

Modifications to treatment of an acute medial malleolar fracture status post ORIF due to an underlying Lisfranc joint injury: A Case Report

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Introduction: Problem

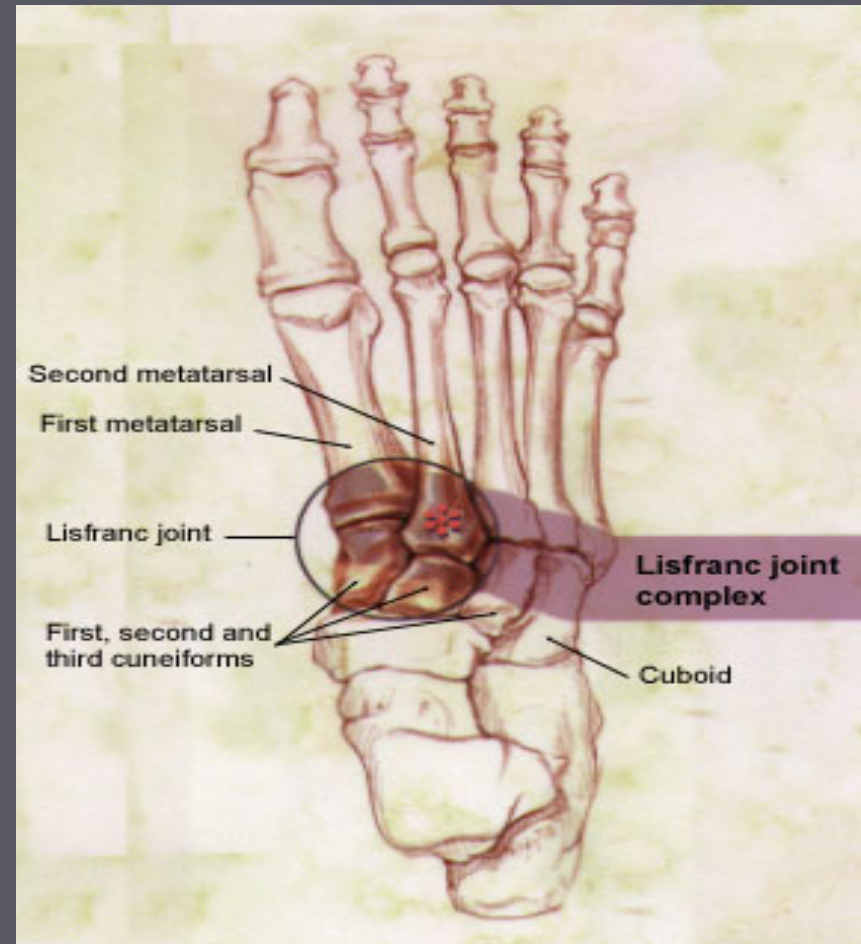
- Lisfranc joint injuries are often missed or misdiagnosed; 20% on initial A-P or oblique radiographs -> serious complication or disability if untreated (Burroughs 1998, Busse 2004, Hunt 2006).
- Lisfranc joint fracture dislocations account for 1 in 55,000 cases of midfoot injuries per year (Burroughs 1998, Hunt 2006).

Introduction: Problem

- Signs and symptoms and mechanism of injury of a Lisfranc injury are not widely known among physical therapists.
- Untreated Lisfranc injuries may result in chronic compensatory changes and complicate rehabilitation of acute foot and ankle injuries.

