

Understanding and Utilizing SCFOs in Your Practice

In this session...

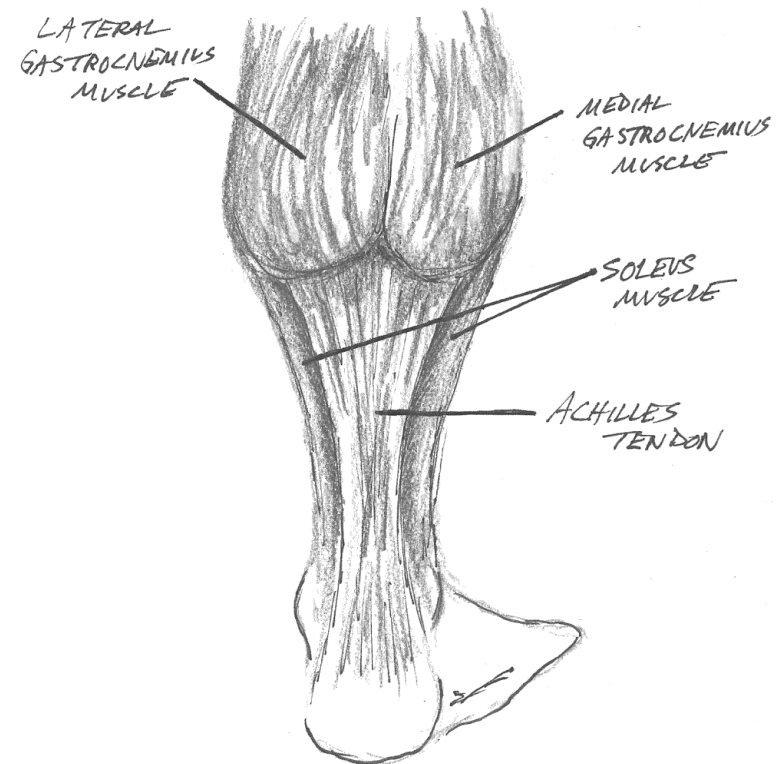
- What is a SCFO?
- Indications
- Prophylactic use
- Efficacy of SCFO devices
- OTC Vs Custom

Subtalar-Control Foot Orthosis (SCFO)

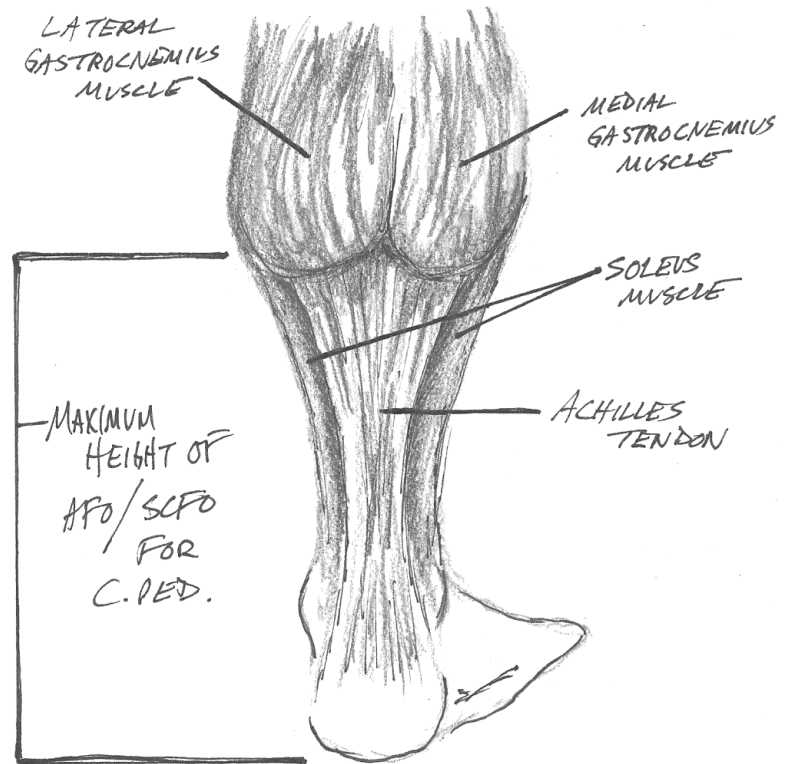
- A lower extremity orthosis designed to manage the function of the anatomy distal to the ankle joint by primarily controlling the range of motion of the subtalar joint. The proximal height of a SCFO does not extend beyond the musculotendinous junction of the gastrocnemius and the Achilles tendon. A SCFO is a method of treatment for conditions related to the foot demanding additional surface area to control forces.

