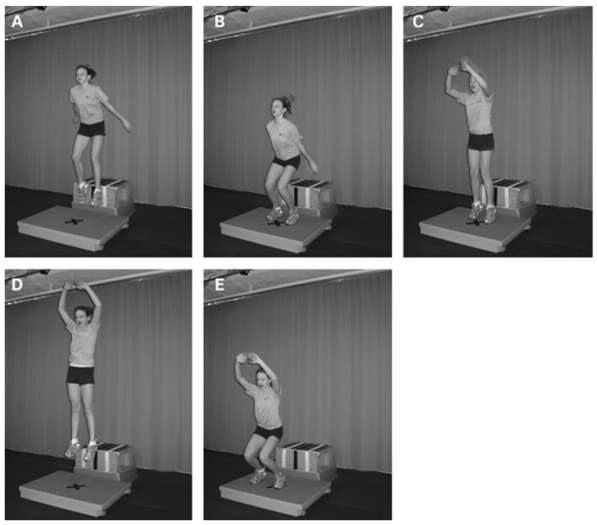
The ACL is most stressed when the knee is placed in a valgus position and the femur is internally rotated on a fixed tibia.[9-11] The knee is placed in these harmful positions during planting, cutting and turning movements that are common in most sports. The two main factors that protect the ACL from valgus stress are proper movement patterns and muscle training — specifically proximal hip strengthening.

Movement patterns originate in the brain and are carried out via motor control. Motor control occurs when the brain and nervous systems coordinate with muscles to perform a task. Therefore, movement retraining is separate from muscle training.

The gluteus maximus and gluteus medius are the primary muscles in the hip that control abduction and internal rotation of the femur. Weakness of these muscles can lead to knee

75

Drop vertical jump test.



P Renstrom et al. Br J Sports Med 2008;42:394-412

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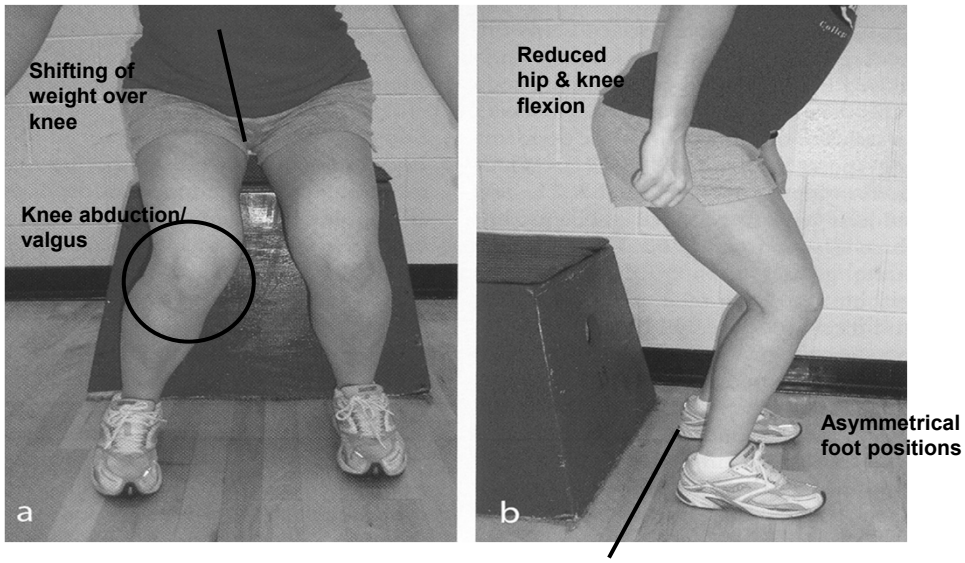
76

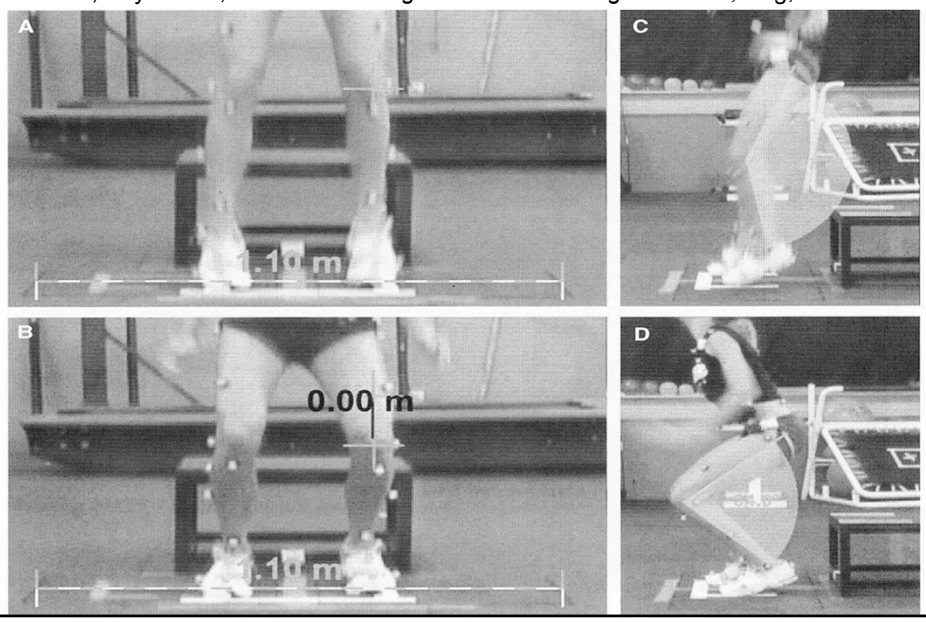
Inappropriate neuromuscular control during landing:

Barber-Westin et al, *Journal of Strength and Conditioning Research,* Nov, 2010:24

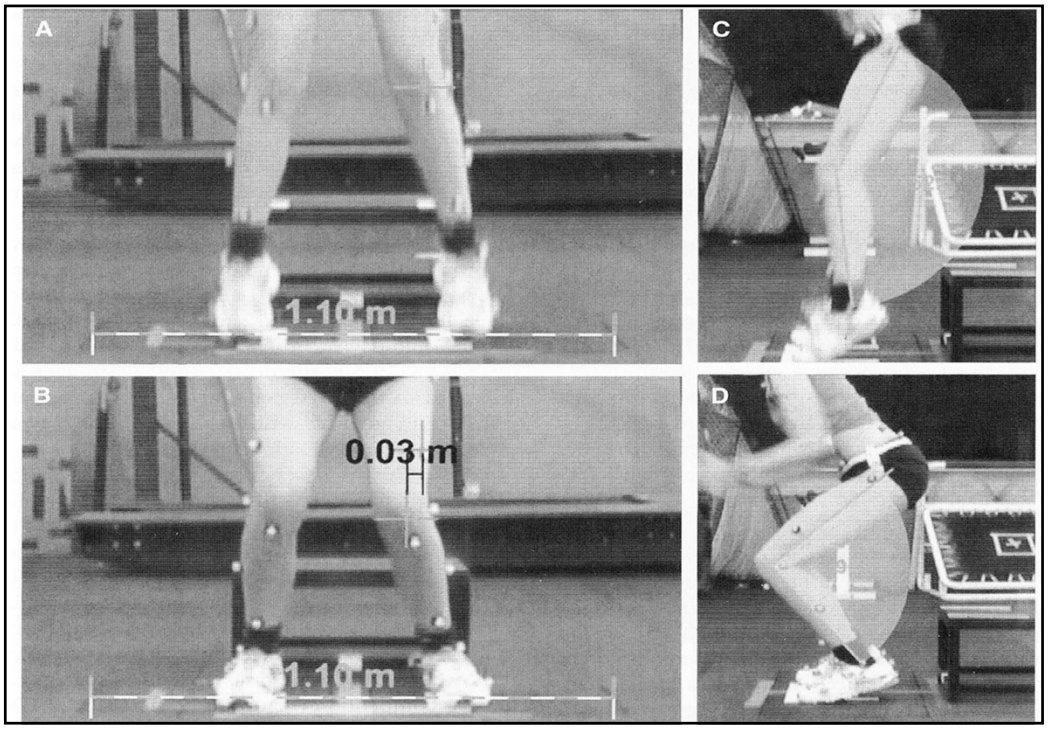


77

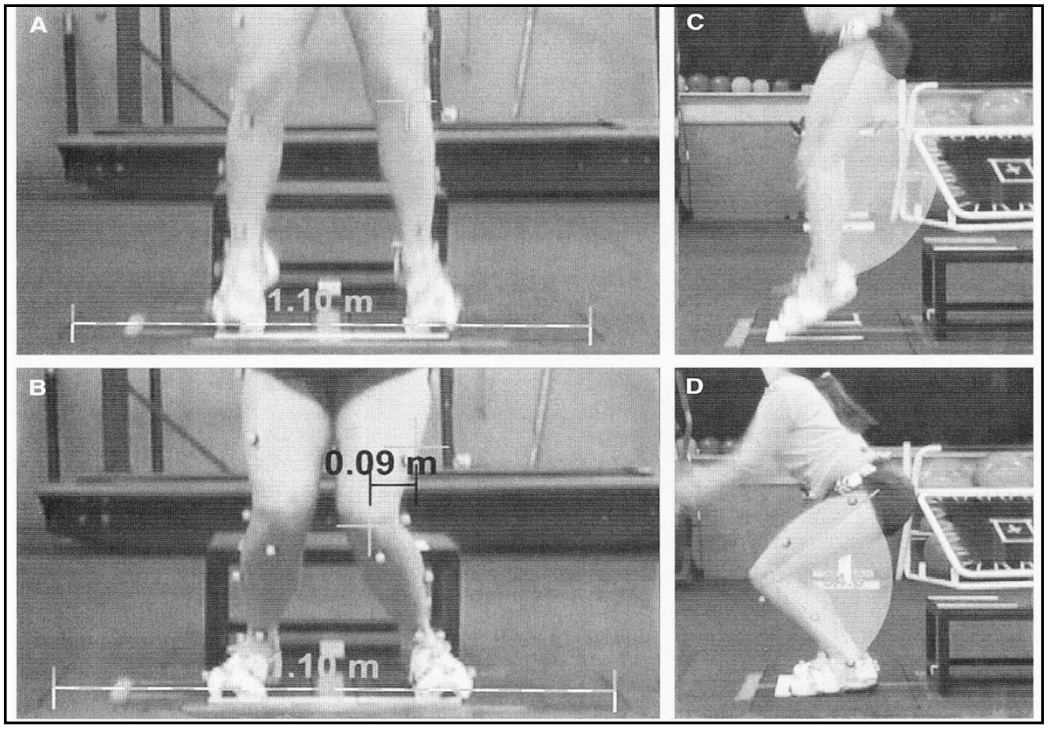
"An integrated approach to change the outcome. Part II: Targeted neuromuscular training techniques to reduce indentified ACL injury risk factors," Myer et al, *Journal of Strength and Conditioning Research,* Aug, 2012



