POST-OPERATIVE LISFRANC INJURY CLINICAL PRACTICE GUIDELINE

Background

A Lisfranc injury denotes a spectrum of injuries involving the tarsometatarsal (TMT) and intercuneiform joints of the foot, including the metatarsal bases, cuneiforms, and interconnecting ligaments. **Relatively uncommon**, they affect approximately 1 in every 55,000 people in the United States and comprise 0.2% of all fractures. **Men are up to 4 times more likely** to sustain a Lisfranc injury than women, and these injuries are **common in the third decade of life**. Up to **20% are initially missed**, particularly in low-energy or poly-trauma situations. These injuries can have devastating consequences and are often associated with poor functional outcomes and high rates of disability due to arch collapse and posttraumatic arthritis. **Non-operative care is less common – if this route is pursued make sure to consult with referring provider for recommendations on timeline and expectations.**

Lisfranc injuries can occur in a wide array of scenarios including motor vehicle accidents (43%), falls from heights (24%), crush injuries (13%), and **sports injuries (9.7%).** These injuries will be divided into two groups: high-energy and low-energy. High-energy injuries typically result from motor vehicle accidents or crush injuries and are not associated with one particular injury pattern. **Low-energy injuries often occur in sports** such as basketball, football, or rugby. They **result from indirect mechanisms** in which an axial and/or rotational load is applied to a plantarflexed foot. This **axial force results in hyper-plantarflexion of the foot**, causing a tension failure of the weak dorsal ligaments. This is followed by fracture of the plantar metatarsal base or rupture of the plantar capsule, which allows the metatarsal bones to dorsally displace.

Disclaimer

Progression is time and criterion-based, dependent on soft tissue healing, patient demographics, and clinician evaluation. Contact Ohio State Sports Medicine at 614-293-2385 if questions arise.

These rehabilitation recommendations are based upon the guidance of content experts and evidence-based practice. Progression through each phase is based on the patient demonstrating readiness by achieving functional criteria rather than the time elapsed from surgery. The times frames identified for each phase of rehabilitation are approximate times for the average patient, NOT concrete guidelines for progression. Always consult with the surgical team or reference the operative report as needed.

Summary of Recommendations

Risk Factors for Injury	• Most common in 3rd decade of life • Male>Female – 4x more likely • MVA – Crush Injury – Sports Injury • Up to 20% are initially missed

Precautions
Inform surgical team of all supplements along with medications
	1. Days 0-3: Strict Rest and Elevation (minimal activity)
	  ○ Prioritize hydration/nutrition
	  ○ Vitamin C and Vitamin D3 supplementation to help with healing
	2. Strict Non-Weightbearing (NWB) x6 weeks
	  ○ Days 1-14: Splint with compressive dressing utilizing axillary crutches
	  ○ Day 14 (week 2): Can start wearing CAM boot – continue strict NWB – axillary crutches, iWalk, or scooter – ABSOLUTELY no weight or pressure on involved foot
	  ○ Prioritize ankle ROM to reduce muscle contracture