What is a SCFO?

“Pedorthic devices” means therapeutic shoes, shoe modifications made for therapeutic purposes, prefabricated below the knee orthoses, partial foot prostheses for transtatarsal and distal amputations, and foot orthoses. It also includes subtalar-control foot orthoses, also referred to as a SCFO, designed to manage the function of the anatomy by primarily controlling the range of motion of the subtalar joint. Excluding footwear, the proximal height of a custom pedorthic device does not extend beyond the junction of the gastrocnemius and the Achilles tendon. (ABC)



What is a SCFO?



Indications

- Any condition that falls within the pedorthic SOP in which one needs more control than an FO provides
- Primarily coronal plane restriction
 - SCFOs do provide some sagittal plane control
 - Studies show that without shoe, most SCFOs provide little in the way of transverse plane control

Indications

- Posterior tibial tendinitis
- Posterior tibial tendon dysfunction (I and II)
- Sinus tarsi pain associated with acquired pes planovalgus deformity
- Peroneal tendinitis
- Subtalar joint osteoarthritis
- Talonavicular arthritis
- Tarsal coalitions

Patient Perception

The effect of ankle stabilizers on athletic performance. A randomized prospective study.

- Pienkowski D, McMorrow M, Shapiro R, Caborn DN, Stayton J. Am J Sports Med. 1995 Nov-Dec;23(6):757-62.
- The ankle is the site of more than one third of all injuries that occur to male basketball players. Although ankle bracing may prevent injury, many players believe that braces restrict athletic performance. This belief discourages use of braces and obviates the injury protection that bracing provides.
- The objectives of this study were to determine whether:
 1. athletic performance (in four basketball-related activities) was affected by three ankle brace designs (Universal, Kallassy, and Air-Stirrup ankle training brace),
 2. specific braces are better for specific athletic activities,
 3. athletic performance changes with brace use.
- Twelve high school basketball players wore each brace type while vertical jumping, standing long jumping, cone running, and 18.3-meter shuttle running at two test times (initially and after 1 week of acclimation).
- Data showed that these braces had no significant effects on athletic performance. No brace affected athletic performance in one specific activity more than another, and athletic performance did not change with brace use. We concluded that prophylactic ankle bracing does not inhibit athletic performance.

The role of ankle bracing for prevention of ankle sprain injuries.

- Gross MT, Liu HY. J Orthop Sports Phys Ther. 2003 Oct;33(10):572-7.
- Lateral ankle sprains are one of the most common injuries incurred in recreational and competitive athletics. These injuries have a significant impact in terms of cost, athletic participation, and activities of daily living. Prophylactic ankle braces are often used to reduce the risk of injury recurrence when individuals return to athletic participation.
- The purpose of this clinical commentary is to review the literature and provide our own experience relative to the use of prophylactic ankle bracing.
- Relatively high incidence rates of ankle sprain injury have been reported for basketball and soccer athletes, military trainees, and individuals with a previous history of ankle sprain injury.
- Semirigid and laced ankle braces have significantly reduced the incidence of initial and recurrent ankle sprain injuries in athletic and military samples.
- With few exceptions, these braces do not appear to affect functional performance adversely. **The prophylactic use of semirigid ankle braces appears warranted to reduce the incidence of initial and, in particular, recurrent ankle sprain injuries for individuals who participate in activities that have the highest risk for these injuries.**

