Guidelines for Post-operative Rehabilitation following a mid-substance Achilles Tendon Repair using the Arthrex® Speedbridge™ System

A Criterion-Based Approach

These guidelines are intended to assist the rehabilitation clinician in their decision making around exercise selection and advice given to patients through their rehabilitation journey. The information provided is not intended to be prescriptive or exclusive, nor is it time-frame driven. Rather, the guidelines are criterion-based which require patients to achieve certain clinical, capacity and functional goals to enable them to successfully progress to the next phase of rehabilitation. You will see minimum time frames outlined at the top of each section. These are in place to respect the biology of the affected tissue and it is not essential that patients commence each phase at that exact time point; it is perfectly acceptable to hold back from starting a phase if they have not achieved the criteria for beginning the phase, which is also clearly indicated at the top of each section.

Rehabilitation therapists should always use their judgement and acknowledge pain, swelling, mobility, proprioception, quality of movement and strength factors in their clinical reasoning towards exercise prescription and patient advice. It is also important to acknowledge that these guidelines are not designed to be used in other Achilles tendon repair situations such as insertional Achilles fixation, repairs involving tendon transfer or any other minimally invasive or knotless system.

Although generally the mid substance Speedbridge fixation results in earlier mobilisation, it is important to assist the patient in setting realistic rehabilitation goals and help them to be motivated by the criteria for recovery rather than being time frame orientated.

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Phase 0: Pre-op

Criteria for beginning phase

Meets surgical criteria for mid-substance Achilles tendon Speedbridge fixation

Range of Motion	Weight Bearing	Exercise	Goals	Guidelines/Restrictions/ Precautions
Caution around excessive ankle loaded plantarflexion stress(i.e. protect the Achilles musculotendi-nous unit) and excessive stretching of the Achilles which may encourage further retraction of the tendon stumps	Full or PWB 1-2 elbow crutches according to gait pattern and symptoms Consider placing in a boot with heel raises or use heel raise inserts within patient's footwear to assist with approximation of the affected tendon. Taping may also be utilised if a boot is temporarily unavailable	• Choose exercise, resistance & equipment after establishing severity, irritability and nature of injury • Assume compromised Achilles tendon but maintain basic ROM with caution into plantarflexion loading and dorsiflexion stretching • Maintain ankle strength as able utilising either isometric non-weight bearing dorsiflexion, inversion and eversion • Quadriceps, gluteal, hamstring and core maintenance exercises as able • Consider strategies to maintain cardiovascular function (i.e. hand bike)	• Preserve Achilles tendon as far as possible • Reduce swelling • Maintain lower limb function • Maintain/maximise ankle dorsiflexion, inversion and eversion strength • Maintain CV function	• Rest foot & ankle and elevate where possible when not performing exercises • Ice the ankle for 10-20min approx. up to 5 times per day as able and indicated according to swelling and pain • Consider using cold compression cuff if available • Use crutches as indicated • Wear tubigrip or other compression garment throughout the day and remove at night if indicated due to swelling • Consider the use of a temporary boot, heel raises and taping

Phase 1: Initial Post-op (Days 1-14)

Criteria for beginning phase

Successful operative outcome | Assumes no complication | Surgeon in agreement with post-operative protocol

Key focus:

