

ACHILLES TENDON REPAIR CLINICAL PRACTICE GUIDELINE

Background

Achilles tendon repair is performed after injury occurs to the Achilles tendon. The injury is often accompanied by an audible and palpable pop with limited ability to push off of the injured limb. For best outcomes, the Achilles tendon repair is typically performed within 2 weeks of the injury and recovery is expected to take between 6 to 9 months. Return to sport may take 9 to 12 months depending on the severity of injury and nature of the sport the patient desires to play.

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.

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.



Summary of Recommendations

Risk Factors for Rupture	<ul style="list-style-type: none"> • Age (30-50 years) • Male • Fluoroquinolone use
Precautions	<ol style="list-style-type: none"> 1. Recommend WBAT in protective device at post-op week 2 (NWB days 0-14 or as directed) 2. No aggressive stretching of Achilles or gastrocnemius-soleus complex before 12 weeks
Outcome Tools	<p>Collect the Lower Extremity Functional Scale (LEFS) at each visit.</p> <p>Consider collecting one of the following outcome tools. Be consistent with which outcome tool is collected each visit.</p> <ol style="list-style-type: none"> 1. The Foot and Ankle Ability Measure (FAAM) 2. The Achilles Tendon Total Rupture Score (ATRS)
Criteria to Discharge Walking Boot	<ol style="list-style-type: none"> 1. <u>ROM</u>: Able to achieve 0° DF 2. <u>Weight Bearing</u>: Demonstrates pain-free ambulation without antalgic gait 3. <u>Timeframe</u>: Full discharge from boot and heel lifts by Week 8
Criteria to Initiate Return to Running and Jumping	<ol style="list-style-type: none"> 1. <u>ROM</u>: 95% symmetry ROM (DF/PF) compared to uninvolved limb 2. <u>Anthropometrics</u>: 95% symmetry calf circumference at 10 cm distal to tibial tubercle compared to uninvolved limb 3. <u>Weight Bearing</u>: Normalized gait and jogging mechanics 4. <u>Strength</u>: 25 single leg heel raises with heel height within 20% of uninvolved limb 5. <u>Timeframe</u>: Initiate between Weeks 12-16
Criteria for Return to Sport	<ol style="list-style-type: none"> 1. <u>ROM</u>: 95% symmetry ROM (DF/PF) compared to uninvolved limb 2. <u>Weight Bearing</u>: Normalized gait and jogging mechanics 3. <u>Strength</u>: <10% plantarflexor asymmetry at 0° DF and <25% asymmetry at 20° PF with handheld dynamometer compared to uninvolved limb (Appendix A) 4. <u>Neuromuscular Control</u>: 90% symmetry between limbs on Y-balance test with appropriate lower extremity mechanics 5. <u>Functional Hop Testing</u>: 90% symmetry SL hop testing (Appendix B) 6. <u>Physician Clearance</u> 7. <u>Timeframe</u>: Initiate between 6-9 months



Red Flags

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

Red Flags	<ul style="list-style-type: none"> • Signs of DVT (<i>Refer directly to ED</i>) <ul style="list-style-type: none"> ○ Localized tenderness along the distribution of deep venous system ○ Entire LE swelling ○ Calf swelling >3cm compared to asymptomatic limb ○ Pitting edema ○ Collateral superficial veins
------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Protection Phase (Post-op - 2 weeks)

Precautions	<ul style="list-style-type: none"> • Maintain post-operative splint or cast per surgeon (if splint or cast is not removable, then treatment will only be initiated at proximal joints) • NWB x 2 weeks (or as directed by surgeon)
ROM	<ul style="list-style-type: none"> • Joint mobilizations: improve accessory motion at subtalar, distal tibiofibular, midfoot, and forefoot joints as needed • Initiate PROM <ul style="list-style-type: none"> ○ PF as tolerated ○ DF to minimal stretch, DO NOT aggressively stretch <p><i>*Only performed if patient is in removable splint or cast</i></p>
Weight Bearing	<ul style="list-style-type: none"> • NWB x 2 weeks (or as directed by surgeon) <ul style="list-style-type: none"> ○ Refer to surgeon's post-operative report or office visit note for specific instructions on weight bearing
Therapeutic Exercise	<ul style="list-style-type: none"> • Initiate foot intrinsic exercises: <ul style="list-style-type: none"> ○ Toe taps ○ Arch doming ○ Toe spreading • Towel crunches • Ankle AROM/alphabets • SLR 4-way <p><i>*All exercises should be pain-free; only performed if patient is in removable splint or cast</i></p>
Goals	<ul style="list-style-type: none"> • Reduce edema • Ensure closure of incision • Educate on DVT/thromboembolism