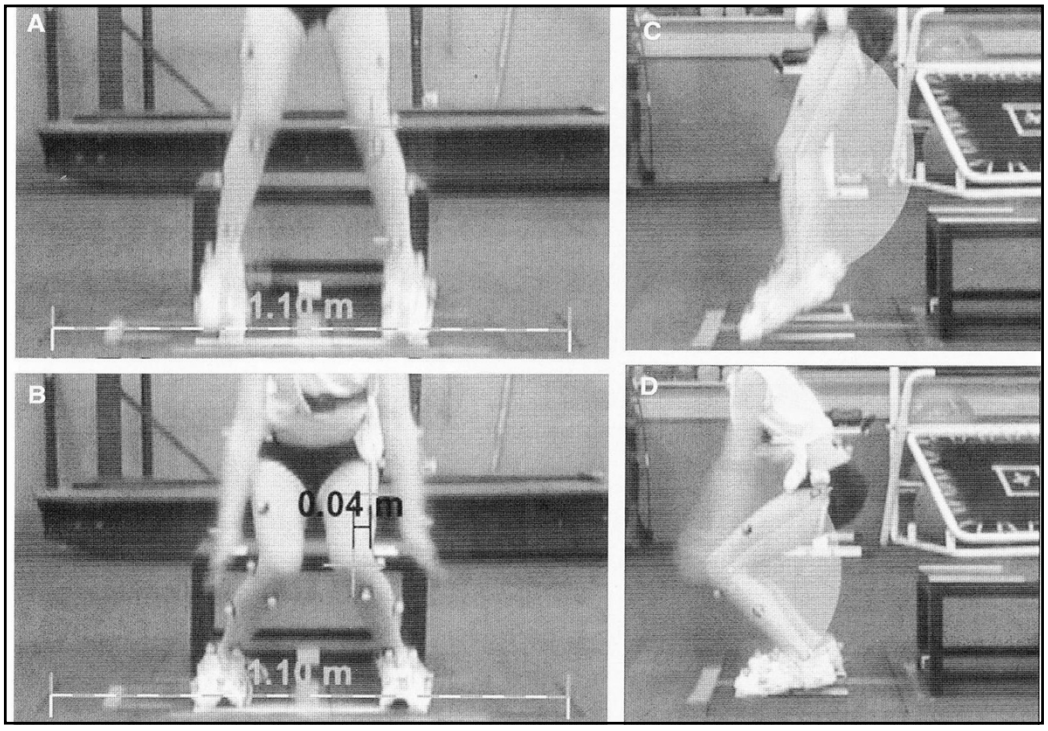
78



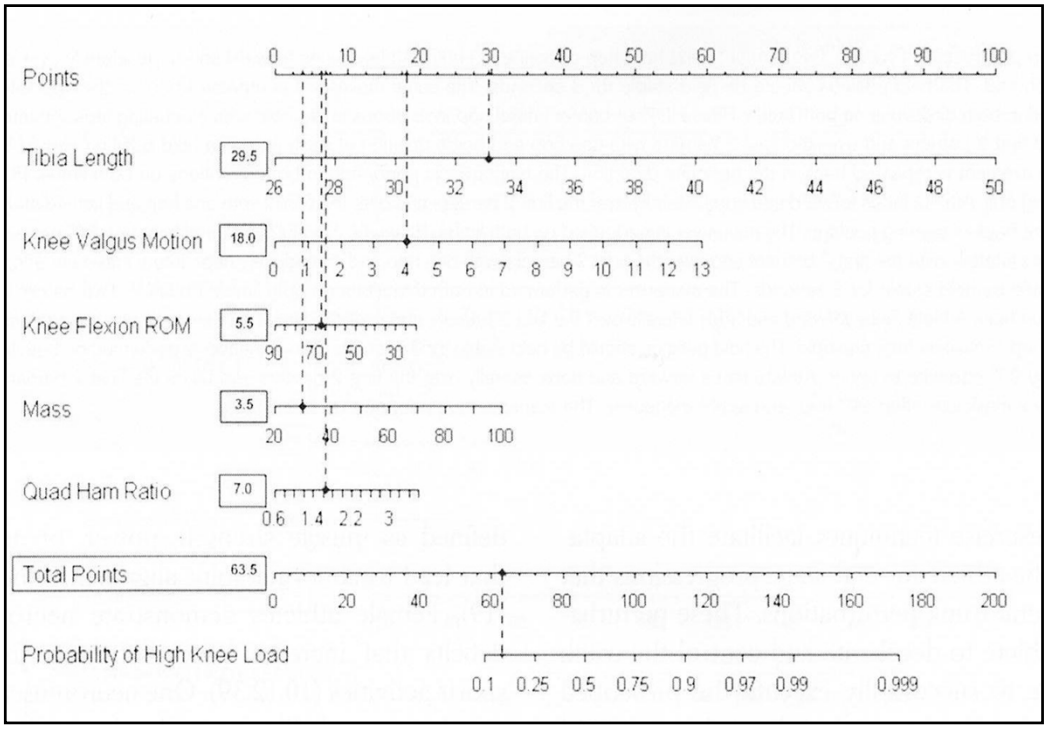
79



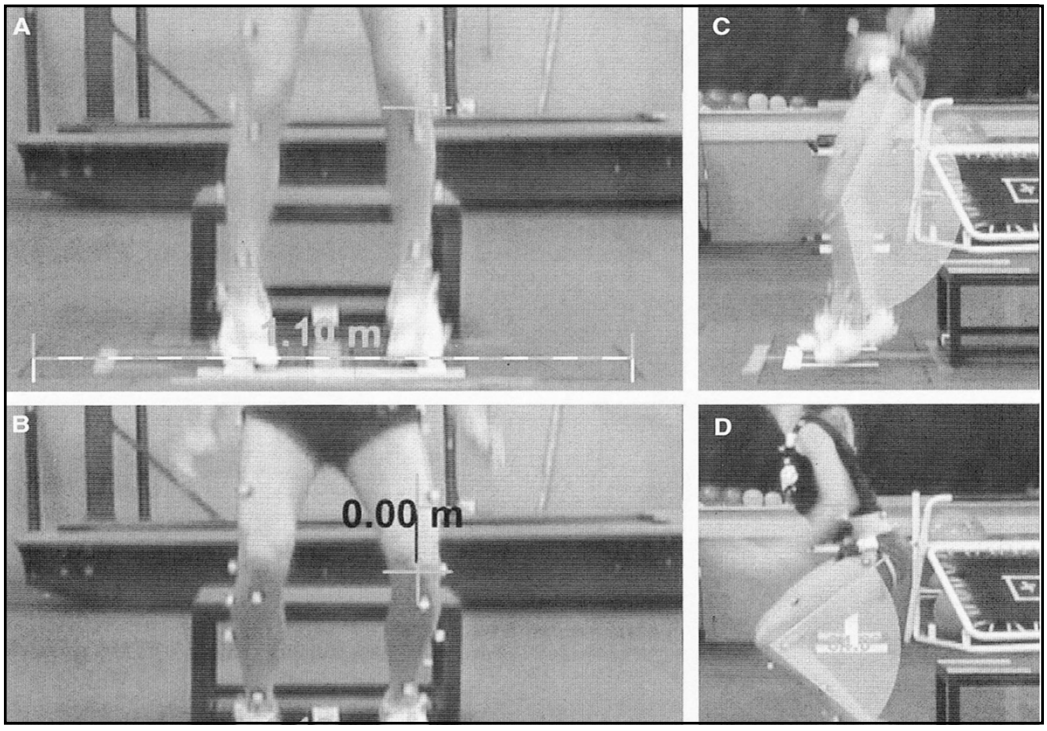
80


A
1.10 m
C
B
0.04 m
1.10 m
D

81


Points
0 10 20 30 40 50 60 70 80 90 100
Tibia Length
29.5
26 28 30 32 34 36 38 40 42 44 46 48 50
Knee Valgus Motion
18.0
0 1 2 3 4 5 6 7 8 9 10 11 12 13
Knee Flexion ROM
5.5
90 70 50 30
Mass
3.5
20 40 60 80 100
Quad Ham Ratio
7.0
0.6 1.4 2.2 3
Total Points
63.5
0 20 40 60 80 100 120 140 160 180 200
Probability of High Knee Load
0.1 0.25 0.5 0.75 0.9 0.97 0.99 0.999

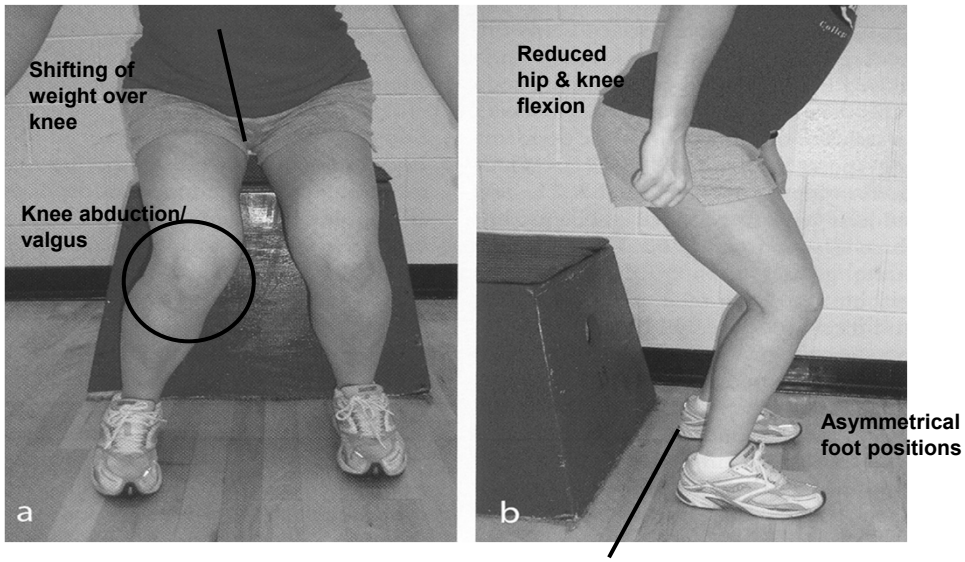
82



83

Inappropriate neuromuscular control during landing:

Barber-Westin et al, *Journal of Strength and Conditioning Research,* Nov, 2010:24



84

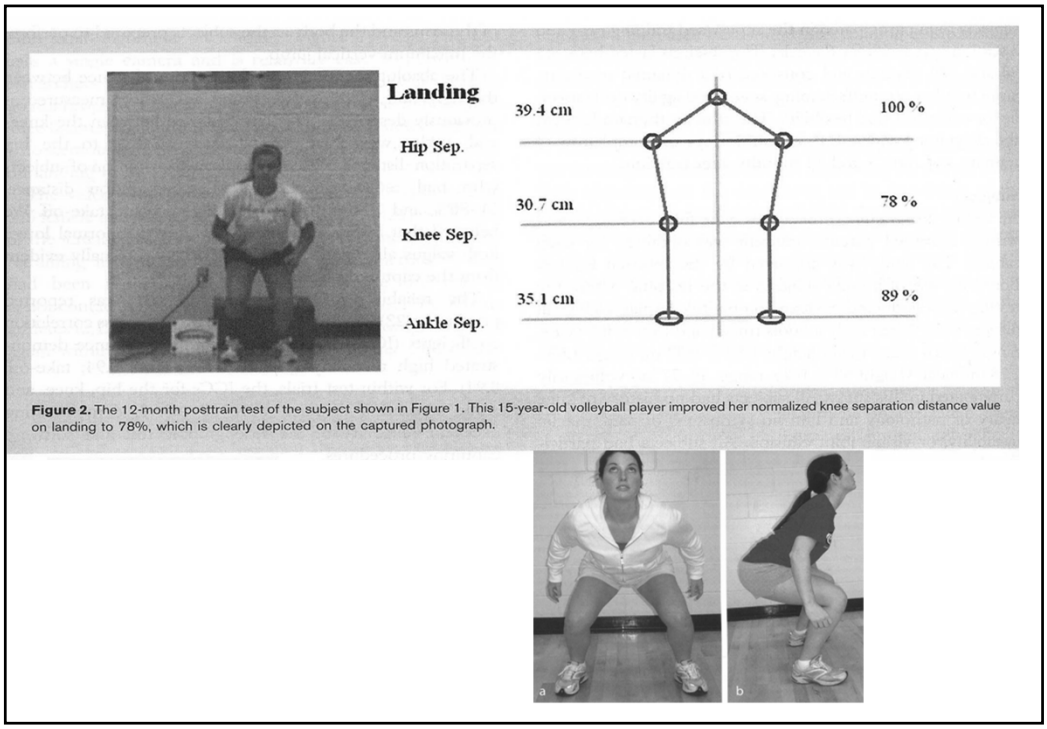
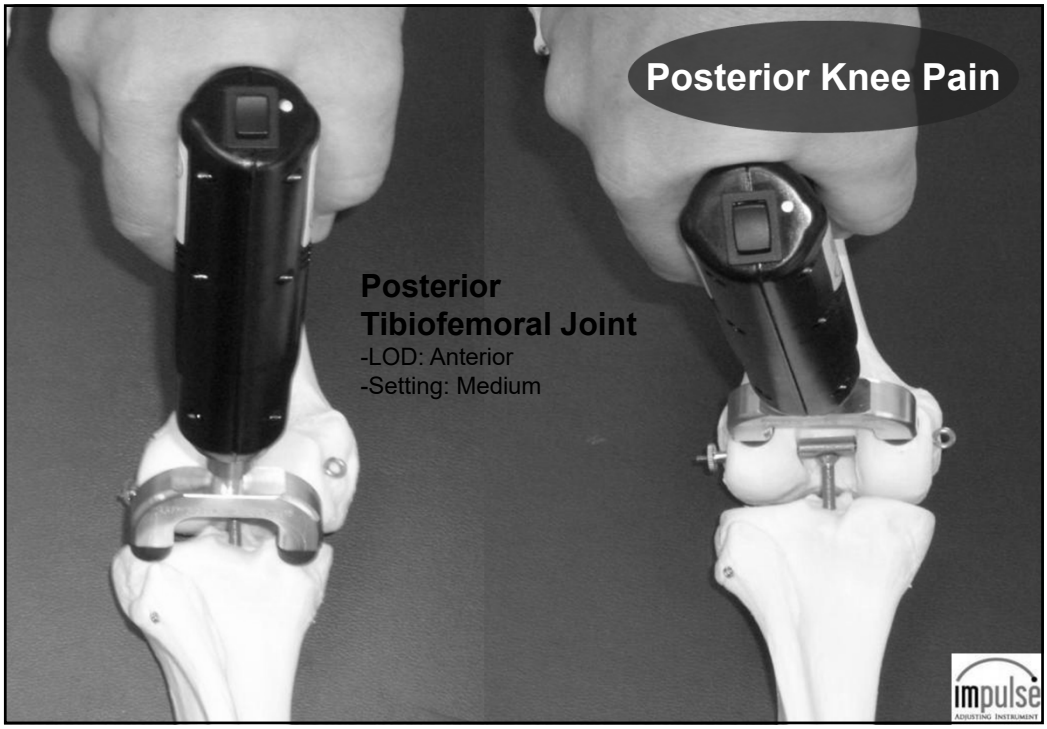


Figure 2. The 12-month posttrain test of the subject shown in Figure 1. This 15-year-old volleyball player improved her normalized knee separation distance value on landing to 78%, which is clearly depicted on the captured photograph.