facilitate wound healing and minimise infection risk

Range of Motion	Weight Bearing	Exercise	Goals	Guidelines/Restrictions/ Precautions
Typically the Speedbridge allows for early mobilisation into slight Achilles tendon stress however pain and wound protection are the key limiting factors in this phase. **Non-weight bearing active dorsi-flexion can be commenced and limited by patient comfort however check if there is a 'safe zone' advised by the surgeon and this is normally not beyond plantar grade/neutral.** **No passive dorsiflexion**	Use of boot with ~1.5cm heel raise inserted Can come out of boot to allow NWB gentle active ROM within patient comfort Partial weight bearing according to comfort 1-2 elbow crutches if required for comfort and gait normalisation. Reduce crutches in stages depending on pain and gait pattern	ROM • Active open chain ankle ROM all directions within comfortable range and phase limits • AP talus passive translation mobilisation* • Subtalar passive mobilisation* • 1st ray/MTPJ passive ROM • No passive dorsiflexion stretching * Take care to protect the wound STRENGTH & CONTROL • Isometric ankle plantarflexion (straight & bent knee), dorsiflexion, inversion and eversion in neutral as tolerated (can be done within the boot) • Foot intrinsic muscle strengthening (i.e. towel scrunches) • Open chain quads strengthening (with or without added resistance) • Hamstring strengthening with resistance band or hamstring curl machine. Nordics can be considered as long as the ankle can be sufficiently protected in the boot. • NWB hip control/strengthening • Core/trunk conditioning without lower limb loading • Gait education and drills CARDIOVASCULAR • Consider hand bike • N.B. Foot pedal bike should be avoided in the wound healing stage to minimise sweating around the wound which may increase infection risk	• Protect surgical wound • Gain patient comfort • Protection of surgical repair • Reinstate optimal gait pattern • Achieve active ankle dorsiflexion to neutral/plantar grade • Maintain quads and hamstrings strength • Maintain hip/pelvis and trunk control & stability	• Wound protection and infection control are key in this phase – due to limited vascularity and the use of a boot excessive movement and loading should be avoided in this phase to prevent creating a hot a humid environment • Rest foot & ankle and elevate where possible when not performing exercises • Use crutches as indicated • Keep walking duration short and only as required • Come out of boot only in a controlled environment to perform gentle ROM exercises and then place boot back on following this • No driving (unless automatic car and right foot unaffected) • No passive ankle stretching • No toe stance • No jumping • No running

Phase 2: Early Post-op (not before week 2)

Criteria for beginning phase

Wound is clean and dry with no infection | Able To walk without crutches in boot | Pain reducing

Key Focus:

Commence standing closed chain strength work in boot and early static standing work without boot

Range of Motion	Weight Bearing	Exercise	Goals	Guidelines/Restrictions/ Precautions
Full active, non-weight-bearing plantarflexion, inversion and eversion. **Active dorsiflexion to patient limits.** **No passive dorsiflexion**	Heel raise can come out of boot Wear boot when not performing ankle rehabilitation FWB in boot No crutches	ROM • Maintain previous ROM exercises • Continue with passive mobilisations and soft-tissue release as indicated (avoiding surgical repair site) • Maintain 1st ray/MTPJ ROM STRENGTH & CONTROL • Maintain previous phase • Maintain isometric ankle plantar flexion – can be done out of boot • Commence band resisted ankle isotonic dorsiflexion, inversion and eversion • Commence wall slides with boot on • Supine glute bridges if patient can comfortably complete without boot • Core / trunk conditioning can include lower limb loading as tolerated PROPRIOCEPTION/BALANCE • Consider narrow base static standing on two feet without boot but within training shoes with eyes closed. *controlled environment only* • No arm movements • Keep work ratio short and ensure plenty of rest time – consider duration of standing time CARDIOVASCULAR • Hand bike, consider static bike with boot on • Consider pool based aqua jogging a light rehab exercise assuming the sutures/clips removed and wound has healed satisfactorily – check with surgeon if unsure	• Minimal pain • Commence isometric plantar flexion • Maintain ankle ROM within phase limits • Maintain lower limb, core and CV conditioning	• Rest the leg and elevate as much as possible when not performing physiotherapy exercises • Walking can be undertaken without crutches using a boot as long as gait pattern is uncompensated. • Walking should be limited to a maximum of 15-20mins continuously and up to a maximum of twice per day according to symptoms • Come out of boot only in a controlled environment to perform rehabilitation exercises and then place boot back on following this • No driving (unless automatic car and right foot unaffected) • No passive ankle dorsiflexion stretching • No toe stance • No jumping • No running

Phase 3: Early functional (not before week 4)

