BROSTROM PROCEDURE
CLINICAL PRACTICE GUIDELINE

Background

A Brostrom procedure is an anatomical lateral ligament surgical reconstruction commonly performed for lateral ankle instability and/or in case of failure of conservative management for chronic ankle instability. Several factors may contribute to failure of conservative treatments and can be identified as the continued presence of mechanical or functional ankle instability for 6 months following injury and 3 months of conservative treatment. There are two common variations of Brostrom procedures: The Brostrom-Evans or the Brostrom-Gould procedure. Each procedure seeks to repair or recreate the anterior talofibular ligament (ATFL) to restore ankle stability. Post-operative outcomes are generally rated as excellent, with 90-95% of patients reporting full return to pre-morbid activity. Additionally, 90-95% of high level athletes return to sport within 6 months, although longevity of career and performance level have not been well examined.

Brostrom-Gould Procedure
The ATFL is debrided and repaired, and a portion of the inferior extensor retinaculum is stretched over the ATFL to reinforce the ligament.

Brostrom-Evans Procedure
In addition to the above, 1/3 of the peroneus brevis muscle is split off and threaded through the fibula, anchoring it to the lateral talus.

Operative considerations: Surgical repair is not indicated for individuals with systemic hypermobility. The following symptoms are considered to be a negative prognostic factor for outcomes following a Brostrom repair:

- Osteochondral defects
- Synovitis
- Impingement
- Peroneal tendon dysfunction
- Medial ankle instability
- Syndesmotic instability
- Obesity (BMI ≥ 30 kg/m_2)

Intra and extra-articular confounders, such as synovitis and OCD, can be managed with arthroscopic repair. This repair is typically performed in conjunction with the primary repair.
Following a Brostrom repair, the following post-operative changes are considered "normal" and are frequently observed:

- Loss of inversion ROM up to 15 degrees
- Ankle eversion strength deficit of 10% or greater
- Decreased balance, with increased postural sway
- Decreased proprioception

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.

Definitions

- *Strong level evidence*: supported by systematic review, meta-analysis, or >5 RCT
- *Moderate level evidence*: supported by 3-4 RCT
- *Low level evidence*: supported in 1-2 RCT or clinical case series
- *Expert opinion*: supported by case studies, expert opinions or opinions of the authors

Summary of Recommendations

Risk Factors for poor outcomes	• Obesity (BMI ≥ 30 kg/m2) • Generalized laxity • Hindfoot and midfoot alignment (hindfoot varus, midfoot cavus)
Corrective Interventions	• Modalities for pain & swelling • Patient education • Restore ankle ROM • Ankle and foot intrinsic strengthening • Proprioception and balance training • Hip and core stability • Therapeutic exercise and activity for specific return to sport and work
Precautions	• NWB 4-6 weeks ○ Review physician's post-operative note for details on immobilization and WB precautions including progression (posterior split, Aircast splint, CAM walking boot) • No active or passive ankle inversion or eversion for **6 weeks** • No ankle inversion at end range ankle PF for **12 weeks**
Manual Therapy	• Gentle midfoot and forefoot mobilizations; • **DO NOT INCLUDE TALOCRURAL/SUBTALAR JOINT** in order to protect repair • PROM/AAROM ankle DF/PF as tolerated • Soft tissue mobilization PRN
Outcome Tools and Testing	Consider patient reported outcome measures 1. Foot and Ankle Ability Measure (FAAM) 2. The American Orthopaedic Foot & Ankle Score (AOFAS) 3. Foot and Ankle Outcome Score (FAOS) Functional Testing 1. Y-Balance 2. Foot Lift Test **(Appendix A)** 3. Functional Hop Testing **(Appendix B)**
Criteria to Initiate Return to Running and Jumping	1. ROM: 95% symmetry ROM (DF/PF) compared to uninvolved limb 2. Weight Bearing: Normalized gait and jogging mechanics 3. Strength: 25 single leg heel raises 4. Timeframe: Initiate between Weeks 12-16
Criteria for Return to Sport/Discharge	1. Subjective Outcome Measure: > 90% 2. DF Lunge: > 7.5 cm 3. Foot Lift Test: < 5 errors. 4. Strength: <10% plantarflexor asymmetry at 0˚DF and at 20˚PF with handheld dynamometer compared to uninvolved limb **(Appendix C)** 5. Strength: <10% ankle inversion and eversion asymmetry at 0˚DF with handheld dynamometer compared to uninvolved limb **(Appendix D)** 6. Return to Sport: Functional Hop Testing > 90% LSI; Y-Balance > 90% composite 7. Physician clearance (if required)