85



86

Medial Knee Pain

Adjustment Directive

Medial Meniscus

Stylus: Single

LOD: Lateral

Setting: 2 (Medium)

87

Lateral Knee Pain

Adjustment Directive

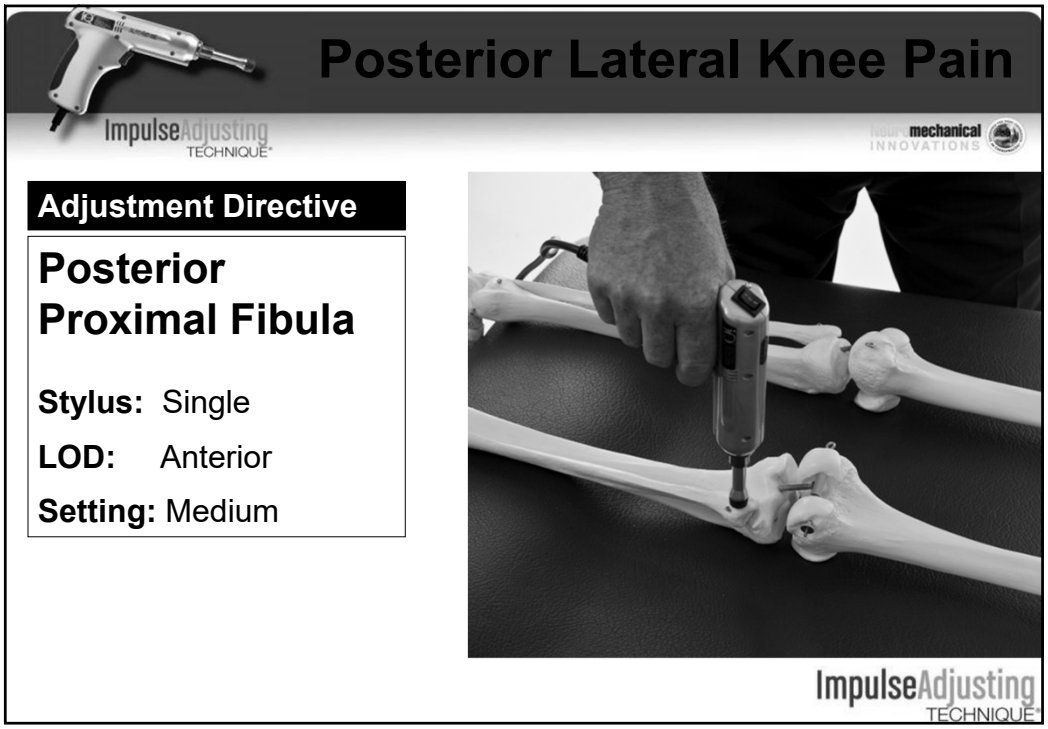
Lateral Meniscus

Stylus: Single

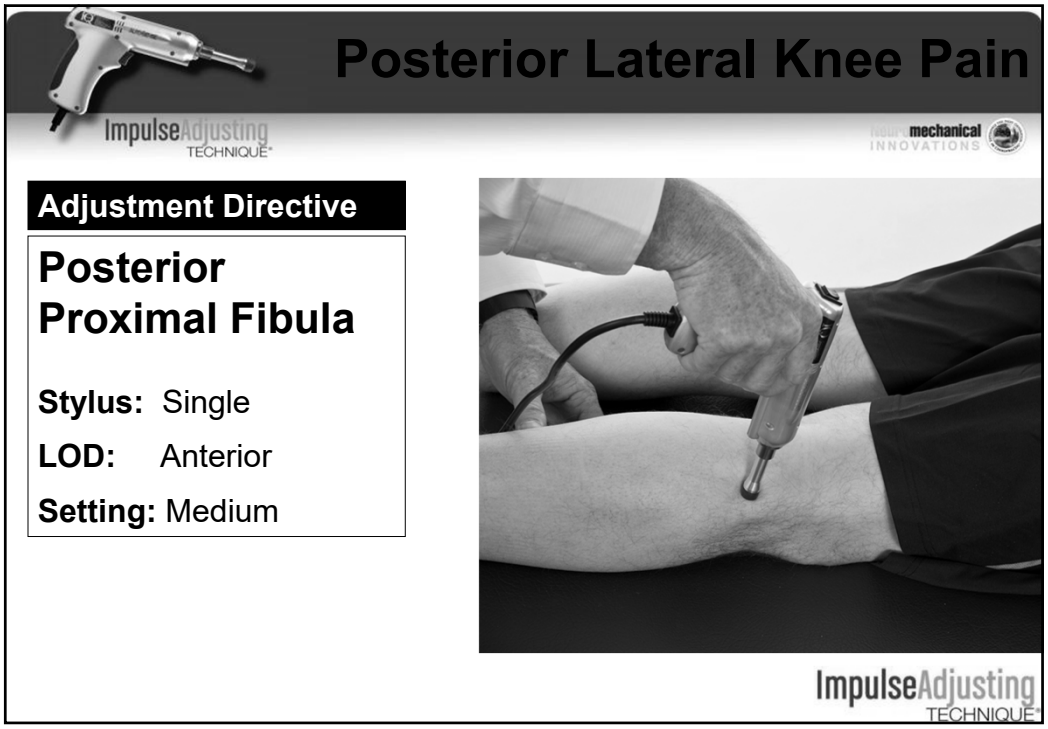
LOD: Medial

Setting: 2 (Medium)

88


Posterior Lateral Knee Pain
ImpulseAdjusting TECHNIQUE
mechanical INNOVATIONS
Adjustment Directive
Posterior Proximal Fibula
Stylus: Single
LOD: Anterior
Setting: Medium
ImpulseAdjusting TECHNIQUE

89


Posterior Lateral Knee Pain
ImpulseAdjusting TECHNIQUE
mechanical INNOVATIONS
Adjustment Directive
Posterior Proximal Fibula
Stylus: Single
LOD: Anterior
Setting: Medium
ImpulseAdjusting TECHNIQUE

90

Patellofemoral Pain Syndrome (PFPS)
(a.k.a. – Chondromalacia of the patella)

- "The major mechanism responsible for PFPS is probably forces causing a lateralization of the patella."

  "Upward squatting in individuals with and without PFPS: a biomechanical study," Dionisio et al, *Journal of Strength and Condition Research,* May, 2011

- "Patellar malalignment has always been thought to be a significant cause of anterior knee pain."

  Hammer, "Treatment for Patellofemoral Pain Syndrome," *Dynamic Chiropractic*, Feb 12, 2001

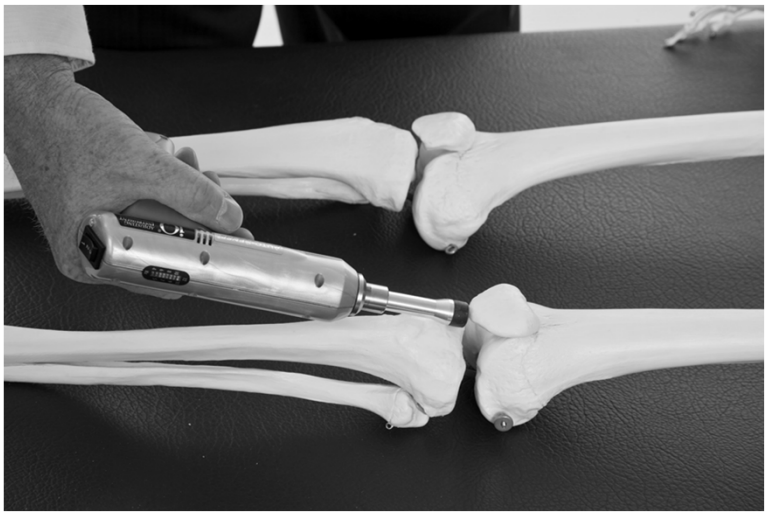
- A tight lateral retinaculum tilts the patella, leading to increased pressure on the lateral facet and reduces normal lateral to medial.

  Ficat, et al, "Chondromalacia patellae: A system of classification," *Clinical Orthopedics*, 144:1979

91

-SCP: Inferior Patella
-LOD: superior
-Setting: Medium or Low

Loss of superior patellar glide



impulse ADJUSTING INSTRUMENT

92

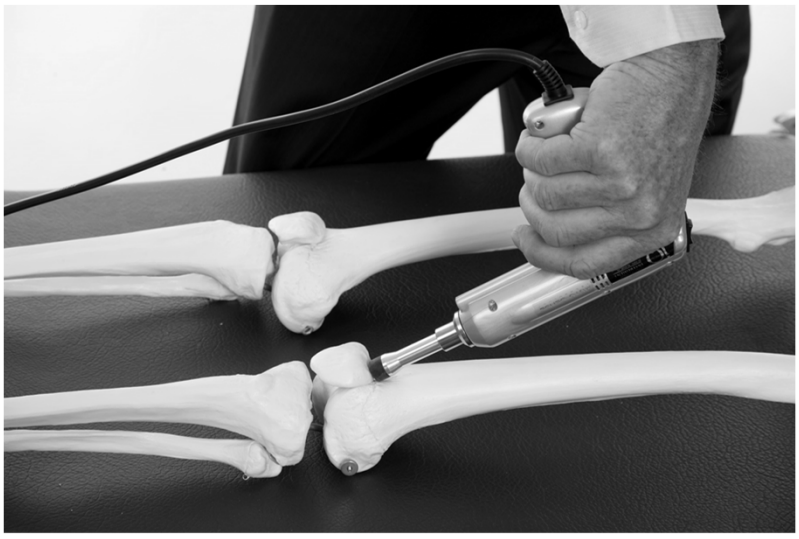
-SCP: Inferior Patella
-LOD: superior
-Setting: Medium or Low