Criteria for beginning phase
Completing full rehabilitation exercises from Phase 2 competently and without pain

Key focus
Develop sufficient dorsiflexion range and plantar flexion strength to facilitate graduated removal of boot

Range of Motion	Weight Bearing	Exercise	Goals	Guidelines/Restrictions/ Precautions
Limit active dorsiflexion by patient comfort **Gentle passive dorsiflexion stretching may be applied if the patient is struggling to reach plantargrade /neutral actively**	FWB in boot Consider short periods walking out with boot as symptoms allow	ROM • Maintain previous ROM exercises • Continue with passive joint mobilisations and soft-tissue release as indicated • Consider passive ankle dorsiflexion stretching only if patient is not achieving active plantargrade/neutral STRENGTH & CONTROL • Maintain previous phase • Develop band resisted ankle isotonic dorsiflexion, inversion and eversion • Introduce band resisted ankle plantar flexion not going beyond plantargrade/neutral – straight and bent knee • Introduce wall squats without boot • Consider single leg glute bridges without boot • Gait practice in controlled environment without boot – short bouts with good rest time PROPRIOCEPTION/BALANCE • narrow base static standing on two feet without boot with eyes closed + arm movements • Wide base static standing on two feet on unstable base (i.e. balance pad/cushion) • Consider single leg static standing with eyes closed no arm movements CARIDOVASCULAR • Static bike with boot on • Aqua jogging	• Achieve active dorsiflexion to plantar grade • Develop early isotonic plantar flexion strength • Progress static balance/proprioception	• Ensure symmetrical patterning on wall squat • Monitor pain and effusion levels in response to introduction of new activities • Walking shoulder be limited to a maximum of 15-20mins continuously and up to a maximum of three times per day according to symptoms • Come out of boot for short duration gait practice only in a controlled environment • Wear boot when outdoors or spending more time on feet • Can commence driving as comfort allows • No toe stance • No jumping • No running

Phase 4: Mid functional (not before week 6)

Criteria for beginning phase

Active ankle dorsiflexion to plantar grade | Completing full rehabilitation exercises from Phase 3 competently and without pain

Phase Exit Testing

ROM | FADI at end of phase | Double leg calf raises

Range of Motion	Weight Bearing	Exercise	Goals	Guidelines/Restrictions/ Precautions
Dorsiflexion aim 0-20 deg active **Passive stretching can be used gently to assist if limited**	FWB Mostly phasing out using boot – may use for comfort as required or if patient spending longer on feet.	ROM • Continue with previous ROM exercises • Commence closed chain ankle dorsiflexion mobilisation up to 20 degrees (goniometer or phone app can be used to monitor) STRENGTH & CONTROL • Continue with band-resisted isotonic ankle strengthening if indicated • Commence double leg gastrocnemius and soleus biased calf raises from the floor • Progress squat activities and consider split squat and single leg squat progressions as able • Continue/progress with previous lower limb strength through chain • Commence small step-up work under control with a view to developing good reciprocal pattern on stairs PROPRIOCEPTION/BALANCE • Single leg stance with arm movements +/- eyes closed on unstable base (i.e. balance pad/cushion) CARDIOVASCULAR • Static bike, aqua jogging, consider rowing machine	• Min 10deg active dorsiflexion ROM • Double leg calf raises from floor – achieves 20 full range plantarflexion • FADI >75% • Reciprocal and symmetrical stair pattern	• Ensure symmetrical pattern on calf raises and squat activities • Patients may experience some discomfort at the posterior calcaneus at the site of the surgical swivel lock fixation – monitor this and consider limiting calf raise volume. • Monitor walking duration and irritability as patient transitions out of the boot • No jumping • No running

Phase 5: Late functional (not before week 10)

Criteria for beginning phase

Ankle dorsiflexion to 10 deg | Completing full rehabilitation exercises from Phase 4 competently and without pain | FADI >75% | Achieves 20 full range double leg calf raises