Medications *Commonly prescribed medications – surgical team will provide recommendations for dosing and frequency*	• Narcotic Pain Medication – take as prescribed for 2-3 days, only as needed • Naproxen – to reduce pain and swelling – twice daily – take with food • Tylenol – as prescribed – to reduce pain • Aspirin – twice daily for 14 days • Gabapentin – twice daily – helps reduce pain – may cause drowsiness • Colace – stool softener – take while on pain medication • Zofran – as needed for nausea and vomiting
Outcome Measures	Collect the Lower Extremity Functional Scale (LEFS) at each visit. Can also collect the FAAM periodically to inform skilled care.
Criteria to Begin Partial Weightbearing in CAM Boot	1. ROM: ankle AROM should be nearly 100% WNL in all directions 2. Effusion: minimal to trace effusion of involved foot/ankle 3. Timeframe: Initiate at Week 6 with use of axillary crutches a. Week 7 – 25%, Week 8 – 50%, Week 9 – 75%, Week 10 – 100%
Criteria to Initiate Return to Running and Jumping	1. ROM: 95% symmetry ROM (DF/PF) compared to uninvolved limb a. Isolated 1st metatarsophalangeal mobility (with proximal stabilization of this metatarsal) 25-30 degrees with first ray plantarflexion past neutral 2. Weight Bearing: Normalized gait mechanics at slow and moderate cadence w/o deviations 3. Strength: 25 single leg heel raises with heel height within 20% of uninvolved limb 4. Patient is able to tolerate 200-250 foot contacts (equivalent to 1/3 mile of running) 5. Timeframe: Initiate between Weeks 16-20 – criterion dependent – consult surgeon PRN
Criteria for Return to Sport: Initiate at 6-9 months	1. ROM/Strength: 95% symmetry ROM and unilateral strength compared to uninvolved limb – consider using isometric mid-thigh pull for strength assessment **(Appendix A)** 2. Weight Bearing: Normalized gait, running, and jumping/landing mechanics 3. Neuromuscular Control: 90% symmetry between limbs on Y-balance test with appropriate lower extremity mechanics 4. Functional Hop Testing: 90% symmetry SL hop testing **(Appendix B)** 5. Physician Clearance

Red Flags

Red flags are signs/symptoms that require immediate referral for re-evaluation.

Red Flags
 	
Require immediate referral for re-evaluation
	• Signs of DVT *(Refer directly to ED)*
	  ○ Localized tenderness along the distribution of deep venous system
	  ○ Entire LE swelling
	  ○ Calf swelling >3cm compared to asymptomatic limb
	  ○ Pitting edema
	  ○ Collateral superficial veins
	• Signs of Infection and systemic illness
	  ○ Persistent or increasing exudate from wound
	  ○ Area around wound becoming swollen, hot, or having a foul odor
	  ○ Patient has a fever
	  ○ Pain excessive or suddenly develops

Yellow Flags
 	
Require modifications to plan of care
	• Persistent reactive effusion or pain following therapy for ADLs
	  ○ Decrease intensity of rehab interventions, continue effusion management, educate patient regarding activity modifications until symptoms resolve
	  ○ Communicate with surgeon as needed
	• Fear-avoidance behavior
	• Negative coping strategies

Protection Phase (Post-op - 2 weeks)

Precautions	• Maintain post-operative splint or cast per surgeon (treatment will only be initiated at proximal joints) • **Strict NWB during this time period with crutches** • Strict elevation of foot/ankle to heart level • Do not stick anything in your splint/cast
ROM	• Wiggle toes frequently throughout the day • Gentle isometric holds into toe extension/flexion – 3-5 seconds • No foot/ankle mobility due to splint/cast placement
Weight Bearing	• Strict NWB with axillary crutches during this timeframe ○ Refer to surgeon's post-operative report or office visit note for specific instructions on weight bearing

Therapeutic Exercise	• Initiate foot intrinsic exercises:
	  ○ Toe wiggles
	  ○ Toe extension/flexion
	  ○ Toe spreading
	• SLR 4-way – 5-6 times daily
	  ○ Start with flexion and sidelying abduction and progress as tolerated
	• Upper body exercises – seated or bench only – no pushups or planks – goal is protection of repair and avoidance of axial loading into plantarflexed position
	
	**All exercises should be pain-free; performed in small ROM within splint/cast*

Goals	• Reduce edema • Reduce and manage pain • Ensure closure of incision • Educate on DVT/thromboembolism • Prioritize protection of hardware

Early Loading Phase (2-6 weeks)

Precautions	• Strict NWB continued during this phase – transition to iWalk or scooter if appropriate • Sutures are removed – monitor proper healing of surgical incision • CAM boot on for all NWB walking activity
ROM	• Initiate pain-free AROM plantarflexion, inversion, eversion – 5-10x daily out of boot ○ Utilize PROM as needed • Joint mobilizations: grade 1-2 only - improve accessory motions at talocrural, subtalar, distal tibiofibular, navicular/midfoot, forefoot, 1st MTP, and sesamoid distal mobilization.
Weight Bearing	• Continue NWB in CAM boot • Utilize axillary crutches, iWalk, or scooter for mobility