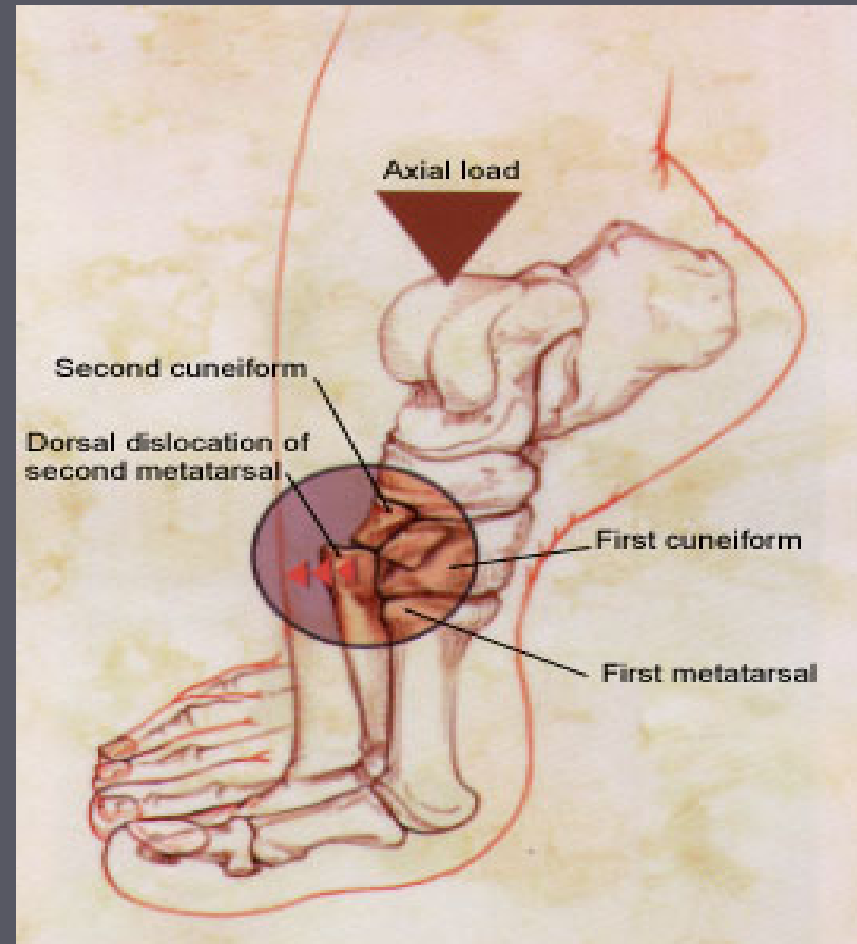
Anatomy of a Lisfranc Joint

- Lisfranc joint complex
- The Lisfranc Joint
- The Lisfranc Ligament
- Keystone for plantarflexion and dorsiflexion (Burroughs, 1998).



Mechanism of Injury-Direct and Indirect

- Axial loading
- Motor vehicle accidents
- Industrial accidents
- Falling from high places
- Heavy objects falling
- Missing a step or curb
- Lineman's stance
- Foot stuck in stirrups
- Parachuting landing



Introduction: Review of the Literature

- PT Diagnosis of Lisfranc joint injury:
 - Provocative clinical tests:
 - Side to side compression of the midfoot and dorsal or plantar deviation of the first metatarsal head while stabilizing the second metatarsal bone, producing pain (Nunley 2002, Hunt 2006).
 - Passive pronation abduction stress test of the forefoot (Ross 1996, Burroughs 1998, Busse 1995, Hunt 2006, Wadsworth 2005).

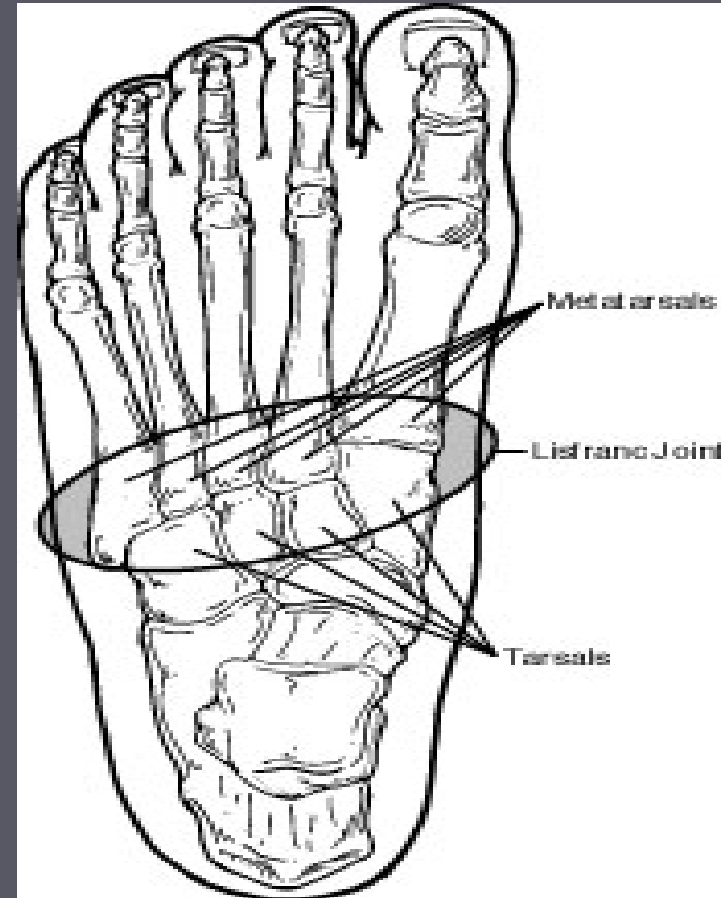
Introduction: Review of the Literature

- *Signs and Symptoms:*
 - Difficulty/ pain or inability to weight bear on foot (especially on the toes)
 - Pain with passive range of motion of the foot
 - Plantar ecchymosis sign (Ross 1996).