Loss of superior patellar glide

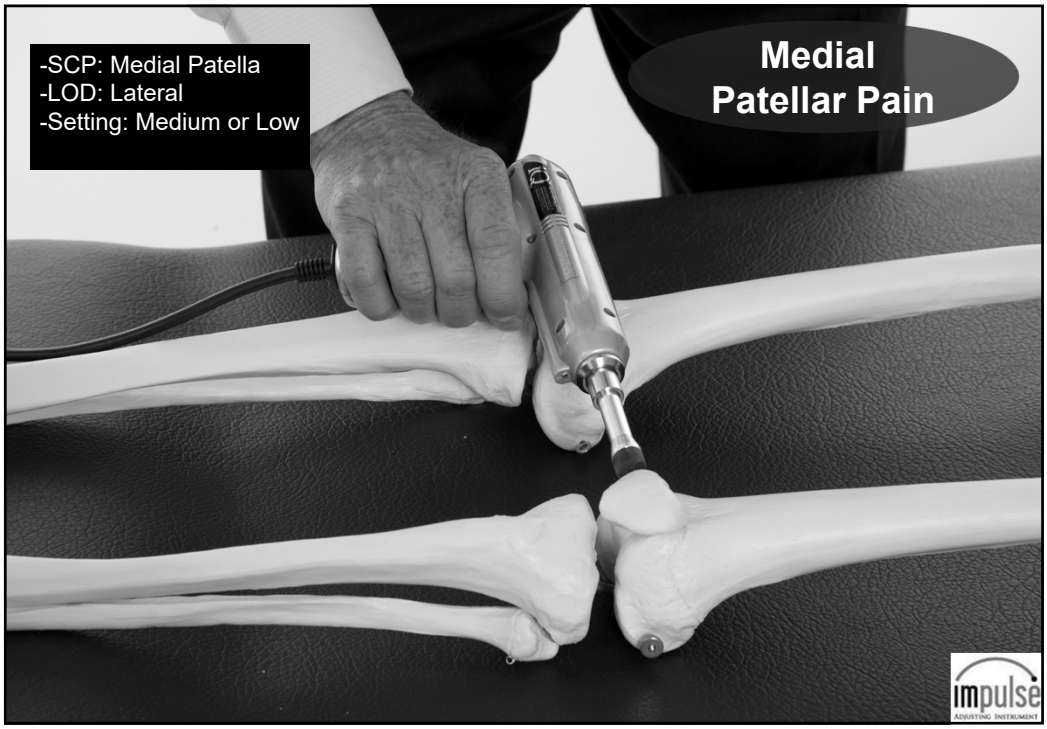
93

-SCP: Superior Patella
-LOD: Inferior
-Setting: Medium or Low

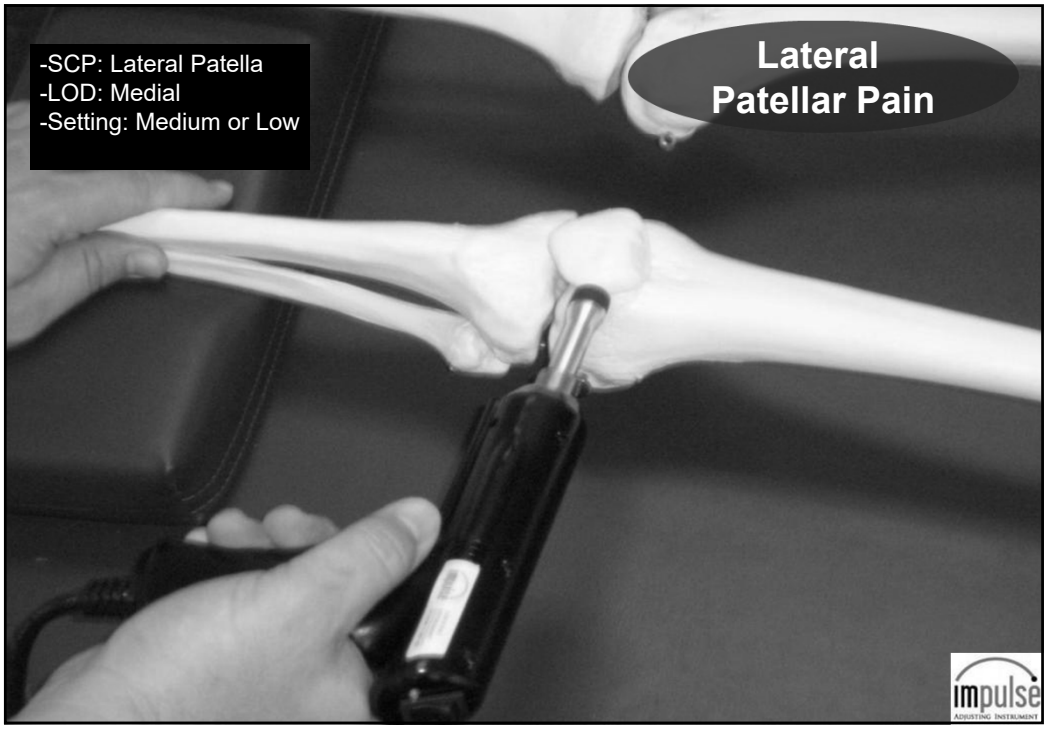
Superior patellar pain



94


-SCP: Medial Patella
-LOD: Lateral
-Setting: Medium or Low
Medial
Patellar Pain
impulse
ADJUSTING INSTRUMENT

95

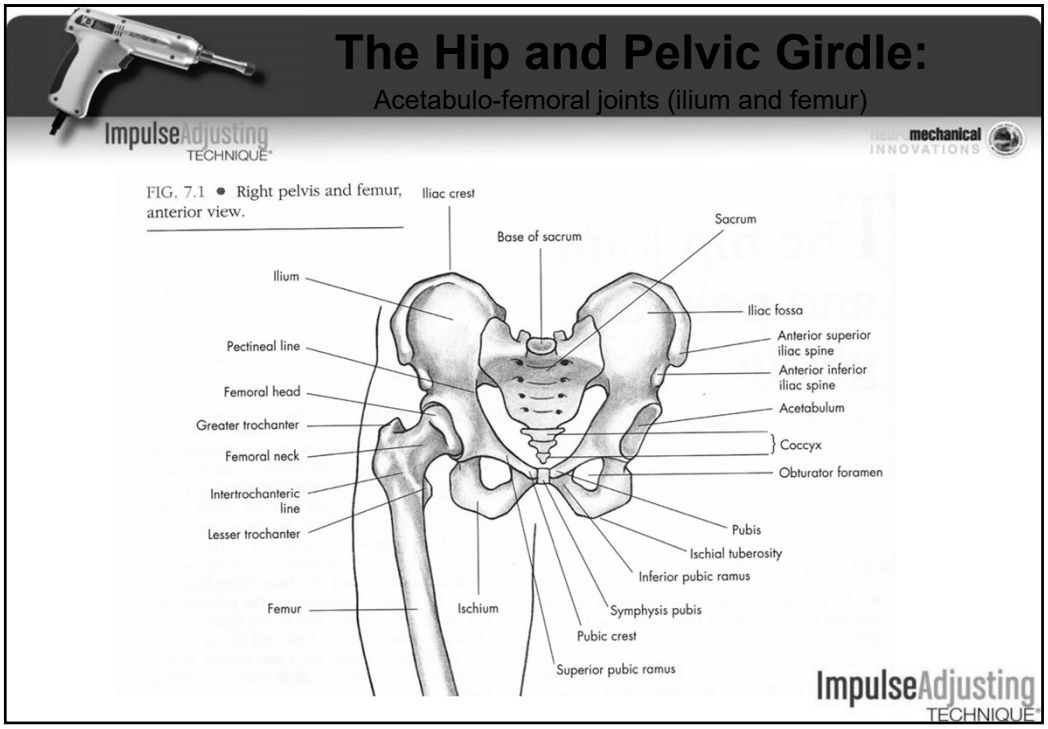

-SCP: Lateral Patella
-LOD: Medial
-Setting: Medium or Low
Lateral
Patellar Pain
impulse
ADJUSTING INSTRUMENT

96

- "The pain from PFPS causes reflex inhibition of the quadriceps leading to decreased activation and atrophy."
- The greater the degree of knee flexion (during the descent portion of the squat before the upward segment of the squat) the greater the torque and compression forces against the patellofemoral joint leading to pain and reflex inhibition.
- Thus initial strengthening of the quads should be performed over the final 40 degrees of knee extension during the upward squat.

"Upward squatting in individuals with and without PFPS: a biomechanical study," Dionisio et al, *Journal of Strength and Condition Research,* May, 2011

97



98

"Comparison of manual therapy and exercise therapy in OA of the hip," Hoeksma et al, *Arthritis and Rheumatism,* 2004:51

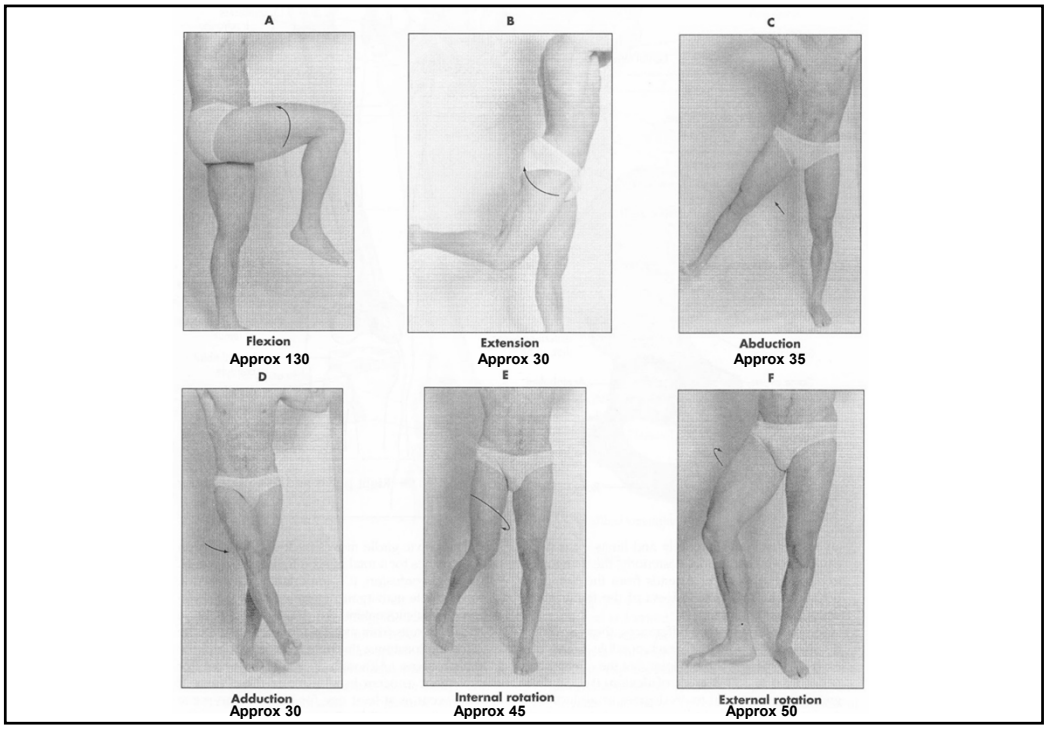
- Manual therapy was shown to be superior to exercise.

99

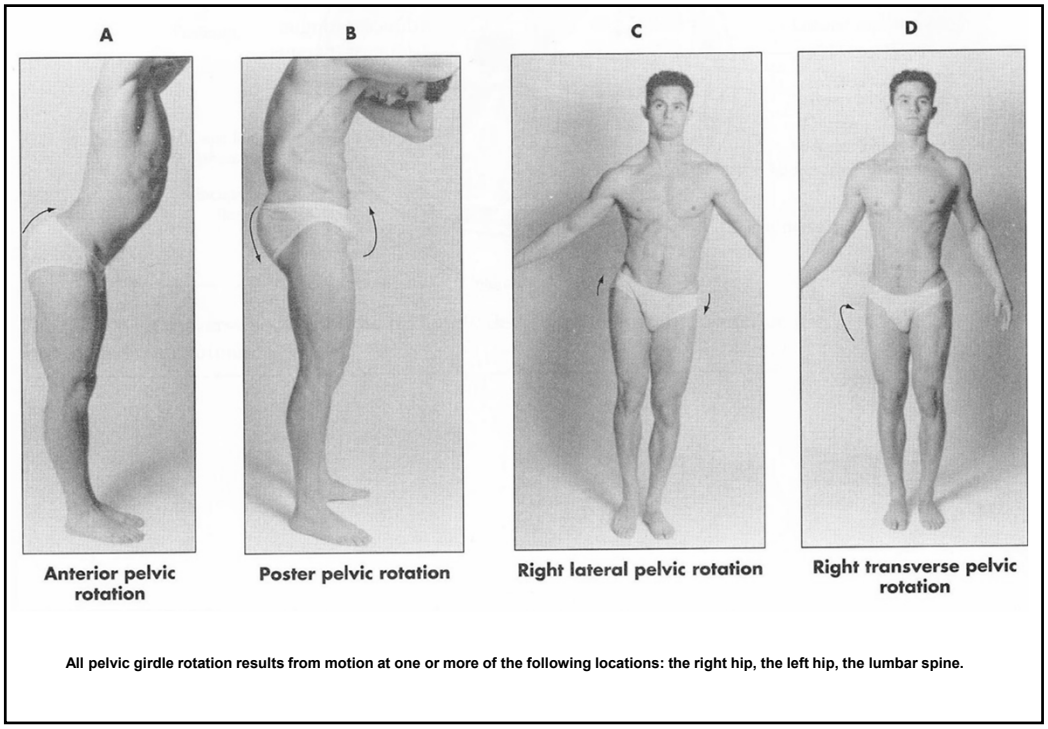
"Effect of therapeutic exercise for hip OA pain," Hernandez-Molina et al, *Arthritis and Rheumatism,* 2008:59

- Therapeutic exercise, especially with an element of strengthening, is an efficacious treatment for hip OA.

