Guidelines for Post-operative Rehabilitation following a Modified Broström Repair (for anterior talofibular ligament) with *Internal Brace*™ Augmentation

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 requires 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 concurrent injury and surgical procedures associated with lateral ligament disruption (i.e. osteochondral lesions, microfracture, fracture fixation) as these are likely to influence the patient's recovery.

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 internal brace augmentation

Range of Motion	Weight Bearing	Exercise	Goals	Guidelines/Restrictions/ Precautions
Aim to maintain ankle dorsiflexion. **Active range within a pain-free range.** **Caution around excessive stress to affected ligament i.e. plantarflexion & inversion in anterior talofibular ligament involvement**	Full or PWB 1-2 elbow crutches according to gait pattern and symptoms	• Choose exercise, resistance & equipment after establishing severity, irritability and nature of injury • Assume unstable ankle but maintain basic ROM with caution into plantarflexion and avoid inversion • Maintain ankle strength as able utilising either isometric or non-weight bearing plantarflexion, dorsiflexion, inversion and eversion • Basic static proprioception in neutral can be considered according to severity and irritability of the presentation • Quadriceps, gluteal, hamstring and core maintenance exercises as able • Consider strategies to maintain cardiovascular function (i.e. aqua running, static bike, hand bike)	• Protect unstable ankle • Reduce swelling • Maintain lower limb function • Maintain/maximise ankle dorsiflexion and eversion • Maintain CV function	• Rest 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 external brace, support and taping

Phase 1: Initial Post-op (Days 1-7)

Criteria for beginning phase

Successful operative outcome | Assumes no or minimal additional structural pathology i.e. osteochondral lesion or fracture repair | Surgeon in agreement with post-operative protocol

Testing

ROM i.e. "Dorsiflex" iphone app

Range of Motion	Weight Bearing	Exercise	Goals	Guidelines/Restrictions/ Precautions
Aim for full dorsiflexion and eversion. **Plantar flexion and inversion can be commenced and limited by patient comfort however check if there is a 'safe zone' advised by the surgeon.** **Typically the internal brace allows for early mobilisation into affected ligament stress.**	1 elbow crutch if required for comfort and gait normalisation. Reduce in stages depending on pain and gait pattern	ROM • Active open chain ankle ROM all directions within comfortable range and phase limits • Closed chain ankle dorsiflexion mobilisation within pain-free range • AP talus translation mobilisation • Posterior chain soft-tissue release work (plantar foot & calf) • Calf stretches • Ankle pumps • Consider exercise bike up to 10min low resistance within ankle comfort - no standing STRENGTH & CONTROL • Isometric ankle plantarflexion, dorsiflexion, inversion and eversion • Open chain quads (with or without added resistance) • Wall slides (0-45º) • Hamstring strengthening with resistance band or hamstring curl machine. Nordics can be considered as long as the ankle can be sufficiently protected. • NWB hip control/strengthening • Core/trunk conditioning without lower limb loading • Gait education and drills PROPRIOCEPTION/BALANCE • Low grade ankle proprioception / joint position sense exercises	• Good control of pain • Grade 1+ effusion or less • Walking without crutches • Reinstate optimal gait pattern • Achieve 80% or > ankle dorsiflexion compared with contralateral side • Maintain quads and hamstrings strength • Maintain hip/pelvis and trunk control & stability	• Rest 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 • Use crutches as indicated • Wear tubigrip or other compression garment throughout the day and remove at night if indicated due to swelling • Consider using cold compression cuff if available • No running • Keep walking duration short and only as required

Phase 2: Early Post-op (not before 1 week)

Criteria for beginning phase

Able To walk without crutches | Ankle dorsiflexion ROM ~ 80% or greater compared with contralateral side | Pain reducing | Effusion grade 1+ or less

Testing

ROM i.e. "Dorsiflex" iphone app

Range of Motion	Weight Bearing	Exercise	Goals	Guidelines/Restrictions/ Precautions
Aim for full dorsiflexion and eversion. **Plantar flexion and inversion can be commenced and limited by patient comfort however check if there is a 'safe zone' advised by the surgeon.**	FWB	ROM • Maintain previous ROM exercises • Continue with passive mobilisations and soft-tissue release as indicated • Increase exercise bike up to 15min still low resistance. No standing STRENGTH & CONTROL • Maintain previous phase • Commence band resisted ankle isotonic plantarflexion, dorsiflexion, inversion and eversion • Progress wall slides to 90º flexion as ankle range and comfort allows • Double leg calf/heel raises from the floor • Small step work • Supine glute bridges • Core / trunk conditioning can include lower limb loading as tolerated PROPRIOCEPTION/BALANCE • Static single leg stance on stable base – ensure good pelvis/hip positioning • Double leg stance with arm movements +/- eyes closed on unstable base (i.e. balance pad/cushion) • Keep work ratio short and ensure plenty of rest time – consider duration of standing time CARDIOVASCULAR • Hand bike, consider static bike	• Minimal pain • Trace effusion or less • Achieve 80% or > ankle dorsiflexion compared with contralateral side • Begin reciprocal stair ascending and descending • Able to achieve 3 sets of 15 repetitions of full range double leg calf raises from the floor	• Rest the leg and elevate as much as possible when not performing physiotherapy exercises • Ice the ankle for 10-20min approx. up to 5 times per day as able and indicated according to swelling • Consider using cold compression cuff if available • No running • Walking can be undertaken without crutches as long as gait pattern is uncompensated. • Walking shoulder be limited to a maximum of 15-20mins continuously and up to a maximum of 3 times per day according to symptoms