Introduction: Review of the Literature

- Signs and Symptoms:
 - Tenderness with or without swelling on the dorsal midfoot
 - Possible palpable deformity
 - Prominence of 1st MT base
 - Gross instability of the foot joints and crepitus (Lattermann 2007, Burroughs 1998, Busse 2004, Wadsworth 2005, Ross 1996)



Introduction: Review of the Literature

Biomechanical Compensations and Complications

- Gait Abnormalities
 - Abnormal foot posture and motion during gait
 - Excessive lateral pelvic tilt of greater than 4 degrees (Trendelenburg sign)
 - Circumduction of affected limb resulting in external rotation in swing and internal rotation in stance
 - Poor gluteal control-hip abductors and external rotators (Wadsworth 2005)

Introduction: Review of the Literature

- Other Complications:
 - Injury to the dorsalis pedis artery
 - Joint stiffness, swelling or persistent pain
 - Traumatic arthritis (Busse 2004).

Introduction: Review of the Literature

Physical Therapy:

- 6 week period of non weight bearing activities
- Referral for semirigid thermoplastic orthotics
- Optimize gait pattern
- Strengthening of foot and ankle muscles
- Increase joint stability
- Proprioception retraining
- Taping to increase plantarflexion of first ray
- Gradual return to activity or sport (Wadsworth 2005)

Introduction: Purposes

- To describe signs and symptoms of a Lisfranc injury in a 44 y/o male following an open reduction internal fixation for a left medial malleolar fracture
- To describe therapeutic interventions needed to address this condition.
- To explain how this particular patient's treatment course was modified to address his specific sign and symptom presentation.

Case Description- Patient Description

- 44 year old male
- *Surgical History:*
 - Medial malleolar fx: ORIF surgery 1.5 mo prior
 - cast removed one week prior to treatment
 - toe touch weight bear for one week -> WBAT
- Patient's goals:
 - no pain in the ankle
 - return to jogging and water skiing.



Case Description: Patient Description

- *Current Status:*
 - CAM Boot with bilateral axillary crushes on initial visit
 - Apprehensive: boot removal, toe touch
- *Social History:*
 - Slim, Active, Pleasant, Sound engineer
 - Enjoyed Water Skiing, Cycling 3-4 times/week, jogging 1-2x/week up/down
- *Past Medical History and Prognosis:*
 - Healthy-no significant medical or surgical history
 - Hx of undiagnosed ankle/foot injuries
- *Provided informed consent and signed HIPPA forms*

Case Description: Examination

- *Observation:*
 - Visual observation of posture
 - Performed in standing
 - Reliability is .80-.99 for MMT (Florence et al. 1992).
-
- no noted abnormalities in posture
 - foot arches appeared normal bilaterally but with mild pes planus

Case Description: Examination

- *Strength:*
- MMT for strength assessment performed in supine
- Reliability is .80-.99 for MMT (Florence et al. 1992).
- Atrophy of the left gastrocnemius, soleus and quadriceps muscles
- Ankle DF, PF, INV, EVER = 4/5

Case Description: Examination

- *Gait:*
- Visual observation by physical therapist of pt. amb. at pt.'s normal cadence
- Performed in standing
- Reliability is .60-.73 (Krebs et al. 1985).
 - Normal gait cycle in Hertling and Kessler (Hertling and Kessler 1996).
 - Decreased weight bearing on left limb during stance phase
 - Circumduction of the limb during swing

Case Description: Examination

- *Pain:*
- Subjective 0-10/10 measurement scale
- Reliability is .73-.82 (Good et al. 2001)
 - Intermittent pain
 - 2/10
 - aggravated by:
 - stretching
 - standing up in the morning
 - dependent upon activity
 - relieved with resting the limb
 - tenderness at the incision site
 - **dorsal and plantar surfaces of the metatarsal bones and plantar fascia**