100


A
B
C
Flexion
Approx 130
Extension
Approx 30
Abduction
Approx 35
D
E
F
Adduction
Approx 30
Internal rotation
Approx 45
External rotation
Approx 50

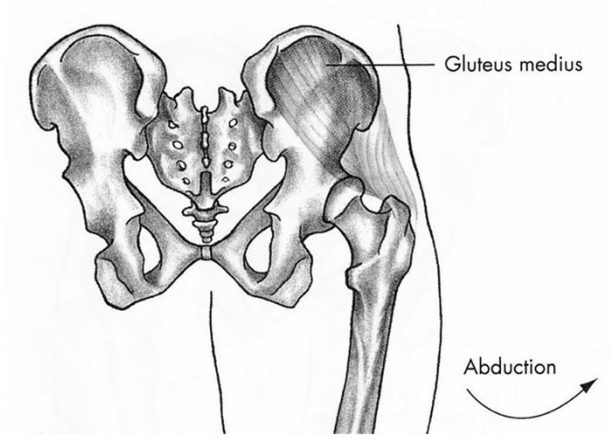
101


A
B
C
D
Anterior pelvic rotation
Poster pelvic rotation
Right lateral pelvic rotation
Right transverse pelvic rotation
All pelvic girdle rotation results from motion at one or more of the following locations: the right hip, the left hip, the lumbar spine.

102

The Hip Joint: Kinesiology

Most of the muscles acting on the hip function as a 3rd class levers (where the force is between the axis of rotation and the resistance) favoring large ROM and speed.



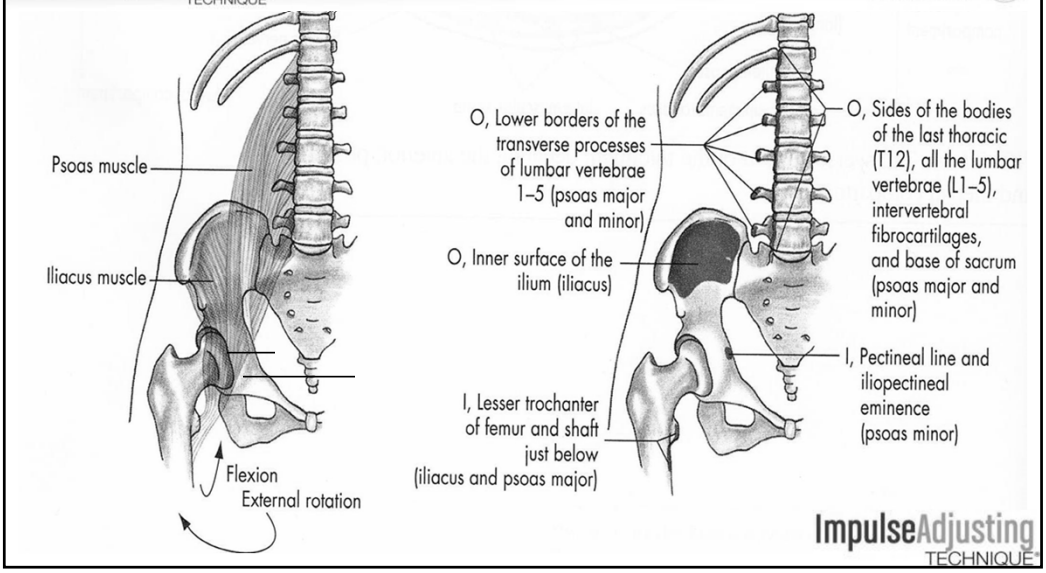
103

The Hip Joint: Kinesiology

- At the hip there are 7 two-joint muscles that have one action at the hip and another at the knee.
- The body part that moves the most (hip or knee) will be the part least stabilized.

104

The Hip Joint: Anatomy



105

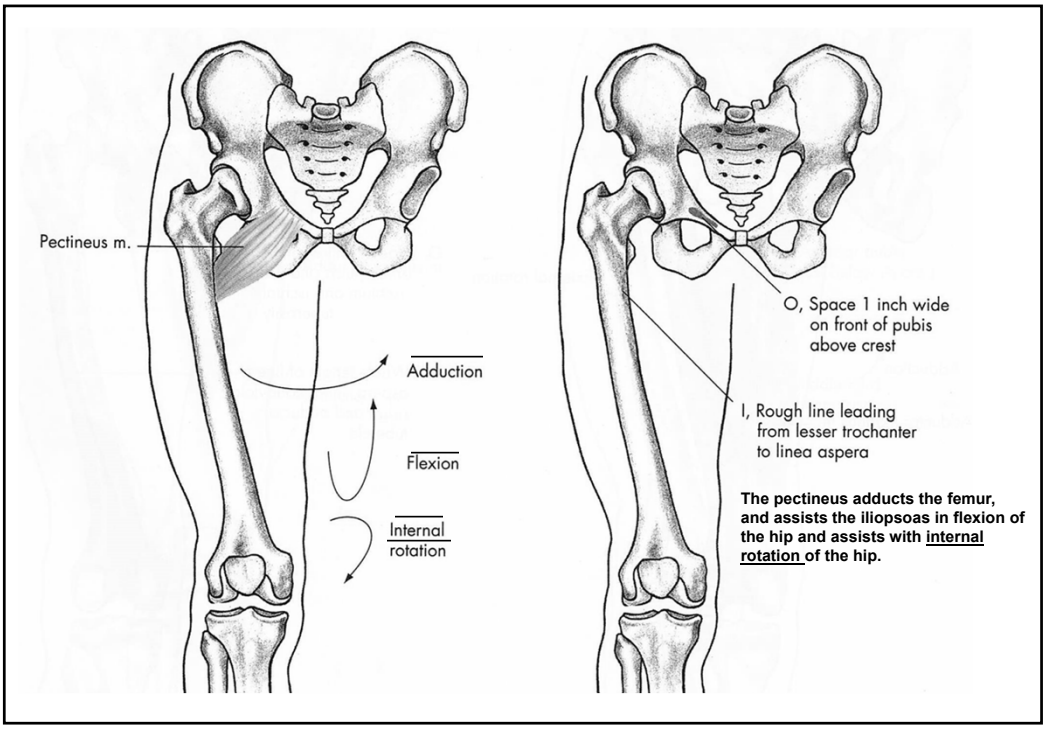
The iliopsoas

In most individuals, the hip flexors remain strong and rarely need strengthening exercises but the hip extensors (and abductors and abdominals) become weak.

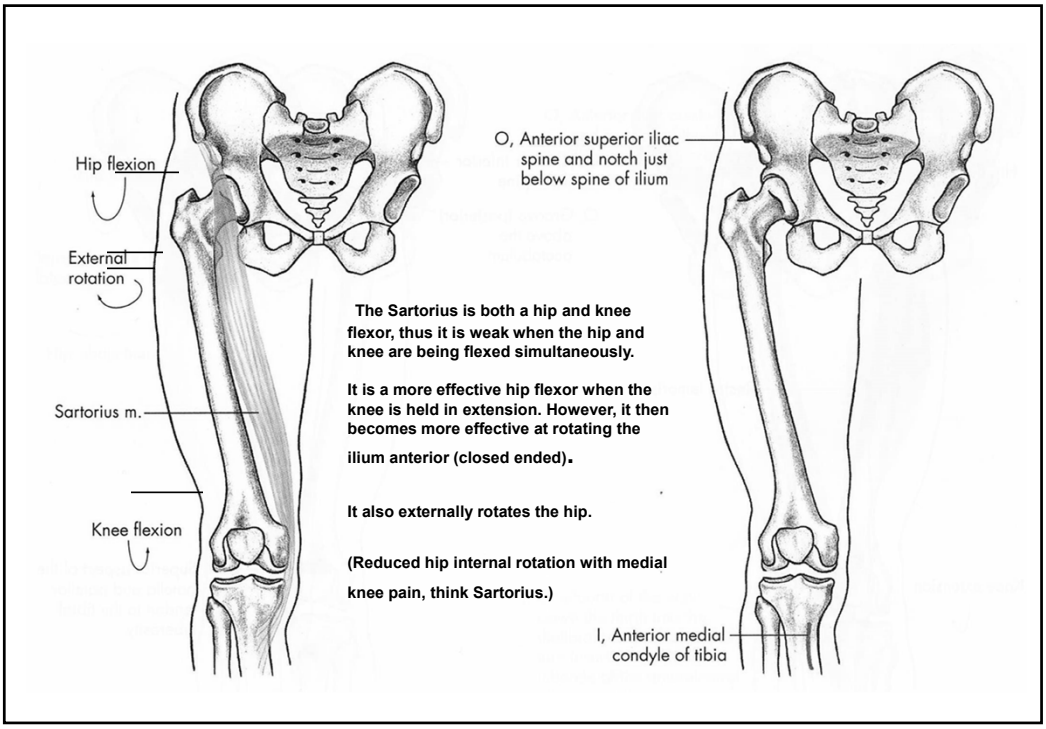
However, the hip flexors often become shortened due to excessive sitting (hips flexed positioned). Muscles habitually placed in relaxed (shortened) postures will become shorter due to the action of the muscle spindles

(spindles are facilitory mechanoreceptors that react to changes in muscle length to protect the muscle and will “take up the slack” to shorten a muscle that is habitually relaxed in order to maintain the muscle “tone.”)

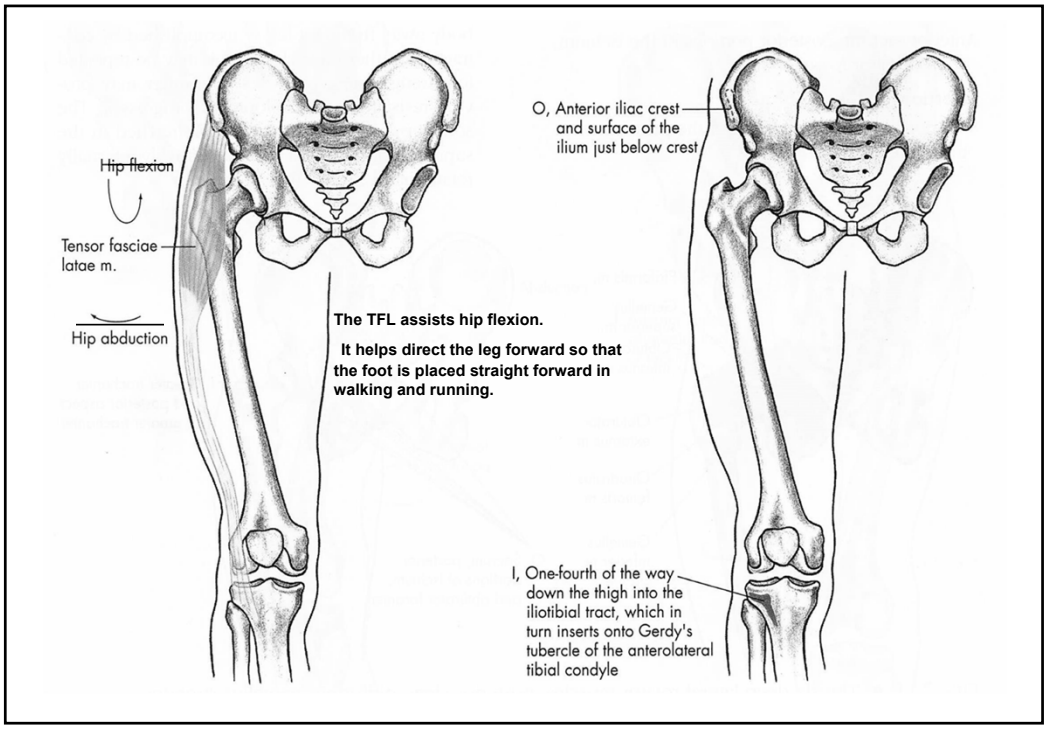
106


Pectineus m.
Adduction
Flexion
Internal rotation
O, Space 1 inch wide on front of pubis above crest
I, Rough line leading from lesser trochanter to linea aspera
The pectineus adducts the femur, and assists the iliopsoas in flexion of the hip and assists with internal rotation of the hip.