Early Loading Phase (2-6 weeks)

Precautions	<ul style="list-style-type: none"> • DF P/AROM to minimal stretch, DO NOT aggressively stretch
ROM	<ul style="list-style-type: none"> • Initiate pain-free AROM plantarflexion, inversion, eversion; continue PROM • Joint mobilizations: improve accessory motions at subtalar, distal tibiofibular, midfoot, and forefoot joints as needed
Weight Bearing	<ul style="list-style-type: none"> • Initiate WBAT with crutches in CAM walker boot starting post-op Week 2 <ul style="list-style-type: none"> ○ 2 heel lifts: remove 1 lift every 1-2 weeks per surgeon's note • Discharge crutches by Week 4 • Week 4: Initiate weight shifts out of boot as tolerated
Therapeutic Exercise	<ul style="list-style-type: none"> • Submaximal ankle isometrics all planes • Seated heel raises • BAPS board seated as tolerated • Recumbent bike with CAM boot • Gluteal and lumbopelvic strength and stability • Initiate at 4 weeks: <ul style="list-style-type: none"> ○ Progressive resisted PF, inversion, and eversion with theraband ○ Seated heel raises with light weight ○ Initiate balance/proprioceptive training on stable surface once able to weight bear in neutral ankle position out of boot ○ Standing BAPS board as tolerated: PWB → FWB ○ Light weight double leg press <p><i>All exercises should be pain-free</i></p>
Other Suggested Interventions	<ul style="list-style-type: none"> • May initiate soft tissue mobilization and incisional mobility after adequate wound closure • Pool therapy may begin at post-op week 4 (if wound closed and able to weight bear in neutral ankle position out of boot) • Neuromuscular Electrical Stimulation at 4 weeks in standing when patient able to equally bear weight
Goals	<ul style="list-style-type: none"> • Initiate ankle strengthening • DF P/AROM to 0° with knee extended



Strength Phase (6-12 weeks)

Precautions	<ul style="list-style-type: none"> • DF P/AROM to minimal stretch, DO NOT aggressively stretch
ROM	<ul style="list-style-type: none"> • Achieve full PROM/AROM plantarflexion, inversion, eversion • Joint mobilizations: improve accessory motion at subtalar, distal tibiofibular, midfoot, and forefoot joints as needed
Weight Bearing	<ul style="list-style-type: none"> • Week 8: Begin to wean out of boot, initiate walking in shoe/neutral ankle position <ul style="list-style-type: none"> ○ Use of heel wedges (≤ 2) in shoe as needed: start with number of wedges where no pain is felt and patient demonstrates proper gait mechanics, remove as able
Therapeutic Exercise	<ul style="list-style-type: none"> • Initiate balance training on unstable surfaces • Continue BAPS standing as tolerated within pain-free ROM, increasing level as able • Closed chain hip and knee strengthening per patient's tolerance • Recumbent bike in shoe • Initiate calf raise progression on shuttle: <ul style="list-style-type: none"> ○ Double leg \rightarrow 2 up 1 down \rightarrow single leg ○ Starting position: neutral ankle \rightarrow dorsiflexion • Week 8: Initiate standing heel raise progression as able <ul style="list-style-type: none"> ○ Double leg \rightarrow 2 up 1 down \rightarrow single leg ○ Starting position: neutral ankle \rightarrow dorsiflexion • Week 10: <ul style="list-style-type: none"> ○ Initiate step holds with focus on lower extremity alignment and balance (within available DF) ○ Initiate heel taps (within available DF) <p><i>All exercises should be pain-free</i></p>
Criteria to Discharge Walking Boot	<ol style="list-style-type: none"> 1. <u>ROM</u>: Able to achieve 0° DF 2. <u>Weight Bearing</u>: Demonstrates pain-free ambulation without antalgic gait 3. <u>Timeframe</u>: Full discharge from boot and heel lifts by Week 8
Goals	<ul style="list-style-type: none"> • Initiate weight bearing strengthening exercises • Gradual wean from boot and lifts with goal of ambulation in supportive shoe by Week 8 • ≥ 10 single leg heel raises with heel height within 20% of uninvolved limb