Therapeutic Exercise	• Submaximal ankle isometrics all planes
	• Ankle pumping
	• Alphabet rotations
	• Recumbent bike with or without CAM boot – prioritize mobility – minimal resistance
	• Resisted PF, inversion, eversion with Theraband – start with minimal resistance and gradually increase repetitions – start DF once surgical incision is fully healed/closed
	• Manual Therapy interventions as outlined in **(Appendix C)**
	
	• Initiate at 4 weeks:
	  ○ Pool ROM – if wound is healed/closed
	  ○ Pool "walking" – chest deep/supported walking motion – **gentle treading of water**
	  ○ Gentle calf stretching – low load, long duration
	  ○ Gluteal/lumbopelvic strengthening while respecting NWB status
	  ○ Clamshells (folded towel between insteps), Sidelying multifidus, BOSU single and double leg bridges (straight knees, calves on BOSU or physioball).
	
	• Initiate at 5-6 weeks:
	  ○ Upright bike with or without CAM boot – mild resistance with emphasis on ROM/mobility of ankle
	  ○ % body-weight B leg press progression – start at 25% and gradually increase to 75% prior to week 6 in preparation for functional weightbearing progression
	
	• Continue vasopneumatic compression, elevation, and use of compression sock/sleeve for management of foot/ankle effusion
	
	All exercises should be pain-free

Other Suggested Interventions	• May initiate soft tissue mobilization and desensitization strategies after adequate wound closure • Blood Flow Restriction training as indicated after suture removal • Continue progression of upper body exercises while respecting NWB status

Goals	• Management of foot/ankle effusion • Ankle AROM WNL in all directions • Maintain reduction in pain • Prepare for transition to weightbearing phase

Transition to Weightbearing Phase (6-10 weeks)

Precautions	• Gradual progression of weightbearing in CAM boot • Consider addition of arch support within walking boot for comfort – no heel lifts ○ Can be modified as needed for pain-free loading • Consider use of night splint or sleep in CAM boot, if concerned for muscle contracture
ROM	• Achieve full PROM/AROM – dorsiflexion, plantarflexion, inversion, eversion • Joint mobilizations: improve accessory motion at subtalar, distal tibiofibular, and forefoot joints as needed • Frequent calf stretching to achieve full dorsiflexion ROM
Weight Bearing	• Week 6: begin PWB with axillary crutches and CAM boot • Week 7: 25% bodyweight with axillary crutches and CAM boot • Week 8: 50% bodyweight with axillary crutches and CAM boot • Week 9: 75% bodyweight with single axillary crutch and CAM boot • Week 10: 100% FWB in CAM boot ○ Compression socks to help reduce reactive effusion

Therapeutic Exercise	• Initiate balance board training – forward and lateral for time
	• Continue open-chain theraband strengthening with emphasis on posterior tibialis with theraband held at 45 degree angle or from figure-4 position (forefoot adduction and ankle inversion).
	• Closed chain hip and knee strengthening per patient's tolerance
	• Recumbent bike in shoe
	• Initiate calf raise progression on shuttle:
	  ○ Double leg → 2 up 1 down → single leg
	  ○ Starting position: neutral ankle → dorsiflexion
	• Week 8: Initiate standing heel raise progression as able
	  ○ Double leg → 2 up 1 down → single leg
	  ○ Starting position: neutral ankle → dorsiflexion
	• Week 10:
	  ○ Initiate ankle rocker step holds with focus on lower extremity alignment and balance (within available DF)
	  ○ Initiate heel taps (within available DF)
	  ○ Pedal presses to assist end-range DF
	