Phase 3: Intermediate Post-op (not before week 2)

Criteria for beginning phase

Maintain full ankle dorsiflexion | Effusion Trace or less | Achieving stairs reciprocally with good pattern | Achieves 3 sets of 15 reps double leg calf raise from floor | Completing full rehabilitation exercises from Phase 2 competently and without pain

Testing

ROM i.e. "Dorsiflex" iphone app | FADI at end of phase | Single leg calf raises from step

Range of Motion	Weight Bearing	Exercise	Goals	Guidelines/Restrictions/ Precautions
Full ankle ROM all directions	FWB	ROM • Maintain previous ROM exercises • Progress and challenge plantarflexion as indicated • Continue with passive mobilisations and soft-tissue release as indicated • Graded progression of exercise bike up to 30min with increasing resistance STRENGTH & CONTROL • Maintain previous phase • Develop band resisted ankle isotonic plantarflexion, dorsiflexion, inversion and eversion • Introduce free-standing body weight squats • Commence single leg calf raises from floor or over step if strength and comfort permits. • Larger step work (i.e. step-up with kick) • Supine single leg glute bridges 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 CARIDOVASCULAR • Static bike, consider stepper and cross trainer	• Full ROM • Introduce agility exercises • Sufficient neuromuscular control to commence single leg squats in next phase • FADI >75% by end of phase	• Ensure symmetrical patterning on squat • Monitor pain and effusion levels in response to introduction of new activities • Increase walking to maximum of 30mins continuously and up to a maximum of 3 times per day according to symptoms • No running

Phase 4: Late Post-op (not before week 4)

Criteria for beginning phase

Maintain full ankle dorsiflexion | Effusion Trace or less | Achieves 3 sets of 15 reps single calf raise from step | Completing full rehabilitation exercises from Phase 3 competently and without pain | Obtains >75% on FADI

Testing

ROM | FADI at end of phase | Hopping on the spot at end of phase

Range of Motion	Weight Bearing	Exercise	Goals	Guidelines/Restrictions/ Precautions
Aim for full ROM – no restrictions	FWB	ROM • Continue with previous ROM exercises if there is a perception of 'tightness' or 'stiffness' or a tendency to clinically stiffen STRENGTH & CONTROL • Continue with band-resisted isotonic ankle strengthening if indicated • Continue and progress single leg calf raises over step • Commence single leg squats up to 90 degrees knee flexion • Commence lunging activities • Commence entry level landing control exercises (i.e. landing from small step, mini jumps) • Commence hopping drills once entry level landing control exercises above are performed satisfactorily • Continue with previous lower limb strength through chain PROPRIOCEPTION/BALANCE • Single leg – progress level of difficulty and consider sports-specific components (i.e. throw/catch) • Progress agility work into tight space movement drills and introduce 'cutting' movements (i.e. figure of 8's, squares) CARDIOVASCULAR • Develop CV using the most appropriate modality	• Full ROM • FADI >85% • Single leg hopping on the spot – 20 uninhibited pain-free	• Patient to use 'Soreness rules' (see below) to guide rehab intensity and frequency • Monitor kinetic chain ROM and control (i.e. ankle dorsiflexion range, knee flexion during landing & pelvic/hip control). • Increase walking to maximum of 45mins continuously and up to a maximum of twice per day according to symptoms • No running

Phase 5: Transitional Phase (not before week 6)

Criteria for beginning phase

Full ROM |No Effusion | FADI >85% | Single leg hopping on the spot – 20 uninhibited pain-free |Completing full rehabilitation exercises from Phase 4 competently and without pain

Testing

FADI at end of phase| Y-Balance Test – 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 with single leg squats • Continue/progress single leg calf raises on step (consider adding external load) • Commence multidirectional lunge work • Progress closed chain loading (i.e. graded increase back squat load & depth; consider introducing Olympic lifts if part of patients normal training) • Progress landing control exercises (i.e. increased step height; develop single leg landing control; add rotational or external perturbation components) • Commence slide board work if indicated for patients sport • Continue with / advance hamstring, bridge, trunk work PROPRIOCEPTION/BALANCE • Advanced agility circuits with multi-components (i.e. steps, speedladder, balance pads, cones – mix static with dynamic stability) • Develop hopping drills (i.e. zig-zag, ¼ turns) RUNNING PROGRAM Commence on of the running program outlined below or a similar program of your choice	• FADI >95% • Y-Balance Test – composite score >85% contralateral side • Hop testing (single, triple, x-hop, timed lateral, timed forward 6m) > 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, knee flexion during landing & pelvic/hip control). • You may wish to contain the volume of walking undertaken as the patient introduces running

Phase 6: Sport-specific (not before week 8)

Criteria for beginning phase

- Full ROM | No Effusion | FADI >85% | Y-Balance Test – composite score >85% contralateral side | Hop testing (single, triple, x-hop, timed lateral, timed forward 6m) > 85% contralateral side | Completing full rehabilitation exercises from Phase 5 competently and without pain

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 Once the running program is completed – advance to develop relevant components of sport-specific function i.e. increased straight line speed or interval-type.	• 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 6 goals. • Generally patients will not return to competitive sport before 12 weeks and may take considerably longer depending on the multitude of factors involved with their recovery • 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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