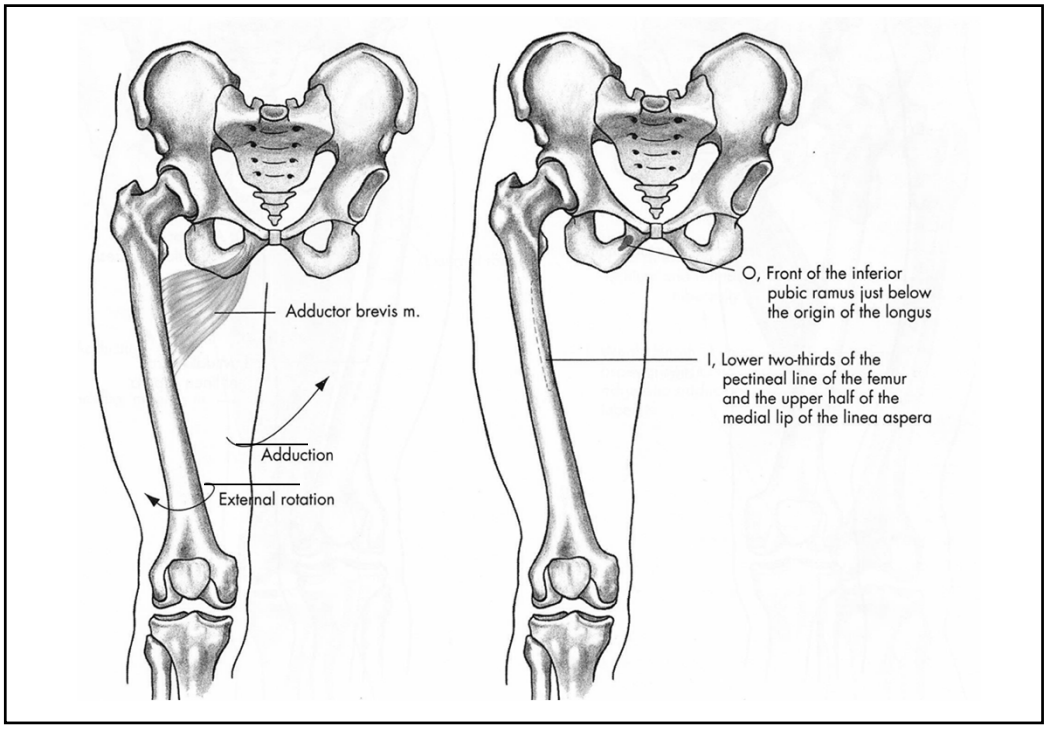
107


Hip flexion
External rotation
Sartorius m.
Knee flexion
O, Anterior superior iliac spine and notch just below spine of ilium
The Sartorius is both a hip and knee flexor, thus it is weak when the hip and knee are being flexed simultaneously.
It is a more effective hip flexor when the knee is held in extension. However, it then becomes more effective at rotating the ilium anterior (closed ended).
It also externally rotates the hip.
(Reduced hip internal rotation with medial knee pain, think Sartorius.)
I, Anterior medial condyle of tibia

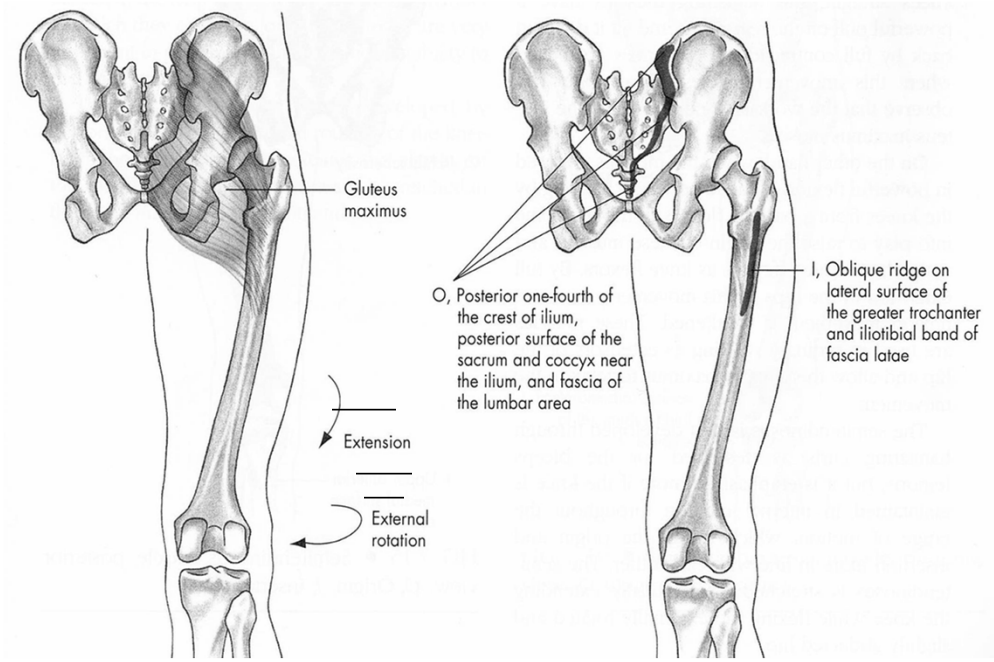
108


Hip flexion
Tensor fasciae latae m.
Hip abduction
O, Anterior iliac crest and surface of the ilium just below crest
I, One-fourth of the way down the thigh into the iliotibial tract, which in turn inserts onto Gerdy's tubercle of the anterolateral tibial condyle
The TFL assists hip flexion.
It helps direct the leg forward so that the foot is placed straight forward in walking and running.

109


Adductor brevis m.
Adduction
External rotation
O, Front of the inferior pubic ramus just below the origin of the longus
I, Lower two-thirds of the pectineal line of the femur and the upper half of the medial lip of the linea aspera

110



111

Gluteus Maximus

ImpulseAdjusting TECHNIQUE

mechanical INNOVATIONS

- **During ordinary walking the Gluteus Maximus comes into action when the femur exceeds 15 degrees of extension, thus it is not used extensively in walking. (The posterior fibers of the G medius and the hamstrings are more active for hip extension during walking).**
- **It is also a powerful external rotator of the hip.**
- **It is a powerful stabilizer of the SI joint (pulls the sacrum laterally to close the SI joint)**
- **It is strengthened by applying resistance to it starting in a hip flexion position and moving into extension with the knee in flexion (the return from the squat position).**

ImpulseAdjusting TECHNIQUE

112

The Effect of Sacroiliac Joint Pain on Muscle Recruitment

Posted on September 8, 2014 by admin

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Research Review: Altered Lumbopelvic Hip Muscle Recruitment in Individuals with Sacroiliac Joint Pain

By **Stefanie DiCarrado** DPT, PT, NASM CPT & CES

Edited by Brent Brookbush DPT, PT, MS, PES, CES, CSCS, ACSM H/FS

Original Citation: Hungerford, B., Gilleard, W., Hodges, P. (2003) Evidence of altered lumbopelvic muscle recruitment in the presence of sacroiliac joint pain. *Spine 28(14),* 1593-1600 - ARTICLE

113

Results	• SIJP (symptomatic side vs CON): IO, LM, GMax onset significantly delayed in comparison to CON; IO and LM, delay greater than 20ms after initiation of movement (not anticipatory). BF onset occurred significantly earlier on symptomatic side than in CON with increased activity before and after intitiation of movement • SIJP (asymptomatic side vs CON): IO and LM significantly delayed but onset was within 20ms; no significant differences in onset of other muscles compared with controls • SIJP (symptomatic vs asymptomatic side): Significant delays in IO, LM, and GMax onset on symptomatic side but no differences in BF, GMed, TFL, and AL. Normal feedforward response ⇨ • CON: IO and LM onset prior to initiation of movement; BF, GMed, TFL, AL, GMax onset after initiation of movement with no significant differences between R & L sides; first to fire were IO and LM followed by AL; BF decreased in activity as compared to quiet standing.
Conclusions	The presence of SIJP may alter recruitment strategies of the lumbopelvic hip stabilizers on both the symptomatic and asymptomatic sides. With continued pain and altered strategies, an individual can develop poor motor control of these muscles leading to further dysfunction, pain, and injury.

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ImpulseAdjusting TECHNIQUE

Sacroiliac Adjustment

mechanical INNOVATIONS

Sacroiliac Joint Adjustment

SCP: Sacroiliac joint, medial aspect of PSIS

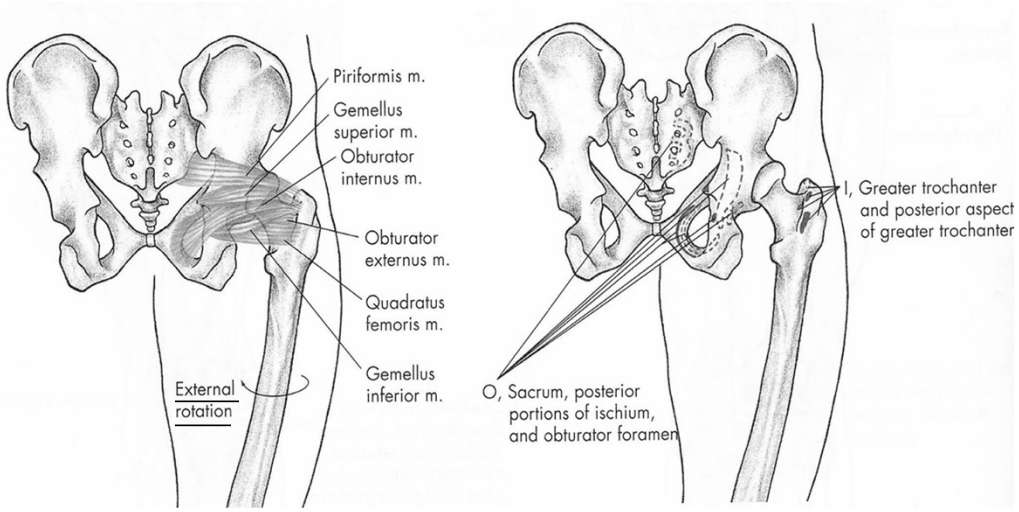
LOD: Anterior-Superior

Setting: High or Medium

ImpulseAdjusting TECHNIQUE

115

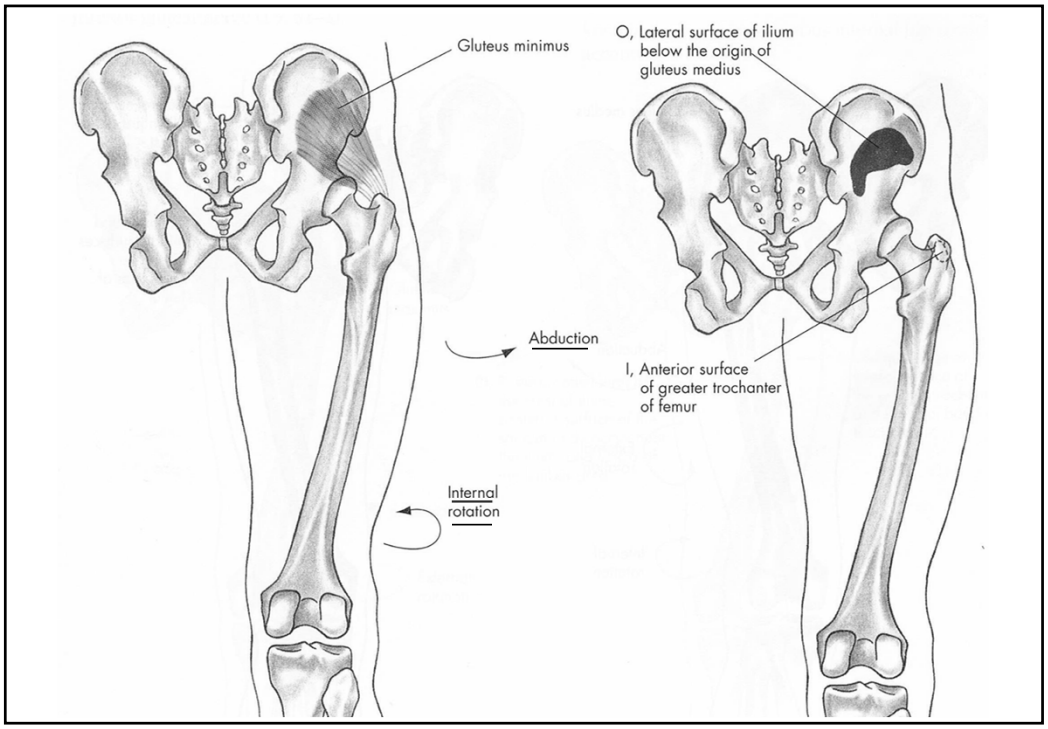
The external rotators of the hip:



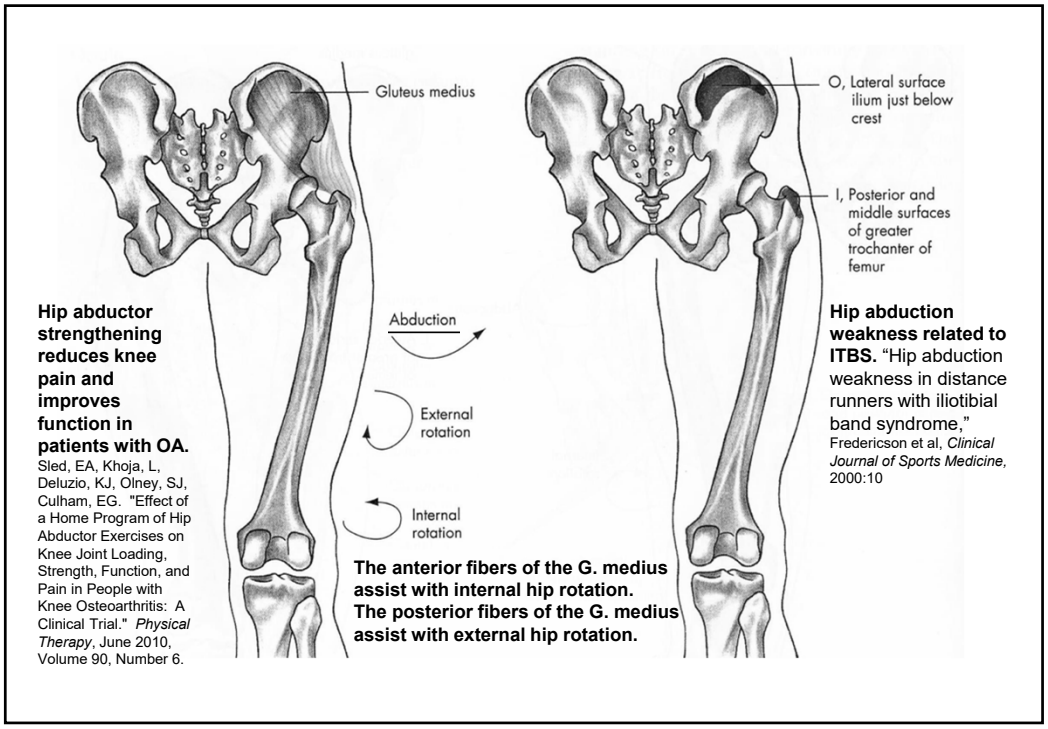
The six deep external rotators, along with the internal rotators, help maintain the correct position of the femoral head in the acetabulum.

They counter-act internal rotation produced in the hip during motions such as throwing a baseball.

116



117



Hip abductor strengthening reduces knee pain and improves function in patients with OA.
Sled, EA, Khoja, L, Deluzio, KJ, Olney, SJ, Culham, EG. "Effect of a Home Program of Hip Abductor Exercises on Knee Joint Loading, Strength, Function, and Pain in People with Knee Osteoarthritis: A Clinical Trial." *Physical Therapy*, June 2010, Volume 90, Number 6.

Hip abduction weakness related to ITBS. "Hip abduction weakness in distance runners with iliotibial band syndrome," Fredericson et al, *Clinical Journal of Sports Medicine,* 2000:10

118

Step 3: Hip Rotation Tests

External (posterior) rotation

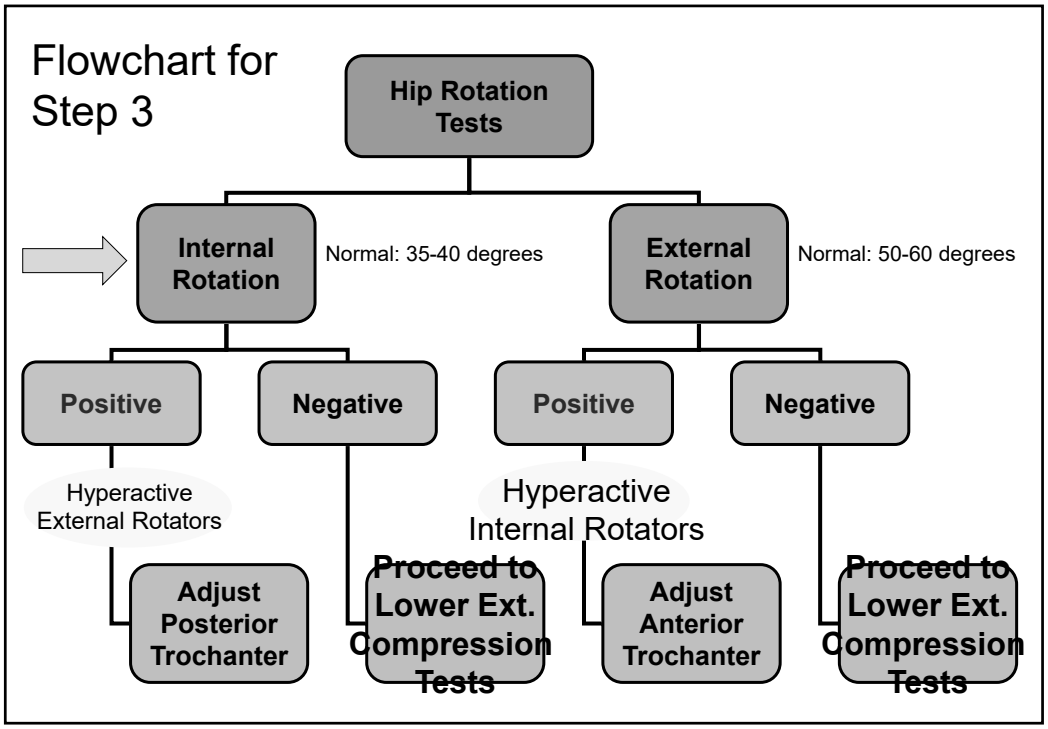
Internal (anterior) rotation

Ilium on the side being examined must be held down firmly to prevent rotation of the pelvis.

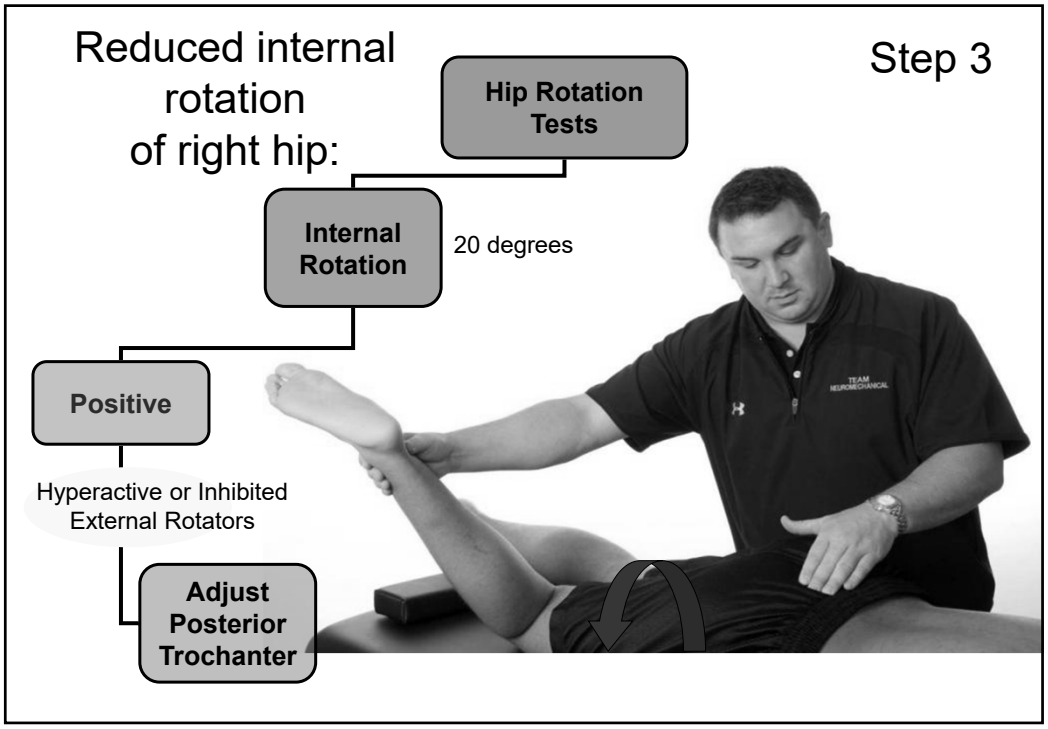
119

Step 3: Hip Rotation Test

120


Flowchart for Step 3
Hip Rotation Tests
Internal Rotation
Normal: 35-40 degrees
External Rotation
Normal: 50-60 degrees
Positive
Negative
Positive
Negative
Hyperactive External Rotators
Hyperactive Internal Rotators
Adjust Posterior Trochanter
Proceed to Lower Ext. Compression Tests
Adjust Anterior Trochanter
Proceed to Lower Ext. Compression Tests

121


Reduced internal rotation of right hip:
Step 3
Hip Rotation Tests
Internal Rotation
20 degrees
Positive
Hyperactive or Inhibited External Rotators
Adjust Posterior Trochanter

122

Hibb's test:

Step 3

Pain in low back or SI joint indicates a lumbar or SI joint lesion:

Pain in the hip indicates a hip lesion (DJD, inhibited external rotators or psoas)

123

Posterior Hip Adjustment

(For Loss of Hip Internal Rotation)

ImpulseAdjusting TECHNIQUE

mechanical INNOVATIONS

Posterior Hip Adjustment (to restore hip internal rotation)

SCP: Posterior aspect of the greater trochanter at the tendinous insertions of the 6 deep rotators, the posterior fibers of the G. medius, and the G. max.