Case Description: Examination

- *Sensation:*
- Measured by light touch of fingers over pt.'s skin
- Performed in supine
- Reliability is .29-.53 (Jau-Hong 2004)
- No complaints of numbness or tingling or loss of sensation in his foot or ankle

Case Description: Examination

- *Swelling:*
- Measured with tape measure in cm in figure eight pattern
- Performed in supine
- Reliability is 0.98-0.99 (Petersen et al. 1999)
 - Girth: Left: 25.5 cm
 - Right: 23.0 cm

Case Description: Examination

- *Range of Motion:*
- Measured with standard goniometer
- Performed in supine
- Reliability is .76-.85 (Kachingwe 2005)

Motion	AROM (degrees)	Pain
DF	0	+
PF	35	+
INV	35	-
EVER	40	-
HIP\KNEE	WNL	-
T-C Joint	Hypomobile	-

Case Description: Examination

- *Palpation:*
- Manually palpated by physical therapist
- Performed in supine
- Reliability is 0.95 (Bendtsen et. al. 1995)
 - palpable bony prominence at the first metatarsal base of his left foot
 - decreased accessory joint motion at the talocrural and first tarsometatarsal joints
 - tender around the dorsal and plantar aspects of the midfoot, plantar fascia, medial malleolus
 - increased sensitivity around the incision site with hypomobile tissue

Case Description: Evaluation

- Expected Findings:
 - active, passive, and accessory range of motion decreased
 - *pain with weight bearing*
 - abnormal gait pattern
 - impaired proprioception
 - increased swelling
 - decreased muscle strength and flexibility
 - tenderness of metatarsal bones
 - decreased functional status with daily activities and recreation
- The patient had a good prognosis for successful outcomes with rehabilitation.

Case Description: Evaluation

- Unexpected findings:
 - bony prominence at the first MET base
 - hypomobile tarsometatarsal joint
 - tenderness on the dorsal and plantar surfaces of the metatarsal bones (although the tenderness was expected to be there initially from referred pain from the surgery and swelling, but not prolonged)

Intervention: Plan of Care

Theoretical Rationale

- Maitland approach
- Impairment-based approach
- Plan/Goals: To improve patient's ROM, gait pattern, dec. pain, full- WB, inc. strength and return to normal activity.
- 2x/week x 3 weeks then 1x/week x 2 weeks (8 total treatments for physical therapy)

Case Description: Intervention

Stage One: Partial Weight Bearing- Standard Fracture

Management: Initial Treatment/PT Visit One:

ROM	Education	Swelling
<ul style="list-style-type: none">•A-P JTM•Ankle Alphabet	<ul style="list-style-type: none">•RICE•Ankle Alphabet•Towel Ankle Exs•Began HEP	<ul style="list-style-type: none">•IFC with RICE

Patient Response:

- Challenged with isolated ankle motions: compensated with knee
- Decreased swelling

Case Description: Intervention

Stage One Contd: Treatment for 2-4 visits:

Patient Complaints	Pre-gait activities	Muscle Flexibility and Strengthening	ROM
<ul style="list-style-type: none">•Difficulty with WB•Swelling•Pain in PF region	<ul style="list-style-type: none">•Mild-full WB activities at the parallel bars	<ul style="list-style-type: none">•Stretches for gastroc and soleus muscles•Strengthening with light progression on Pilates Board (Hertling and Kessler 1996)	<ul style="list-style-type: none">•T-C JTM: began to decrease in stiffness

Patient Response:

-Eager to return to normal WB

Unexpected finding:

- Strengthening in WB positions was challenging

Case Description: Intervention

Stage Two: Full Weight Bearing- : Treatment for 5-8 Visits:

Balance and Proprioception	Strengthening	ROM
<ul style="list-style-type: none">•Balance Exs (SLS, tiltboard),•Proprioception re-training on various surfaces in front of mirror	<ul style="list-style-type: none">•Strengthening of LE's in sitting, supine, and WB positions.	<ul style="list-style-type: none">•T-C and tarsometatarsal joint mobilizations.•STM to plantar fascia.

Patient Response:

- ROM greatly improved
- 3 mo. Post-op (8th visit) pt cont to complain of MET pain with WB.