	All exercises should be pain-free – okay to remove boot for interventions

Criteria to Discharge Walking Boot	1. ROM: Full AROM in all directions without pain 2. Weight Bearing: Demonstrates pain-free ambulation without antalgic gait 3. Timeframe: Full discharge from boot at 10-12 weeks 4. Considerations: carbon fiber insert to protect repair during push-off and/or metatarsal taping – reach out to surgeon for specific recommendations
Goals	• Initiate weight bearing strengthening exercises • Gradual wean from boot with goal of ambulation in supportive shoe by Week 8 – utilize arch supports and/or taping techniques as needed for comfort • Normalize gait pattern and reduce and deviations or compensations

Return to Function Phase (16+ weeks – Return to Sport/Activity)

Precautions	• Monitor for reactive pain, effusion, or other compensation patterns during transition to higher level activity/loading
ROM	• Maintain AROM/PROM of involved foot/ankle to tolerate progression of activity • Joint mobilizations and soft tissue mobility as needed
Weight Bearing	• Normalized gait mechanics - FWB • Normal footwear with supplemental insert as needed ○ Consult surgeon for recommendations – carbon fiber vs arch support vs performance orthotic

Therapeutic Exercise	• Emphasize strengthening at end-range PF
	  ○ Heel raises on decline board (starting in plantarflexed position)
	  ○ Resisted inversion and eversion in plantarflexed position (theraband or ankle weight)
	  ○ DL heel raises with theraband pulls into ankle inversion and eversion
	  ○ Hangover iso holds and hangover step ups
	• Heels raises in knee flexion – focus on volume and add weight as appropriate
	• Triple extension heel raises (from Lorenz and Beauchamp)
	• Continued progression of strength/stability/balance exercise on stable and unstable surfaces to correct altered mechanics.
	• **Strength/Power Training** – Relative/Absolute Strength and Force Development – utilize mid-thigh pull strength assessment to inform skilled care and dosing – **(Appendix A)**
	• Initiate plyometric progression:
	  ○ Shuttle press: DL → alternating → SL
	  ○ FWB: DL straight plane → diagonal plane → rotational → tuck jumps → SL
	• Step/hop holds for training on lower extremity landing mechanics for jogging
	• Resisted jogging in place with resistance in all planes
	• Sports specific exercise/agility progression, emphasis on proper mechanics

Criteria to Initiate Return to Running and Jumping	1. ROM: 95% symmetry ROM (DF/PF) compared to uninvolved limb 2. Isolated 1st metatarsophalangeal mobility (with proximal stabilization of this metatarsal) 25-30 degrees with first ray plantarflexion past neutral 3. Weight Bearing: Normalized gait and jogging mechanics 4. Strength: 25 single leg heel raises with heel height within 20% of uninvolved limb 5. Patient is able to tolerate 200-250 foot contacts (equivalent to 1/3 mile of running) 6. Timeframe: Initiate between Weeks 16-20

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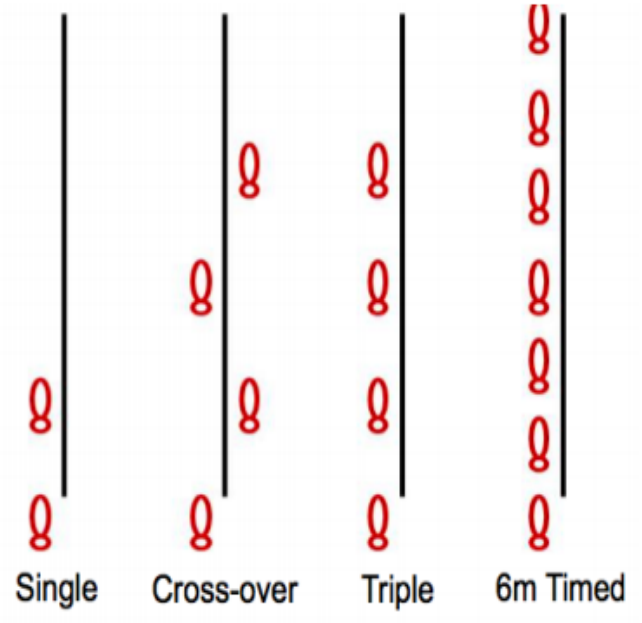
Appendix A: Isometric Mid-Thigh Pull Strength Assessment

