Stress Fracture Rehabilitation Guideline

This rehabilitation program is designed to return the individual to their activities as quickly and safely as possible. It is designed for rehabilitation following a stress fracture. A stress fracture is a partial or incomplete fracture caused by the accumulation of stress in a localized area of bone.[1] Modifications to this guideline may be necessary depending on physician-specific instruction, specific tissue healing timeline, chronicity of injury and other contributing impairments that need to be addressed. This evidence-based stress fracture rehabilitation guideline is criterion-based. Time frames and visits in each phase will vary depending on many factors including patient demographics, goals and individual progress. This guideline is designed to progress the individual through rehabilitation to full sport and activity participation. The therapist may modify the program appropriately depending on the individual's goals for activity following stress fractures.

This guideline is intended to provide the treating clinician with a frame of reference for rehabilitation. It is not intended to substitute clinical judgment regarding the patient's post-injury care, based on exam or treatment findings, individual progress, and/or the presence of concomitant injuries or complications. If the clinician should have questions regarding progressions, they should contact the referring physician.

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General Guidelines/Precautions:

- Rest from pain-provoking activities remains the most effective, if often prolonged, intervention approach at this time.
- Excessive foot pronation if found should be addressed. Focus on the entire lower extremity kinetic chain.
- The general healing timeline varies depending on severity and chronicity.
    - Average return to participation timelines:
        - Low risk, low grade: average of 61 days to return
        - Low risk, high grade: average of 153 days to return
        - High risk, low grade: average of 135 days
        - High risk, high grade: average of 131 days
        - Exercise caution with patients who have low risk, high grade stress fractures to avoid premature return to participation.
- Assess and treat the lower extremity kinetic chain from the lumbopelvic region to the foot.
- Severity/Irritability/Nature/Chronicity of symptoms may affect progressions.
- Intrinsic factors such as nutrition and biomechanical variances.

TABLE 1. Low and high risk stress fracture classification and Fredericson tibial MRI classification

Low risk classification	High risk classification	Fredericson classification for tibial stress fractures
• Heal with conservative treatment • Nonsurgical management • Compression stress fractures • Typically includes o Femoral shaft o Medial tibia o Fibula o Calcaneus o 1st-4th metatarsals	• Risk for complete fracture • Risk for nonunion • Delayed union • Typically requires surgical intervention • Requires nonweight-bearing or assisted weight-bearing • Tension stress fractures • Typically includes o 5th metatarsal o Anterior tibia o Tarsal navicular o Femoral neck o Patella o 1st metatarsal sesamoids	• Grade 1: periosteal edema only • Grade 2: bone marrow edema visible on • T2-weighted images • Grade 3: bone marrow edema visible on both T1-weighted and T2-weighted images • Grade 4: intracortical signal abnormalities

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PHASE	SUGGESTED INTERVENTIONS	GOALS/MILESTONES FOR PROGRESSION
Phase I *Acute Phase*	******Patient will remain in current phase until Criteria to Advance are met without pain or compensation.****** ***Discuss:*** *Anatomy, existing pathology, rehab schedule and expected progressions.* ***Specific Instructions:*** Use of a cast, boot or pneumatic leg splint for 2–4 weeks. ***Suggested Treatments:*** • **Modalities as indicated:** Cryotherapy, low-intensity pulsed ultrasound[2], soft tissue mobilization, electrical stimulation • **ROM:** Gastrocnemius, soleus, flexor digitorum, tibialis posterior • **Manual Therapy:** Soft tissue mobilization of the lower extremity kinetic chain, joint mobilization to joints of the lower extremity kinetic chain where impairments are present (i.e., talocrural joint). Consider forefoot mobilization.[1] ***Exercise Examples:*** • **NWB lower body strengthening focusing on gluteals:** Clams, side-lying straight leg raise, fire hydrants • **Core strengthening:** Planks, side planks, Pallof holds progressing from standing to half kneeling, to kneeling • **Stretching:** Hip flexors/quadriceps, hamstrings, gastrocnemius and soleus Ankle invertor and evertor, foot intrinsic strengthening May continue with upper body strengthening ***Other Activities:*** • Cycling or upper body ergometry	***Goals of Phase:*** 1. Removal of stress from injured area 2. Pain management 3. Prevent deconditioning 4. Educate on activity modification 5. Improved flexibility/range of motion, if found to be limited 6. Reestablished dynamic muscle control, balance and proprioception ***Criteria to Advance to Next Phase:*** 1. No pain to palpation of involved bone 2. Pain-free ADLs 3. Tolerate full or partial WB with assistive device or walking boot. 4. Full ROM