Case Description: Intervention

Lisfranc Joint Treatment:

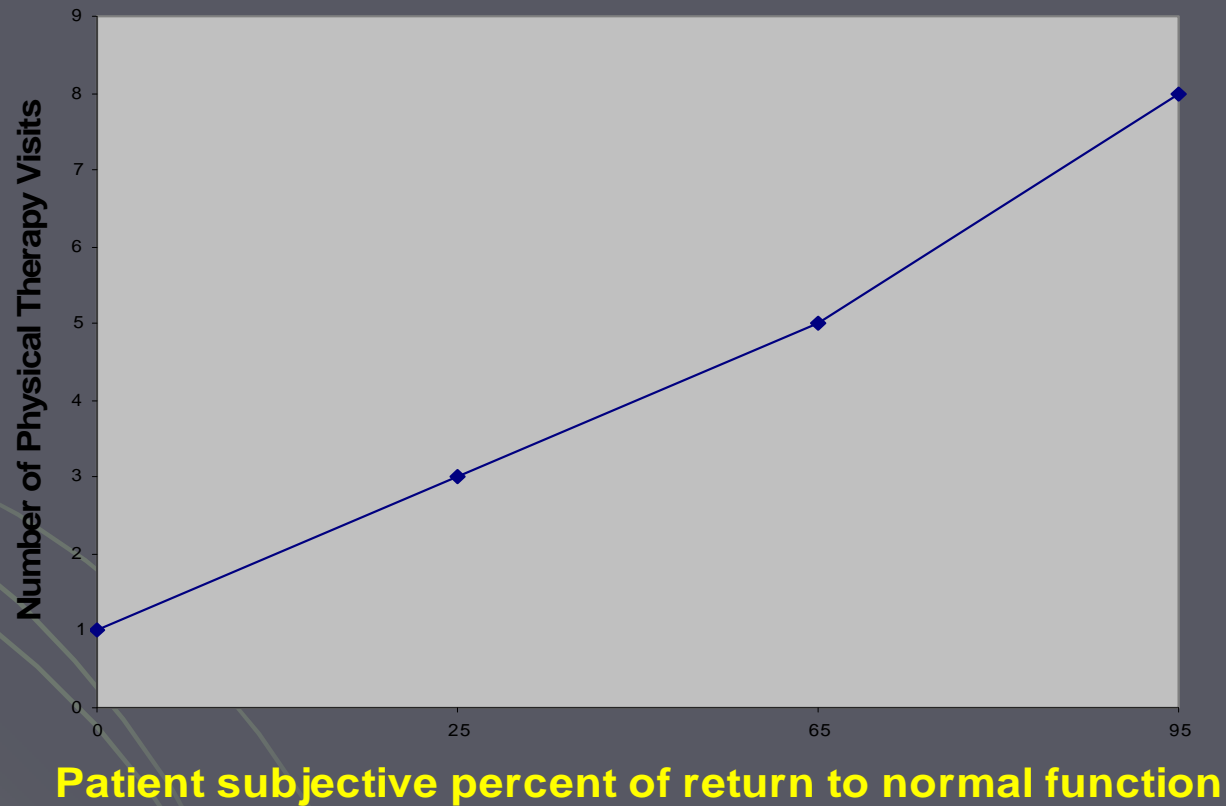
Pain with WB	Biomechanics and gait re-training	Functional Activity Re-integration	Midfoot support
Gr. II-III JTM to TMT	Foot mechanics with balance and proprioception	Pt.'s main goal: reintroduced bike in 4 th visit	McConnell Navicular Sling taping to 1 st /2 nd TMT in A-P direction
Rationale: <ul style="list-style-type: none">•inc. accessory mov't.•dec. pain with WB (Levangie and Norkin 2005)	Rationale: to address midfoot pain with WB	Rationale: for ROM, strength and endurance	Rationale: to dec. ant. Dis. of joint; midfoot/arch support (Hertling & Kessler 1996)

Intervention: Patient Response to Lisfranc Joint Treatment

- Pt. responded well.
- Only limited by midfoot pain with WB;
focused on this to increase outcomes.
- Apprehension decreased.
- HEP with over- activity modification to prevent further injury.

Outcomes: Return to Function

Patient's Subjective changes in Return to Function



Outcomes

Measure	Initial Visit	Final Visit
Pain	2/10	0/10
Ankle DF ROM	0	10
Balance/Proprio.	Unable SLS	<ul style="list-style-type: none">•SLS•Inc. in dynamic stability
Psychosocial	<ul style="list-style-type: none">•Overactivity•Prone to reinjury	<ul style="list-style-type: none">•Activity mod.•Ind. understanding
Gait	<ul style="list-style-type: none">•TTWB•Antalgic	<ul style="list-style-type: none">•Normal•WB discomfort
Palpation	Bony Prominence	Bony Prominence

Discussion

- This case represents one example of an unusual medial malleolar fracture status post ORIF patient clinical presentation complicated by a Lisfranc injury that benefited from a modification of common physical therapy treatment practices.