Rehabilitation Recommendations: Acute Phase (0-6 WEEKS)

Weight Bearing *strong level evidence*	• NWB 4-6 weeks with immobilization ○ Review physician's post-operative note for details on immobilization and WB precautions including progression (posterior split, Aircast splint, CAM walking boot)

ROM Interventions *strong level evidence*	Primarily focused on activation of musculature surrounding the ankle.
	*No active or passive ankle inversion or eversion for **6 weeks**
	
	All exercises should be pain-free
	
	• Gentle AROM exercises
	  ○ DF/PF
	  ○ **No inversion/eversion**
	• Sub maximal ankle isometric
	  ○ PF
	  ○ DF
	  ○ **No Inversion/Eversion**
	• Foot intrinsic strengthening:
	  ○ Splaying
	  ○ Doming
	  ○ Great toe extension
	  ○ Ankle PF with great toe flexion
	  ○ Toe curls
	  ○ Towel curls

Manual Therapy *low level evidence*	As needed: • Gentle soft tissue mobilization to musculature surrounding the repair • Low grade joint mobilizations of accessory joints surrounding the repair. ○ **DO NOT INCLUDE TALOCRURAL/SUBTALAR** • PROM ankle DF/PF as tolerated
Modalities *low level evidence*	Should be utilized in the acute stage of rehabilitation to minimize edema • Vasopneumatic compression • Compression sleeve
Criteria to Progress *moderate level evidence*	• Progression into weight bearing with AD ○ Review physician post-operative note for WB progression (CAM walker, Aircast, brace, or tennis shoe) • Ankle PROM ≥ 75% of uninvolved

Rehabilitation Recommendations: Return to Function Stage (6-12 WEEKS)

Weight Bearing Restrictions	Full weight bearing, progressing to normal gait pattern. Normal ambulation without an AD in tennis shoe no later than **week 9.**
ROM Interventions *moderate level evidence*	Active ROM within tolerance • Stationary bicycle • Begin AROM/PROM ankle inversion/eversion at 6 weeks • Utilize kneeling DF stretch

Neuromuscular reeducation *strong level evidence*	Evidence supports the improvement of passive and dynamic (reactive) balance for return to activity. Suggested interventions include:
	• BAPS board
	  ○ Seated→ standing
	• Single leg stance (progress per patient tolerance)
	  ○ Firm surface
	  ○ Foam surface
	  ○ Dynamic surface
	  ○ Perturbations
	  ○ Cognitive task
	  ○ Eyes closed
	• Functional movement training
	  ○ Squat
	  ○ Lunge
	  ○ Heel tap
	• Step up
	  ○ Forward & lateral
	• Step and Holds (unilateral)
	  ○ Forward
	  ○ Lateral
	  ○ Progress to unstable surfaces

Therapeutic Exercise *moderate level evidence*	Focused on full ROM with special emphasis on end range training:
	***Maintain neutral ankle positioning (no inversion at end range PF for 12 weeks)**
	• Calf raise series
	  ○ Double leg
	  ○ Eccentrics (2 up, 1 down)
	  ○ Single leg
	  ○ Progression of forces
	  ▪ Seated
	  ▪ Partial weight bearing (shuttle, leg press)
	  ▪ Body weight
	• Core strengthening
	• Hip Abductors
	• Hip Extensors
	• Leg press
	• Functional movement training
	  • Squat
	  • Lunge
	  • Heel tap
	  • Step up

Criteria to Progress	• Normalized gait pattern without compensation • PROM: ≥ 90% of uninvolved • Single leg stance : ≥ 90% of uninvolved limb on firm surface • Strength: <10% plantarflexor asymmetry at 0˚DF and 20˚PF with handheld dynamometer compared to uninvolved limb **(Appendix C)** ○ Or 25 SL calf raises if handheld dynamometer is not accessible • Strength: <10% ankle inversion and eversion asymmetry at 0˚DF with handheld dynamometer compared to uninvolved limb **(Appendix D)** • No edema (figure of 8 or volumetric measurement)

Rehabilitation Recommendations: Return to Sport Stage (12-26 WEEKS)