Phase Exit Testing

FADI at end of phase | Single leg calf raises

Range of Motion	Weight Bearing	Exercise	Goals	Guidelines/Restrictions/ Precautions
Full	FWB – no boot	ROM • Work on closed chain dorsiflexion and consider manual mobilisation to facilitate • Maintain through lower limb kinetic chain STRENGTH & CONTROL • Commence single leg gastrocnemius and soleus biased calf raises from the floor and then progressing to over a step (i.e. into dorsiflexion) – N.B. can consider double leg calf raises over step prior to single leg work • Maintain/progress single leg squats • Larger step work (i.e. step-up with kick) • Commence forward lunge-based activities • Develop lower limb & core strength as appropriate PROPRIOCEPTION/BALANCE • Single leg stance with arm movements +/- eyes closed on unstable base (i.e. balance pad/cushion) • Side-stepping, carioca and other entry level agility exercises – may wish to start at a walking pace CARDIOVASCULAR • Utilise static bike, aqua jogging and rowing machine. • Consider cross trainer as ankle function permits	• FADI >85% • Normal gait pattern with no boot • Normal reciprocal stair pattern • Single leg calf raises – achieves 20 full range over edge of step	• Patient to use 'Soreness rules' (see below) to guide rehab intensity and frequency • Patients may experience some discomfort at the posterior calcaneus at the site of the surgical swivel lock fixation – monitor this and consider limiting calf raises over edge of step (i.e. limit end-range loading) • Monitor kinetic chain ROM and control (i.e. ankle dorsiflexion range, knee flexion during landing & pelvic/hip control). • You may wish to contain the volume of walking in the context of overall load

Phase 6: Transitional (not before week 12)

Criteria for beginning phase

- FADI >85% | Achieves 20 full range single leg calf raises over edge of step | Completing full rehabilitation exercises from Phase 5 competently and without pain

Phase Exit Testing

FADI at end of phase | Hop Testing – at end of phase

Range of Motion	Weight Bearing	Exercise	Goals	Guidelines/Restrictions/ Precautions
Full	FWB	ROM Maintain through lower limb kinetic chain STRENGTH & CONTROL • Continue/progress single leg squats • Continue/progress single leg calf raises on step • Continue/progress multi-directional lunge work • Progress closed chain loading (i.e. back squat load & depth; Olympic lifts etc as indicated depending on patient demographic and goals) • Commence landing control exercise as indicated • Continue with / advance hamstring, bridge, trunk work • Can commence entry level plyometrics program if indicated according to patient demographic and functional goals – consider vertical, horizontal and pivoting components of the person's ultimate functional goals. Monitor ground impacts (starting at 80 reps per session) and follow a logical and criterion-based progression** PROPRIOCEPTION/BALANCE • Agility circuits with multi-components – advance to reflect patient goals or sport-specificity	• FADI >95% • Vertical hop testing – able to achieve 20 single leg hops on the spot with equal height to unaffected side without pain or irritation • Y-Balance Test – composite score >85% contralateral side	• Patient to use 'Soreness rules' (see below) to guide rehab intensity and frequency • Monitor kinetic chain ROM and control (i.e. ankle dorsiflexion range & pelvic/hip control) to prevent anterior knee overload • **Elite level athletes and well-conditioned individuals may be able to tolerate the introduction of plyometrics very well, however if patients are not previously familiar with these types of formal plyometric activities, then other lower level stretch-shorten-cycle activities (such as higher speed resistance band plantarflexion oscillations or fast step-ups onto a small step keeping the heel off the ground)

Phase 7: Sport-specific (not before week 16)

Criteria for beginning phase

- Full ROM | FADI >95% | Y-Balance Test – composite score >85% contralateral side | Vertical hop testing – able to achieve 20 single leg with equal height to contralateral side

Phase Exit Testing

FADI at end of phase | Y-Balance Test – at end of phase | Hop Testing – at end of phase | Sport-specific fitness testing