LOD: Anterior

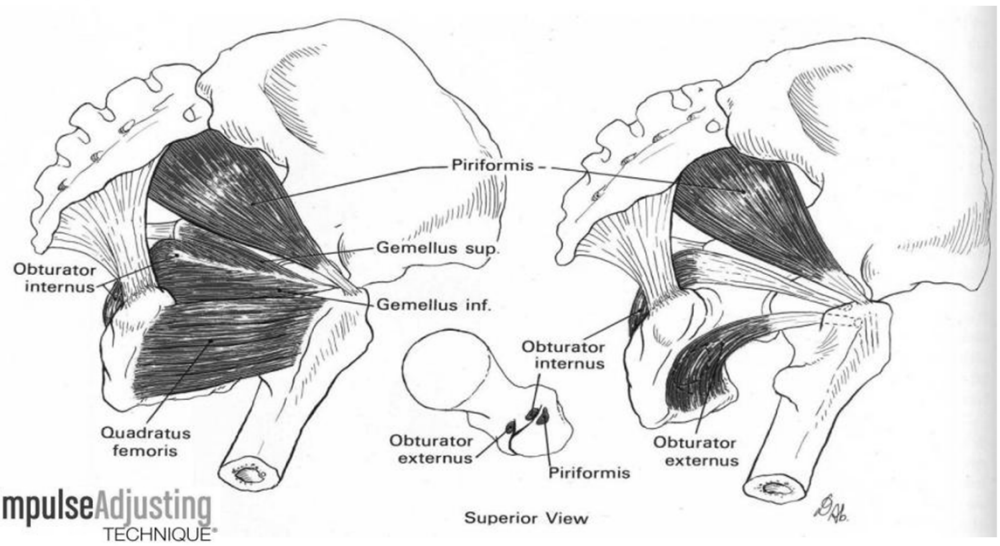
Setting: High or Medium

ImpulseAdjusting TECHNIQUE

124

External Rotators

Muscles, Testing and Function with Posture and Pain,
Kendall et al, 2005, Lippincott Williams & Wilkins



125

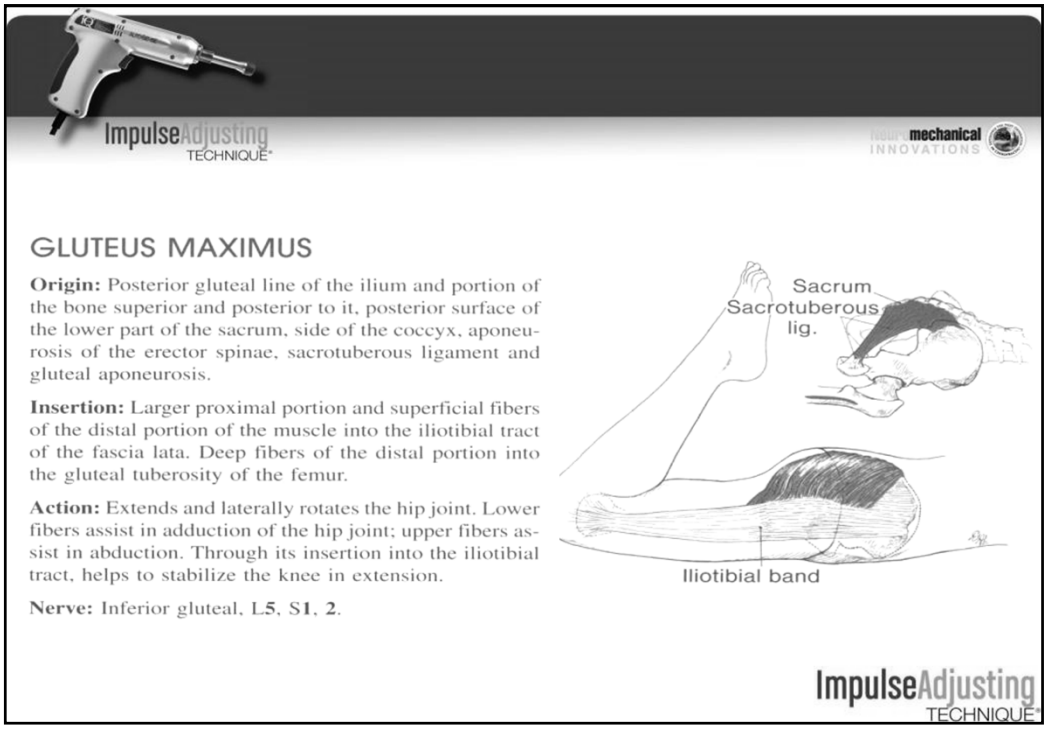
External Rotators

***Muscles, Testing and Function with Posture and Pain*, Kendall et al, 2005,**
Lippincott Williams & Wilkins

GLUTEUS MEDIUS

Posterior fibers

126


ImpulseAdjusting TECHNIQUE
mechanical INNOVATIONS
GLUTEUS MAXIMUS
Origin: Posterior gluteal line of the ilium and portion of the bone superior and posterior to it, posterior surface of the lower part of the sacrum, side of the coccyx, aponeurosis of the erector spinae, sacrotuberous ligament and gluteal aponeurosis.
Insertion: Larger proximal portion and superficial fibers of the distal portion of the muscle into the iliotibial tract of the fascia lata. Deep fibers of the distal portion into the gluteal tuberosity of the femur.
Action: Extends and laterally rotates the hip joint. Lower fibers assist in adduction of the hip joint; upper fibers assist in abduction. Through its insertion into the iliotibial tract, helps to stabilize the knee in extension.
Nerve: Inferior gluteal, L5, S1, 2.
Sacrum
Sacrotuberous lig.
Iliotibial band
ImpulseAdjusting TECHNIQUE

127


Failure to normalize or greatly improve hip internal rotation restriction:
ImpulseAdjusting TECHNIQUE
mechanical INNOVATIONS
Psoas Facilitation/Inhibtion:
ImpulseAdjusting TECHNIQUE

128

Psoas syndrome:

ImpulseAdjusting TECHNIQUE

mechanical INNOVATIONS

- **Psoas syndrome can produce the following:**
- **Excessive anterior tilt of the pelvis;**
- **Anterior rotation of one ilium causing counternutation of the SI complex;**
- **Reduced internal rotation of the femur;**
- **Pubic symphysis/groin pain;**
- **Excessive lumbar lordosis (bilateral) or lumbar lateral curvature with vertebral rotation (unilateral);**
- **Inability or pain when attempting to stand erect after sitting.**

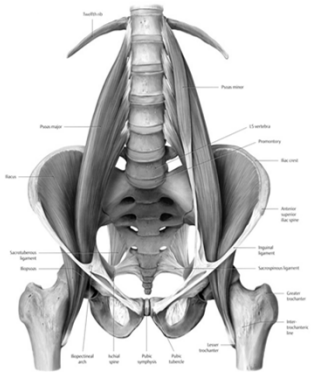
ImpulseAdjusting TECHNIQUE

129

Psoas Test:

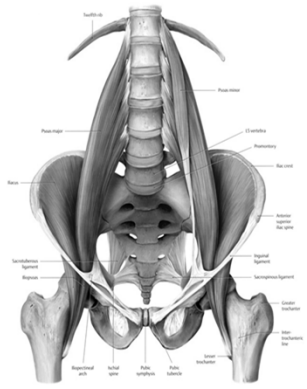
ImpulseAdjusting TECHNIQUE

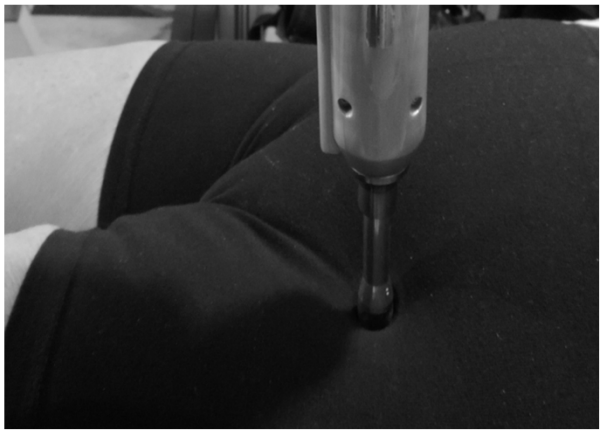
mechanical INNOVATIONS



130

Psoas Adjustment:





Contact just lateral and inferior to pubic ramus on the tendon of the psoas.

131

Psoas Test:

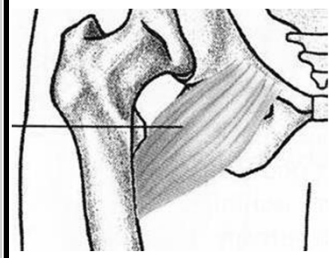
- **Remission of psoas syndrome most strongly predicted LBP response.**

(Restricted sacral nutation was most strongly correlated with other biomechanical dysfunctions.)

Licciardone et al, "Changes in biomechanical dysfunction and low back pain reduction with osteopathic manual treatment: Results from the Osteopathic Trial," *Manual Therapy,* April, 2014

132

The pectineus adjustment:



Contact just inferior to the pubic ramus between the ramus and the medial aspect of the superior femur

133

"The Hip Joint: Myofascial and Joint Patterns,"
Marc Heller, DC, *Dynamic Chiropractic*, May 7, 2007:

ImpulseAdjusting TECHNIQUE

mechanical INNOVATIONS

- **Internal rotation is the first motion affected with hip capsular problems and DJD.**
- **"When you find a severe lack of internal rotation in the hip and this motion cannot be restored, the patient is usually on their way to hip replacement surgery."**

ImpulseAdjusting TECHNIQUE

134

Reduced external rotation of right hip:

Step 3

Hip Rotation Tests

External Rotation

50-60 degrees

Positive

Hyperactive or Inhibited Internal Rotators

Adjust Anterior Trochanter

135

Flowchart for Step 3

Hip Rotation Tests

Internal Rotation

External Rotation

Positive

Negative

Positive

Negative

Hyperactive or Inhibited External Rotators

Hyperactive or Inhibited Internal Rotators

Adjust Posterior Trochanter

Proceed to Lower Ext. Compression Tests

Adjust Anterior Trochanter

Proceed to Lower Ext. Compression Tests

136

Anterior Hip Adjustment
(For Loss of Hip External Rotation)

Anterior Hip Adjustment (to restore hip external rotation)

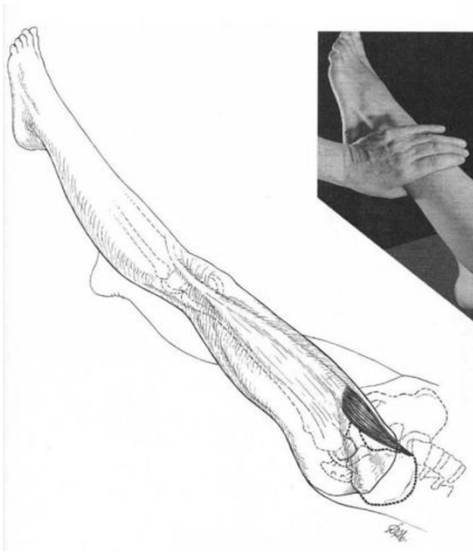
SCP: Anterior aspect of the greater trochanter at the tendinous insertions of the TFL, anterior fibers of the G. medius, and the G. minimus.

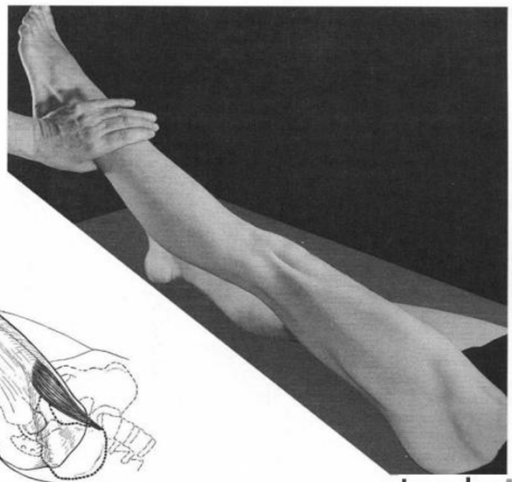
LOD: Posterior

Setting: High or Medium

137

Hip Internal Rotators: TFL
Muscles, Testing and Function with Posture and Pain, **Kendall et al, 2005, Lippincott Williams & Wilkins**

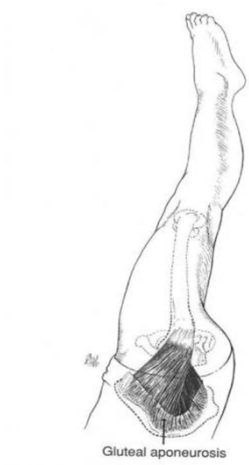




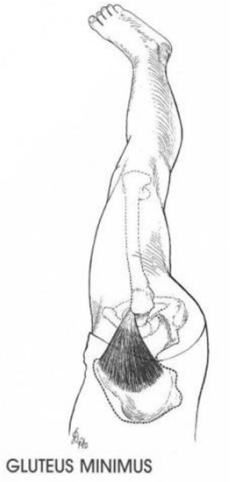
138

Hip Internal Rotators

Muscles, Testing and Function with Posture and Pain, Kendall et al, 2005, Lippincott Williams & Wilkins



GLUTEUS MEDIUS
Anterior fibers



GLUTEUS MINIMUS

139

Unilateral Hip Rotation Range of Motion Asymmetry in Patients With Sacroiliac Joint Regional Pain

Cibulka et al. *Spine*: Volume 23(9) 1 May 1998 pp 1009-15

"The presence of such asymmetry in patients with low back pain may help identify those with sacroiliac joint dysfunction."

140