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Phase II *Subacute Phase*	****Patient will remain in current phase until Criteria to Advance are met without pain or compensation.**** ***Specific Instructions:*** **Establish gradual return to prior level of function. Start at <50% prior training volume. Abide by soreness rules (see appendix).** ***Suggested Treatments:*** • **Modalities as indicated:** Edema-controlling treatments • **ROM:** Ankle DF ROM • **Manual Therapy:** Continue as needed for joint and soft tissue limitations throughout the lower extremity kinetic chain ***Exercise Examples:*** • **Foot/ankle strengthening** - Progress balance activities, emphasis single-limb stability - Single leg heel raises - Foot intrinsic strengthening in weight-bearing position • **Lower extremity mobility** - Gastrocnemius/soleus stretching - Continue to address lower extremity kinetic chain mobility deficits • **Hip strengthening** - Double and single limb proximal stability exercise, may include: squats, single leg squats, lunges with forward trunk lean, step ups, step downs, lateral band walks ***Other Activities:*** • Swimming, deep water/pool running, Alter G, if available at pain-free level, encourage shock absorption strategies such as increasing step rate, step width and/or forward trunk lean[3]	***Goals of Phase:*** 1. Initiation of return to activity 2. Improve muscular strength, endurance, and flexibility. 3. Non antalgic gait with normal shoe and no AD. ***Criteria to Advance to Next Phase:*** 1. 30-minute walk with minimal to no increase in pain 2. Barbell Back squat: 6 repetitions in 6 seconds at 60% body weigh 3. >25 single leg heel raises bilaterally 4. Pain free ADLs with normal weight bearing. 5. >25 single leg squats to metronome at 60 bpm

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Phase III *Advanced Strengthening*	******Patient will remain in current phase until Criteria to Advance are met without pain or compensation.****** ***Specific Instructions:*** • Continue with previous exercise program. A good guideline is to increase activity by no more than 15-20% per week • Consider the Return to Running program[4] (see appendix) ***Suggested Treatments:*** • **Modalities Indicated:** Continue as needed for pain control • **Manual Therapy:** Continue as needed for joint and soft tissue limitations throughout the lower extremity kinetic chain ***Exercise Examples:*** • **Plyometrics:** Emphasis on soft landing and hip strategy - Double limb: box jumps, drop jumps, forward jumps, tuck jumps - Single limb: lunge hop, single box hop, drop with single leg land, single forward hop • **Foot/ankle strengthening** - Continue balance and foot intrinsic strengthening in single limb weight-bearing position • **Lower extremity mobility** - Continue to address lower extremity kinetic chain mobility deficits • **Hip strengthening** - Continue single limb proximal stability exercises ***Other Activities:*** • Begin Return to Running program[4] using soreness rules (see appendix)	***Goals of Phase:*** 1. Return to running 2. Return to recreational/ sporting activity 3. Normal lower extremity kinetic chain strength 4. Normal lower extremity kinetic chain muscle length ***Criteria to Advance to Next Phase:*** 1. Pain-free completion of interval running program
Phase IV *Return to full activity*	******Patient will remain in current phase until Criteria to Advance are met without pain or compensation.****** ***Specific Instructions:*** • Continue with proper load management and progression to full activity	

Post Stress Fracture Return-to-Running Program

This program is to be used for returning to continuous running following injury. It should be started once you are able to walk 30 min consecutively without pain/injury. A minimum of one off-day is required between running sessions.

Begin each session with a warm-up consisting of a 2-5 min brisk walk followed by your specific stretching/activation exercises. All running is intended to be performed at easy or conversational pace. Perform the appropriate walk/run combination based on the table below. Be sure to follow the walk/run with your stretching exercises.

Week	Day 1	Day 2	Day 3
1	6x: walk – 4.5 min. run – 0.5 min.	6x: walk – 4.0 min. run – 1.0 min.	6x: walk – 3.5 min. run – 1.5 min.
2	6x: walk – 3.0 min. run – 2.0 min.	6x: walk – 2.5 min. run – 2.5 min.	6x: walk – 2.0 min. run – 3.0 min.
3	6x: walk – 1.5 min. run – 3.5 min.	6x: walk – 1.0 min. run – 4.0 min.	6x: walk – 0.5 min. run – 4.5 min.
4	run – 30 min.	run – 30 min.	run – 30 min.

Upon completing Week 4, you may resume a gradual transition back to continuous running following a 2 min warm-up walk and stretching. As you return to your pre-injury running level, training duration or intensity should be increased by no more than 10-20% per week to minimize risk for injury recurrence. Be sure to continue your stretching program as instructed.

Higher-risk stress fracture sites or higher-grade fractures may warrant slower progression and/or a greater number of recovery days – defer to PT or ATC guidance.

Soreness Rules – Related to pain or soreness at stress fracture site

Criterion	Action
1. Soreness during warm-up that continues	2 days off, return to prior step
2. Soreness during warm-up that goes away	Stay at step until completed without soreness
3. Soreness during warm-up that goes away but redevelops during session	2 days off, return to prior step
4. Soreness the day after lifting	1 day off, do not advance program to the next step

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