Criteria to Initiate Return to Running and Jumping	1. ROM: 95% symmetry ROM (DF/PF) compared to uninvolved limb 2. Weight Bearing: Normalized gait and jogging mechanics 3. Strength: 25 single leg heel raises 4. Timeframe: Initiate between Weeks 12-16
Factors to Consider Prior to Return to Play	• Demands of the athlete's sport • Position specific requirements of sport • Competition level
Therapeutic Exercise *strong level evidence*	Utilize end range strengthening for ankle plantarflexors, evertors, and invertors. Manipulate training to include both endurance and power considerations based on sport. Interventions can include: • Resisted inversion and eversion in end range PF (theraband, ankle weight) • DL heel raises with theraband pulls into ankle inversion and eversion • Toe walking • Single leg calf raises (Neutral→ start in DF) • RDL's • Initiate plyometric progression: ○ Shuttle press: DL → alternating → SL • FWB: DL straight plane → diagonal plane → rotational → tuck jumps → SL Triple extension exercise • Planks • Side planks • Hip Abductors • Hip Extensors
Agility Training and Sport Specific Drills *low level evidence*	Consider periodization (in season v. out of season athlete), power v. endurance and cardiovascular conditioning with these intervention options: • Return to running progression (if met criteria above) • Lateral shuffling • Carioca • Figure 8 drills • Cone drills • Back pedal Ladder drills • Resisted jogging (sport cord) • Hop training • Drop counter jump • Change of direction drills
Criteria for Return to Play *moderate level evidence*	• Functional Hop Testing • LSI ≥90% for all tests • Star Excursion Balance Test : within 4 cm in anterior direction • Single leg stance time: 90% of contralateral limb • Foot lift test: < 5 errors • Y-Balance: > 90% composite • Pain ≤ 1/10 with activity • No reactive edema in 24 hours post activity • Ankle ROM: within 90% of contralateral limb using standard techniques • DF Lunge > 7.5 cm • Outcome Tool ○ FAAM with ≤ 1 MCID from full score (9 points)

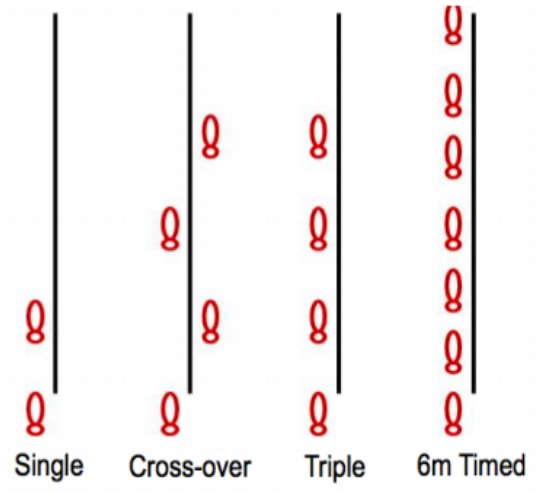
Appendix A: Foot Lift Test

Begin with patient standing on involved limb on a firm surface, hands on iliac crests. The uninvolved limb is slightly flexed at hip and knee. The patient is to maintain this position for 30 seconds with eyes closed. Instruct patient as follows: “Remain as motionless as possible, if you move out of position please return to original position as quickly as possible.” The examiner will count the number of foot lifts within the 30 second time period. Each foot lift constitutes as 1 error. A foot lift is considered as any part of the foot that loses contact with the ground (eg. lifting toes from the floor). If the uninvolved limb touches the floor it is counted as an error, 1 error added for every second it is out of position. Patient is allowed 1 practice trial, then an average of 3 trials will be calculated. A 30 second rest should be given between each trial.

Discharge and return to sport criteria: < 5 errors

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: Hand-Held Dynamometry for Ankle Plantarflexion

Position	• Patient in long-sit position on non-slip floor with foot against wall; barefoot • Knee is fully extended
Placement	• 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	• Testing performed at 0° DF and 20° PF • 3 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: (involved/uninvolved)*100 = % symmetry
Goal	• 0° DF: ≤ 10% asymmetry between limbs • 20° PF: ≤ 10% asymmetry between limbs

0° dorsiflexion

20° plantarflexion

*Measurements obtained via hand-held dynamometry with 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.

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Appendix D: Hand-Held Dynamometry for Ankle Inversion and Eversion

Position	• Patient in long-sit position on plinth with ankle off the edge; barefoot • Knee is fully extended
Placement	• Inversion: Hand-held dynamometer placed on the medial border of the foot at the midpoint of the shaft of the first metatarsal • Eversion: Hand-held dynamometer placed on the lateral border of the foot at the midpoint of the shaft of the fifth metatarsal

	• Stabilize lower leg just proximal to ankle as needed
Protocol	• Testing performed at 0° DF • 3 contractions performed in each position lasting 3-5 seconds each • Minimum 10 second rest between trials • Take average of the 3 trials • Determine symmetry index for each position: (involved/uninvolved)*100 = % symmetry
Goal	• 0° DF: ≤ 10% asymmetry between limbs

Ankle Eversion

*Measurements obtained via hand-held dynamometry with 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.

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