Effect of SCFOs on Athletic Performance*

Table 2 Effect of orthoses on performance on tests of vertical jump, sprint and agility

<i>Author</i>	<i>Orthosis</i>	<i>Effect of orthoses on:</i>		
		<i>Vertical jump</i>	<i>Sprint</i>	<i>Agility</i>
Paris ⁵⁷	Swede-O-universal	No effect	No effect	No effect
	McDavid	No effect	No effect	No effect
	New Cross	Detrimental	No effect	No effect
Burks <i>et al</i> ⁵⁹	Swede-O-universal	Detrimental		No effect
	Kallassy	Detrimental		No effect
Bocchinfuso <i>et al</i> ⁶⁸	Aircast airstirrup	No effect	No effect	No effect
	Active ankle brace	No effect	No effect	No effect
Robinson <i>et al</i> ⁶¹	"Plastic stiffeners"			Detrimental
Greene and Hilman ¹⁷	Donjoy ALP	No effect		
MacPherson <i>et al</i> ⁶⁰	Aircast airstirrup	No effect	No effect	
	Donjoy Rocketsoc	No effect	No effect	
MacKean <i>et al</i> ⁶	Swede-O-universal	Detrimental	No effect	
	Active ankle brace	No effect	No effect	
	Aircast airstirrup	No effect	No effect	
Greene and Wight ¹⁶	Swede-O-universal		No effect	
	Donjoy ALP		No effect	
	Aircast airstirrup		Detrimental	
Pienkowski <i>et al</i> ⁶²	Aircast airstirrup	No effect	No effect	No effect
	Swede-O-universal	No effect	No effect	No effect
	Kallassy	No effect	No effect	No effect
Verbrugge ⁶³	Aircast airstirrup	No effect	No effect	No effect
Wiley and Nigg ⁶⁴	Malleoloc	No effect	No effect	No effect

* Callaghan MJ, 1997

SCFOs for Improved Proprioception

- Karlsson J, Andreasson GO. The effect of external ankle support in chronic lateral ankle joint instability. *Am J Sports Med* 1992;20:257-61.
- Jerosch J, Hoffstretter I, Bork H, Bischof M. The influence of orthoses on the proprioception of the ankle joint. *Knee Surg Sports Traumatol Arthrosc* 1995;3:39-46.
- Lentell G, Baas B, Lopex D, McGuire L, Sarrels M, Snyder P. The contributions of proprioceptive deficits, muscle function and anatomical laxity to functional instability of the ankle. *J Ortho Sports Phys Ther* 1995;21:206-15.
- Robbins S, Waked E, Rappel R. Ankle taping improves proprioception before and after exercise in young men. *Br J Sports Med* 1995;29:242-7.
- Hamill J, Knutzen KM, Bates BT, Kirkpatrick G. Evaluation of two ankle appliances using ground reaction force data. *J Ortho Sports Phys Ther* 1986;7:244-9.

Efficacy of Different Brace Designs

Efficacy of an ankle brace with a subtalar locking system in inversion control in dynamic movements.

Zhang S¹, Wortley M, Chen Q, Freedman J. J Orthop Sports Phys Ther. 2009 Dec;39(12):875-83.

OBJECTIVES:

To examine effectiveness of an ankle brace with a subtalar locking system in restricting ankle inversion during passive and dynamic movements.

BACKGROUND:

Semirigid ankle braces are considered more effective in restricting ankle inversion than other types of brace, but a semirigid brace with a subtalar locking system may be even more effective.

METHODS:

Nineteen healthy subjects with no history of major lower extremity injuries were included in the study. Participants performed 5 trials of an ankle inversion drop test and a lateral-cutting movement without wearing a brace and while wearing either the Element (with the subtalar locking system), a Functional ankle brace, or an ASO ankle brace. A 2-way repeated-measures analysis of variance (ANOVA) was used to assess brace differences ($P < .05$).