Discussion

Clinical Presentation Post ORIF for Malleolar Fracture:

- antalgic gait pattern
- decreased weight bearing during stance on the affected limb
- limited ankle dorsiflexion and sometimes ankle plantar flexion
- decreased ankle joint accessory motion
- tenderness and possible pain at the location of the screws (often over the medial malleolus, **not midfoot**)
- some swelling, pain and nerve sensitivity at incision site

(Talarico 2004, Van Laarhoven 1996)

Discussion

- Expected Findings s/p ORIF for a medial malleolar fracture (Talarico 2004, Van Laarhoven 1996):
 - immobilization and non-weight bearing for 6 weeks post surgery,
 - toe touch weight bearing for 1-2 weeks
 - weight bearing as tolerated
 - 6 weeks following the operation the patient is referred to physical therapy for range of motion exercises and for pain and swelling reduction

Discussion

- Unexpected Findings (related to Lisfranc joint injury) (Burroughs 1998):
 - pain in the dorsal and plantar surfaces of the foot with weight bearing
 - pain in the plantar fascia
 - palpable bony prominence at the first metatarsal head
 - decreased joint accessory motion at the 1-2 tarsometatarsal joints

Discussion: Indicators of Patient's Lisfranc Joint Injury

- History of ankle/foot injuries
- Previous undiagnosed Lisfranc injury from 2 years prior
- Mechanism of injury for the medial malleolar fracture involved getting the left foot and ankle caught in a water ski stirrup
- Acute injury could have been responsible for flaring the chronic underlying Lisfranc joint injury

Discussion: Biomechanical Compensations for a Lisfranc Joint Injury

- Pain in the midfoot with weight bearing is one of the most common clinical presentations of a Lisfranc joint injury (Wadsworth 2005).
- Patient's biomechanical compensations for a Lisfranc injury that were observed:
 - calcaneal eversion (not measured),
 - gait impairment with slight circumduction of the affected limb
 - poor foot mechanics (Wadsworth 2005).

Discussion: Modifications Required for a Lisfranc Joint Injury

- Modifications for this patient's rehabilitation:
 - passive accessory joint mobility for the tarsometatarsal joints (Hertling & Kessler 1996).
 - McConnell navicular sling taping to support the Lisfranc joint (Hertling & Kessler 1996).
 - specific instruction and proprioceptive activities for altered foot mechanics (Wadsworth 2005).

Discussion: Change in Medial Malleolar Course of Recovery

- Pain in midfoot during WB after 8 weeks post surgery (most common clinical presentation of Lisfranc injury) (Wadsworth 2005)
- Pain in midfoot during WB after 12 weeks post surgery.
- Focus on plantar fascia and arch support to decrease pain during WB by supporting midfoot.
- Heavy treatment focus on foot mechanics.

Discussion: Limitations

- PT intern working on patient with no prior experience with treating patients with Lisfranc joint injuries
- Other modifications that could have been addressed
- Measurement of biomechanical compensations, such as calcaneal eversion, glut med strength, etc.
- Use of functional outcome scale for objective measurement of level of return to function pre and post physical therapy
- Use of standardized functional measure
 - Stride dimensions or footprint analysis for gait

Discussion: Future Work

- Future Studies:
 - Acute immediately diagnosed compared to chronic delayed diagnosis cases compared to no PT.
 - PT treatment on case by case depending on type of Lisfranc injury (Modified Hardcastle Classification).
 - Best PT treatment for Lisfranc injury to improve functional outcomes.

Discussion

- Physical therapists can use this case report to further their understanding of:
 - Lisfranc joint injury
 - Mechanism of injury
 - Clinical presentation
 - Possible biomechanical compensations and adverse outcomes
 - Recommended physical therapy treatment

Conclusion

- Once physical therapists have the understanding of Lisfranc joint injuries they can:
 - Better rule out Lisfranc injuries in patients that present with acute foot injuries
 - Make the appropriate referrals
 - Modify treatment plan in order to get the patient the necessary treatment and successful outcomes
 - Prevent further adverse outcomes and disability.

Thank You!

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