Position	• Patient is standing in a hinged position holding on to handheld dynamometer as demonstrated in pictures • When performing unilateral assessments – patient is allowed to maintain contact with rear foot for balance
Placement	• Hands should be resting at approximate mid-thigh position – make sure the patient is positioned close to the anchor point to avoid “leaning back” during assessment
Protocol	• Starting position roughly 145 deg – relative hinge position of hip/knee/ankle • 2 trials of maximum effort with 2 min rest between each trial • Instruct patient to gradually increase pulling force and then maintain maximum effort for at least 5 seconds • Determine symmetry index for each side: (involved/uninvolved)*100 = % symmetry
Goal	• Patient should be able to demonstrate the ability to sustain maximal effort pulling w/o deviation away from involved side during bilateral testing • During unilateral testing patient should be able to demonstrate at least 95% limb symmetry and report no pain w/ increased compressive loading to involved foot

Appendix B: Single Leg Hop Series

1) **Single hop for distance:** Have the subject line their heel up with the zero mark of the tape measure, wearing athletic shoes. The subject then hops as far as he/she can, landing on the same push off leg, for at least 3 seconds. The arms are allowed to move freely during the testing. Allow him/her to perform 2 practice hops on each leg. Then, have the subject perform 2 testing trial, recording each distance from the starting point to the back of the heel. Average the distanced hopped for each limb. The Limb Symmetry Index: Involved limb distance/Uninvolved limb distance X 100%.
2) **Cross-over hop for distance:** The subject lines their heel up with the zero mark of the tape measure and hops 3 times on one foot, crossing fully over the center line each time. Each subject should hop as far forward as he/she can on each hop, but only the total distance hopped is recorded. The arms are allowed to move freely during the testing. Allow him/her to perform 2 practice hops on each leg. Then, have the subject perform 2 testing trial, recording each distance from the starting point to the back of the heel. Average the distanced hopped for each limb. The Limb Symmetry Index: Involved limb distance/Uninvolved limb distance X 100%.
3) **Triple hop for distance:** The subject lines their heel up with the zero mark of the tape measure and hops 3 times on one foot. Each subject should hop as far forward as he/she can on each hop, but only the total distance hopped is recorded. The arms are allowed to move freely during the testing. Allow him/her to perform 2 practice hops on each leg. Then, have the subject perform 2 testing trial, recording each distance from the starting point to the back of the heel. Average the distanced hopped for each limb. The Limb Symmetry Index: Involved limb distance/Uninvolved limb distance X 100%.
4) **Timed 6-meter hop:** The subject lines their heel up at the zero mark of the tape measure and hops, on cue with the tester, as fast as they can the length of the 6-meter tape. The arms are allowed to move freely during the testing. Allow him/her to perform 2 practice hops on each leg. Then, have the subject perform 2 testing trial, recording each distance from the starting point to the back of the heel. Average the distanced hopped for each limb. The Limb Symmetry Index: Involved limb time/Uninvolved limb time X 100%.



Appendix C: Early Stage Manual Therapy Intervention

1) Talocrural Mobilizations

a. Posterior glide to improve ankle dorsiflexion

Technique: ankle in resting position (10 degrees of plantarflexion), stabilize distal tib/fib and glide is given to talus in posterior direction to improve ankle DF.

b. Anterior glide to improve ankle plantarflexion

Technique: ankle in resting position (10-20 degrees of plantarflexion), stabilize distal tib/fib with one hand as you apply glide perpendicular to proximal part of joint.