RESULTS:

All 3 braces significantly reduced total passive ankle frontal plane range of motion (ROM), with the Element ankle brace being the most effective. For the inversion drop the results showed significant reductions in peak ankle inversion angle and inversion ROM for all 3 braces compared to the no brace condition; and the peak inversion velocity was also reduced for the Element brace and the Functional brace. In the lateral-cutting movement, a small but significant reduction of the peak inversion angle in early foot contact and the peak eversion velocity at push-off were seen when wearing the Element and the Functional ankle braces compared to the no brace condition. Peak vertical ground reaction force was reduced for the Element brace compared to the ASO brace and the no brace conditions.

CONCLUSIONS:

These results suggest that the tested ankle braces...provided effective restriction of ankle inversion during both passive and dynamic movements.

Efficacy of an ankle brace with a subtalar locking system in inversion control in dynamic movements.

- Element® Sport by DeRoyal
 - Patented heel control strapping system holds the calcaneus under the talus controlling subtalar inversion and talar rotation



SCFO + FO Combo

Consider:

An Ankle-Foot Orthosis With a Lateral Extension Reduces Forefoot Abduction in Subjects With Stage II Posterior Tibial Tendon Dysfunction.

- Neville C, Bucklin M, Ordway N, Lemley F. J Orthop Sports Phys Ther. 2016 Jan;46(1):26-33.
- **Background:** Posterior tibial tendon dysfunction is a common musculoskeletal problem that includes tendon degeneration and collapse of the medial arch of the foot (flatfoot deformity). Ankle-foot orthoses (AFOs) typically are used to correct flatfoot deformity. Correction of flatfoot deformity involves increasing forefoot adduction, forefoot plantar flexion, and hindfoot inversion.
- **Objectives:** To test whether a foot orthosis with a lateral extension reduces forefoot abduction in patients with stage II posterior tibial tendon dysfunction while walking.
- **Methods:** The gait of 15 participants with stage II posterior tibial tendon dysfunction was evaluated under 3 conditions: a standard AFO, an AFO with a lateral extension, and a shoe-only control condition. Kinematic variables of interest were evaluated at designated time points in the gait cycle and included hindfoot inversion/eversion, forefoot plantar flexion/dorsiflexion, and forefoot abduction/adduction. A 3-by-4, repeated-measures analysis of variance (brace condition by gait phase) was used to compare variables across conditions.
- **Results:** The AFO with a lateral extension resulted in a significantly greater change in forefoot adduction compared to the standard AFO (2.6° , $P = .02$) and shoe-only conditions (4.1° , $P < .01$) across all phases of stance. Forefoot plantar flexion was significantly increased when comparing the standard AFO and AFO with a lateral extension to the shoe-only condition. The AFO with the lateral extension also demonstrated significantly increased hindfoot inversion during the loading response and terminal stance phases.
- **Conclusion:** Off-the-shelf and standard AFOs have been shown to improve forefoot plantar flexion and hindfoot eversion, but not forefoot adduction. A lateral extension added to a standard AFO along the forefoot significantly improved forefoot adduction in participants with posterior tibial tendon dysfunction while walking.