Return to Function Phase (12 weeks – Return to Sport/Activity)

Precautions	<ul style="list-style-type: none"> • None
ROM	<ul style="list-style-type: none"> • May initiate gastrocnemius-soleus complex stretching as needed to restore DF ROM • Joint mobilizations and soft tissue mobility as needed
Weight Bearing	<ul style="list-style-type: none"> • Normalized gait mechanics • Reciprocal pattern with stair ascent and descent
Therapeutic Exercise	<ul style="list-style-type: none"> • Emphasize strengthening at end-range PF <ul style="list-style-type: none"> ○ 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 ○ Toe walking • Heels raises in knee flexion • Continued progression of strength/stability/balance exercise on stable and unstable surfaces to correct altered mechanics • Initiate plyometric progression: <ul style="list-style-type: none"> ○ 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	<ol style="list-style-type: none"> 1. <u>ROM</u>: 95% symmetry ROM (DF/PF) compared to uninvolved limb 2. <u>Anthropometrics</u>: 95% symmetry calf circumference at 10 cm distal to tibial tubercle compared to uninvolved limb 3. <u>Weight Bearing</u>: Normalized gait and jogging mechanics 4. <u>Strength</u>: 25 single leg heel raises with heel height within 20% of uninvolved limb 5. <u>Timeframe</u>: Initiate between Weeks 12-16
Criteria for Return to Sport	<ol style="list-style-type: none"> 1. <u>ROM</u>: 95% symmetry ROM (DF/PF) compared to uninvolved limb 2. <u>Weight Bearing</u>: Normalized gait and jogging mechanics 3. <u>Strength</u>: ≤10% plantarflexor asymmetry at 0° DF and <25% asymmetry at 20° PF with handheld dynamometer compared to uninvolved limb (Appendix A) 4. <u>Neuromuscular Control</u>: 90% symmetry between limbs on Y-balance test with appropriate lower extremity mechanics 5. <u>Functional Hop Testing</u>: 90% symmetry SL hop testing (Appendix B) 6. <u>Physician Clearance</u> 7. <u>Timeframe</u>: Expected time frame between 6-9 months



Appendix A: Hand-Held Dynamometry for Ankle Plantarflexion

Position	<ul style="list-style-type: none"> • Patient in long-sit position on non-slip floor with foot against wall; barefoot • Knee is fully extended
Placement	<ul style="list-style-type: none"> • Hand-held dynamometer placed between wall and foot, against plantar surface of foot just proximal to the metatarsal heads • Stabilize lower leg just proximal to ankle as needed
Protocol	<ul style="list-style-type: none"> • Testing performed at 0° DF and 20° PF • 3 isometric contractions performed in each position lasting 3-5 seconds each • Minimum 10 second rest between trials, 1 minute rest between testing angles • Take average of the 3 trials at each angle • Determine symmetry index for each angle: $(\text{involved/uninvolved}) * 100 = \% \text{ symmetry}$
Goal	<ul style="list-style-type: none"> • 0° DF: $\leq 10\%$ asymmetry between limbs • 20° PF: $\leq 25\%$ asymmetry between limbs

0° dorsiflexion



20° plantarflexion



*Measurements obtained via hand-held dynamometry will always yield lower values than formal Biodex testing. The numbers obtained from hand-held dynamometry are best utilized to determine level of symmetry between involved and uninvolved limbs versus as an accurate representation of force production.

References

- Marmon, Adam R, Federico Pozzi, Ali H Alnahdi, and Joseph A Zeni. (2013). "The Validity of Plantarflexor Strength Measures Obtained through Hand-Held Dynamometry Measurements of Force." *International journal of sports physical therapy* 8(6): 820–27.
- Orishimo, Karl F et al. (2018). "Can Weakness in End-Range Plantar Flexion After Achilles Tendon Repair Be Prevented?" *Orthopaedic journal of sports medicine* 6(5): 2325967118774031.
- Spink, Martin J., Mohammad R. Fotoohabadi, and Hylton B. Menz. (2010). "Foot and Ankle Strength Assessment Using



THE OHIO STATE UNIVERSITY

WEXNER MEDICAL CENTER

For OSUWMC USE ONLY. To license, please contact the OSU Technology Commercialization Office at <https://tco.osu.edu>.