2) Proximal and Distal Tibiofibular Glides

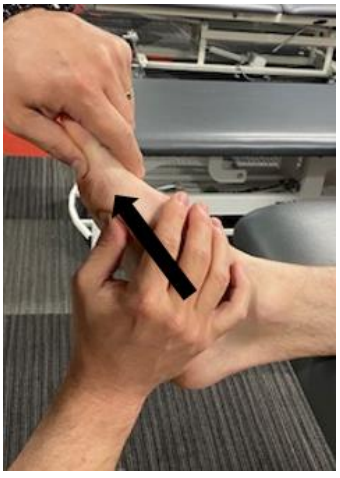
Technique for distal tibiofemoral glide: ankle in resting position (10 degrees PF), stabilize the distal tibia with one thenar eminence and glide with the other thenar eminence.

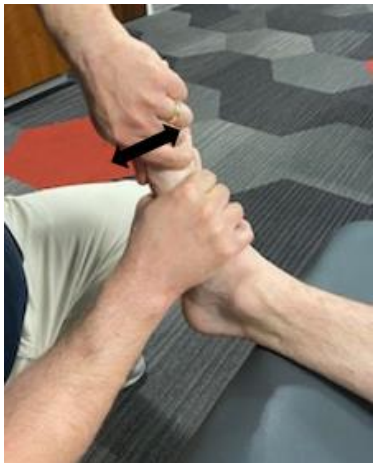
Technique for proximal tibiofemoral glide: stabilize proximal fibula (fibular head) with index and middle finger as you flex the knee with pressure through your opposite hand.

3) Superior and Inferior Navicular and Cuboid Glides

Technique: either stabilize talus or calcaneus and gentle glide the navicular or cuboid respectively in the plantar and dorsal direction. Depending on surgery may even stabilize the navicular and anything above and gentle glide the cuneiforms.

4) Distal Mobilization of Medial/Lateral Sesamoids and 1st Ray Mobilization





Technique: Distal glides were performed by placing thumb on the proximal aspect of the sesamoid (tip of other thumb can be on distal aspect for support if needed) and applying a proximal to distal force to tissue tension. (To improve great toe dorsiflexion & flexor hallucis length). 1st MTP joint mobilizations performed via stabilization of midfoot with anterior/posterior gliding of 1st MTP joint to maximize great toe ROM

Appendix D: Suggested Interventions – Mid/Late Stage

Resisted Plantarflexion/Inversion for improved posterior tibialis activation and progressive loading.

Option A: seated figure-4 position – great for home programming independence
Option B: band secured at forefoot and held at 45 deg angle by therapist

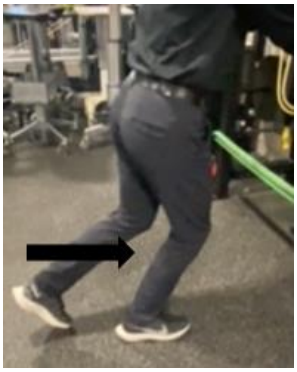
Balance board for improved weightbearing and prolonged isometric contraction of foot/ankle musculature. Cue patient to keep board as level as possible. Hold for 1 min. Repeat 2-3x

Option A: forward orientation
Option B: lateral orientation

Appendix D: Suggested Interventions Continued – Mid/Late Stage

Dorsiflexion Pedal Presses to improve end range dorsiflexion and initiation of plantarflexion to mid-stance.

Secure band to either side of rack – cue patient to step down on band – keeping heel in contact with the floor allow the band to assist ankle into dorsiflexion and then press to mid-stance and encourage loading to tolerance.



Ankle Rocker Step Hold to improve eccentric control into dorsiflexion and overall load acceptance into forefoot. Allow patient to utilize BUE for support and assist deceleration.

Goal is to improve loading quality to allow for improved mechanics with descending stairs and achieving motion necessary to allow for unhindered squatting/lunging.

End-Range Heel Raise: Position heels onto a slantboard or other elevated surface – perform heel raises in isolated end range of motion

Triple Extension Leg Press/Heel Raise: While on leg press machine, cue your patient to be active on toes – maintain this position as they move into knee and hip extension – avoid excessive lateral foot pressure

Hangover Iso Holds: Standing on small box or plate – cue knee over toe position – maintain neutral ankle or slight plantarflexion – hold for 30-60 seconds

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