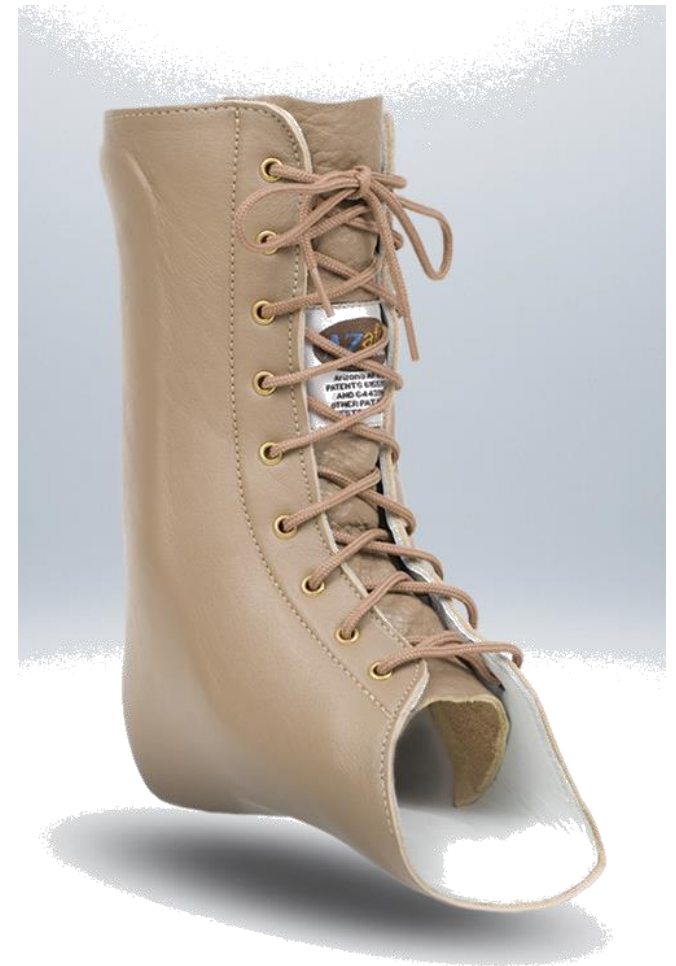
The Arizona AFO™

- Developed in 1994 by Ernesto Castro, CPed
- The Arizona AFO™ stabilizes the ankle, talocalcaneal, midtarsal and subtalar joints.



The Arizona AFO™

- Lin SS, et al. Non-operative treatment of posterior tibial tendonitis. 1997
- 90% success



The Arizona AFO™

- Augustin JF, Lin SS, Berberian WS, Johnson JE. Nonoperative treatment of adult acquired flat foot with the Arizona brace. Foot Ankle Clin 2003;8(3):491-502.
- Conclusion: AZ AFO can be effective at relieving symptoms and obviating or delaying surgical intervention



The Arizona AFO™

- The Articulated Arizona AFO is designed to stabilize the subtalar, talocalcaneal, and midtarsal joints while still allowing motion at the ankle. It is available with a variety of ankle joints and stops.



The Arizona AFO™

- The Partial Foot AFO is the standard AFO with a partial foot filler and a removable multi-density insole added. The filler portion is built into the device and covered with leather.
- It is designed to fit into a shoe.



Gauntlet-style AFO

- Arthritis
 - John S, Bongiovanni F. Brace management for ankle arthritis. Clin Podiatr Med Surg 2009;26(2):193-197.
 - Bluman EM, Chiodo CP. Tibiotalar arthrodesis. Semin Arthroplasty 2010;21(4):240-246.
- Posterior tibial tendon dysfunction/Adult acquired flatfoot
 - Elftman NW. Nonsurgical treatment of adult acquired flat foot deformity. Foot Ankle Clin 2003;8(3):473-489.
 - Beitzl WC, Noll KH. Postsurgical orthotic devices. Foot Ankle Clin 2001;6(2):297-314.
 - Neville CG, Houck JR. Choosing among 3 ankle-foot orthoses for a patient with stage II posterior tibial tendon dysfunction. J Orthop Sports Phys Ther 2009;39(11):816-824.
 - Augustin JF, Lin SS, Berberian WS, Johnson JE. Nonoperative treatment of adult acquired flat foot with the Arizona brace. Foot Ankle Clin 2003;8(3):491-502.
- Chronic Achilles tendinitis
 - Hurwitz SR, Parekh S. *Musculoskeletal Examination of the Foot and Ankle: Making the Complex Simple*. Thorofare, NJ: Slack; 2011.
- Partial foot amputation
 - Goldberg B, Hsu, JD, eds. *Atlas of Orthotics and Assistive Devices*. Third edition. St. Louis, MO: Mosby; 1996.