Hand-Held Dynamometry: Reliability and Age-Related Differences." *Gerontology* 56(6): 525–32.

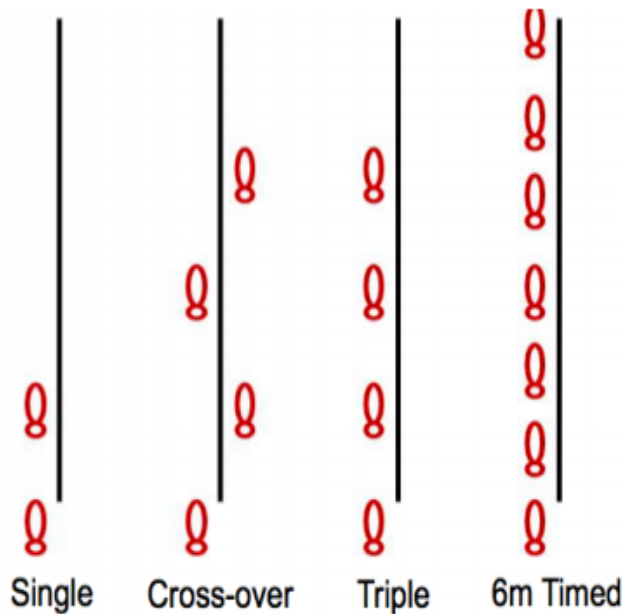
Appendix B: Single Leg Hop Series



THE OHIO STATE UNIVERSITY
WEXNER MEDICAL CENTER

For OSUWMC USE ONLY. To license, please contact the OSU Technology Commercialization Office at <https://tco.osu.edu>.

- 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: $\text{Involved limb distance} / \text{Uninvolved limb distance} \times 100\%$.
- 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: $\text{Involved limb distance} / \text{Uninvolved limb distance} \times 100\%$.
- 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: $\text{Involved limb distance} / \text{Uninvolved limb distance} \times 100\%$.
- 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: $\text{Involved limb time} / \text{Uninvolved limb time} \times 100\%$.



Author: Tessa Kasmar, PT, DPT, OCS

Reviewers: Adam Groth MD, Timothy Miller MD, Kevin Martin MD, Tiffany Marulli, PT, DPT, OCS; Lucas VanEtten, PT, DPT, OCS, Victoria Otto, PT, DPT