Range of Motion	Weight Bearing	Exercise	Goals	Guidelines/Restrictions/ Precautions
Full	FWB	ROM Maintain through lower limb kinetic chain STRENGTH & CONTROL • Continue/progress single leg squats • Continue/progress single leg calf raises on step • Continue/progress multi-directional lunge work • Progress closed chain loading (i.e. back squat load & depth; Olympic lifts etc) • Progress landing control exercises (i.e. add plyometric components) • Continue with / advance hamstring, bridge, trunk work • Add more advanced cutting/twisting/turning movements with progressive exposure to training drills. Start with few variables and progress towards open play PROPRIOCEPTION/BALANCE • Agility circuits with multi-components – advance to reflect sport-specificity RUNNING PROGRAM Patients can commence a running program – two examples are outlined below. In some exceptional circumstances, elite athletes or highly conditioned patients may be able to commence running prior to 16 weeks, however this decision should be made in conjunction with the surgeon. For most people it is sensible and appropriate to wait until at least 16 week.	• FADI >95% • Y-Balance Test – composite score >95% • Hop testing (single, triple, x-hop, timed lateral, timed forward 6m) > 95%	• Patient to use 'Soreness rules' (see below) to guide rehab intensity and frequency • Monitor kinetic chain ROM and control (i.e. ankle dorsiflexion range & pelvic/hip control) to prevent anterior knee overload • Patient must adequately demonstrate sport-specific training and sport-specific testing may be indicated to determine return to play readiness alongside the Phase 7 goals. • Generally patients will not return to competitive sport before 16 weeks and may take considerably longer depending on the multitude of factors involved with their recovery, including the sport or activity they wish to return to • The most important factors in determining readiness to return to play are the objective functional measures outlined and the patient's confidence in their abilities.

Soreness Rules	
1. Soreness during warm-up that continues	2 days off, drop down one level
2. Soreness during warm-up that goes away	Stay at level that led to soreness
3. Soreness during warm-up that goes away but returns during the session	2 days off, drop down one level
4. Soreness the day after session (not muscle soreness)	1 day off, do not advance program to next level
5. No soreness	Advance 1 level per week or as instructed by physiotherapist

Running Program 1 (easy)			
	Run	**Walk**	**Sets**
Level 1	30s	4min 30s	X 4
Level 2	1min	4min	X 4
Level 3	1min 30s	3min 30s	X 4
Level 4	2min	3min	X 4
Level 5	2min 30s	2min 30s	X 4
Level 6	3min	2min	X 4
Level 7	3min 30s	1min 30s	X 4
Level 8	4min	1min	X 4
Level 9	4min 30s	30s	X 4
Level 10	5min	0s	X 4

Perform no more than 4 times in 1 week and no more frequently than every 2nd day. Do not progress more than 2 levels in a 7 day period. Patient should follow the 'Soreness Rules' outlined above to guide their progression through the running program.

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Running Program 2 (harder)		
	Option 1: Treadmill or Outdoors	**Option 2: Track**
Level 1	0.2 km walk; 0.2 km jog x 10 (4 km)	Jog straights /walk bend (4 km)
Level 2	0.2 km walk; 0.4 km jog x 7 (4.2 km)	Jog straights / jog 1 bend every 2nd lap (4km)
Level 3	0.2 km walk; 0.6 km jog x 5 (4 km)	Jog straights / jog 1 bend every lap (4 km)
Level 4	0.2 km walk; 0.8 km jog x 4 (4 km)	Jog 1.75 laps / walk 1 curve (2 km)
Level 5	Jog full 4 km	Jog all laps (2km)
Level 6	Jog 5 km	Jog 5km
Level 7	Jog 6 km	Jog 6 km
Level 8	Alternate between running and jogging every 0.5 km x 6	Alternate between running on the straights and jogging on the bends (6km)

Perform no more than 4 times in 1 week and no more frequently than every 2nd day. Do not progress more than 2 levels in a 7 day period. Patient should follow the 'Soreness Rules' outlined above to guide their progression through the running program. Based on running program proposed by Adams et al. (2012).

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