Completion date: May 2020

References

- Achten, J., Parsons, N. R., Kearney, R. L., Maia Schlüssel, M., Liew, A. S., Dutton, S., ... Costa, M. L. (2017). Cast versus functional brace in the rehabilitation of patients treated non-operatively for a rupture of the Achilles tendon: protocol for the UK study of tendo achilles rehabilitation (UK STAR) multi-centre randomised trial. *BMJ Open*, 7(10), e019628. <https://doi.org/10.1136/bmjopen-2017-019628>
- Agres, A. N., Gehlen, T. J., Arampatzis, A., Taylor, W. R., Duda, G. N., & Manegold, S. (2018). Short-term functional assessment of gait, plantarflexor strength, and tendon properties after Achilles tendon rupture. *Gait and Posture*, 62(March), 179–185. <https://doi.org/10.1016/j.gaitpost.2018.03.007>
- Bäcker, H. C., Yenchak, A. J., Trofa, D. P., & Vosseller, J. T. (2018). Strength Measurement After Achilles Tendon Repair. *Foot and Ankle Specialist*, XX(X), 1–9. <https://doi.org/10.1177/1938640018819779>
- Brumann, M., Baumbach, S., Mutschler, W., & Polzer, H. (2014). Accelerated rehabilitation following Achilles tendon repair after acute rupture - Development of an evidence-based treatment protocol. *Injury*, 45(11), 1782–1790.
- Chiodo, C. P., Glazebrook, M., Bluman, E. M., Cohen, B. E., Femino, J. E., Giza, E., ... American Academy of Orthopaedic Surgeons. (2010). Diagnosis and treatment of acute Achilles tendon rupture. *The Journal of the American Academy of Orthopaedic Surgeons*, 18(8), 503–510. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/20675643>
- Eliasson, P., Agergaard, A.-S., Couppé, C., Svensson, R., Hoeffner, R., Warming, S., ... Magnusson, S. P. (2018). The Ruptured Achilles Tendon Elongates for 6 Months After Surgical Repair Regardless of Early or Late Weightbearing in Combination With Ankle Mobilization: A Randomized Clinical Trial. *The American Journal of Sports Medicine*, 46(10), 2492–2502. <https://doi.org/10.1177/0363546518781826>
- Huang, J., Wang, C., Ma, X., Wang, X., Zhang, C., & Chen, L. (n.d.). *Rehabilitation Regimen After Surgical Treatment of Acute Achilles Tendon Ruptures A Systematic Review With Meta-analysis*. <https://doi.org/10.1177/0363546514531014>
- Maffulli, G., del Buono, A., Richards, P., Oliva, F., & Maffulli, N. (2017). Conservative, minimally invasive and open surgical repair for management of acute ruptures of the achilles tendon: A clinical and functional retrospective study. *Muscles, Ligaments and Tendons Journal*, 7(1), 46–52. <https://doi.org/10.11138/mltj/2017.7.1.046>
- Maffulli, N., Tallon, C., Wong, J., Peng Lim, K., & Bleakney, R. (2003). Early Weightbearing and Ankle Mobilization after Open Repair of Acute Midsubstance Tears of the Achilles Tendon. *The American Journal of Sports Medicine*, 31(5), 692–700. <https://doi.org/10.1177/03635465030310051001>
- Martin, R. L., Chimenti, R., Cuddeford, T., Houck, J., Matheson, J. W., Mcdonough, C. M., ... Torburn, L. (2018). Clinical Practice Guidelines Achilles Pain, Stiffness, and Muscle Power Deficits: Midportion Achilles Tendinopathy Revision 2018 Summary of Recommendations. *J Orthop Sports Phys Ther*, 48(5), 1–38. <https://doi.org/10.2519/jospt.2018.0302>
- McCormack, R., & Bovard, J. (2015). Early functional rehabilitation or cast immobilisation for the postoperative management of acute Achilles tendon rupture? A systematic review and meta-analysis of randomised controlled trials. *British Journal of Sports Medicine*, 49(20), 1329–1335. <https://doi.org/10.1136/bjsports-2015-094935>
- Mullaney, M., Tyler, T. F., McHugh, M., Orishimo, K., Kremenik, I., Caggiano, J., & Ramsey, A. (2011). Electromyographic analysis of the triceps surae muscle complex during achilles tendon rehabilitation program exercises. *Sports Health*, 3(6), 543–546. <https://doi.org/10.1177/1941738111416911>
- Orishimo, K. F., Schwartz-Balle, S., Tyler, T. F., McHugh, M. P., Bedford, B. B., Lee, S. J., & Nicholas, S. J. (2018). Can Weakness in End-Range Plantar Flexion After Achilles Tendon Repair Be Prevented? *Orthopaedic Journal of Sports Medicine*, 6(5), 2325967118774031. <https://doi.org/10.1177/2325967118774031>
- Saxena, A., Ewen, B., & Maffulli, N. (n.d.). *Rehabilitation of the Operated Achilles Tendon: Parameters for Predicting Return to Activity*. <https://doi.org/10.1053/j.jfas.2010.10.008>
- Spennacchio, P., Vascellari, A., Cucchi, D., Canata, G. L., & Randelli, P. (2016). Outcome evaluation after Achilles tendon ruptures. A review of the literature. *Joints*, 4(1), 52–61. <https://doi.org/10.11138/jts/2016.4.1.052>
- Zhao, J.-G., Meng, X.-H., Liu, L., Zeng, X.-T., & Kan, S.-L. (2017). Early functional rehabilitation versus traditional immobilization for surgical Achilles tendon repair after acute rupture: a systematic review of overlapping meta-analyses. *Scientific Reports*, 7, 39871. <https://doi.org/10.1038/srep39871>



THE OHIO STATE UNIVERSITY

WEXNER MEDICAL CENTER

For OSUWMC USE ONLY. To license, please contact the OSU Technology Commercialization Office at <https://tco.osu.edu>.