The Richie Brace®

- The Richie Brace® was designed and introduced to the medical community in 1996 by Doug Richie, DPM.
- Recognized by podiatrists, pedorthists, orthotists and orthopedic surgeons as a technology to treat a wide variety of foot and ankle pathologies.



THE RICHIE CALIFORNIA AFO BRACE

- Clinical Indications:
 - Rigid, non-reducible Adult Acquired Flatfoot (Stage III & IV)
 - Severe DJD or Deformity of hindfoot
 - Charcot Arthropathy
- Features:
 - Adjustable Leather Closure over tibia & forefoot
 - Patented Medial or Lateral Arch Suspender
 - Rearfoot Stabilizing Post
 - Continuous single strap closure-no laces
- Benefits:
 - Total restraint of foot and ankle movements
 - Self-adjusting arch support
 - Prevents medial/lateral instability



Richie OTC

- Clinical Indications:
 - Acute Ankle Sprain
 - Tendinopathy of the Foot and Ankle
 - Interim brace before custom AFO
- Features:
 - Prefabricated orthotic footplate in 4 sizes
 - Full flexion ankle joints or restricted hinge ankle options
 - Adjustable Velcro strap closures
- Benefits:
 - Powerful footplate control over the ankle and hindfoot
 - Economical on-the-spot treatment of acute injuries
 - Interim brace before custom AFO



“Marzano” Short-Articulated AFO



- Alvarez RG, et al. Stage I and II posterior tibial tendon dysfunction treated by a structured nonoperative management protocol: an orthosis and exercise program. Foot Ankle Int. 2006 Jan;27(1):2-8.
 - Treated with aggressive PT and either an FO (30%) or SAAFO (70%).
 - 83% of the patients had successful subjective and functional outcomes.
 - 89% were overall satisfied.
 - 11% required surgery after failure of nonoperative treatment.
 - Conclusion: Patients with stage I and II posterior tibial tendon dysfunction can be effectively treated nonoperatively with an orthosis and structured exercises.

“Marzano” Short-Articulated AFO



- Clinical outcome study presented at 1992 AOFAS Summer Meeting.
 - 79% of patients completely satisfied
 - 90% showed improvement
 - Avg wear of 9 hrs/day

Arizona Balance Brace

- Custom brace designed primarily for improvement in balance.
- Yalla SV, et al. Balance improvement in older adults using customised ankle foot orthoses. 2013
 - Body sway during balance testing decreased by 68% and 75% compared to shoes and barefoot.
 - Use of an AFO provides an immediate reduction of fall risk in the elderly without encumbering functional reach of gait.



Arizona Mezzo™

- Very thin, easy to wear in shoes
- Great cosmetic acceptance
- Excellent alternative to UCBL / AZ AFO



Arizona Mezzo™



Prefab scfos

Customizable



Exos Free Motion Ankle



- **Posterior Tibial Tendon Dysfunction (PTTD)**
- Correct bony alignment and provide support in various planes of motion
- **Chronic Ankle Instabilities**
- Arthritis
- Weak ankles due to ligament damage and over stressed ligaments
- High ankle sprains
- **Post-Trauma / Post-Op Rehabilitation**
- Step down care following casting or walking boot
- Fully customizable and reformable

Prefab SCFOs



DONJOY STABILIZING
PRO ANKLE BRACE

VELOCITY™ MS
(MODERATE SUPPORT)



ROCKETSOC (LACE-UP,
NEOPRENE & DRYTEX)

VELOCITY™ ES
(EXTRA SUPPORT)





Dispensing SCFOs

- Demonstrate to patient how to don the device
 - Must be worn with sock
 - Demonstrate how to lace/tie, strap, adjust snugness, etc.
- Fitting considerations
 - Will need an in-depth shoe, possibly extra *extra* depth shoe
 - Consider tie shoes, if possible. Blucher openings.
 - May need to increase width, or possibly mismatch shoes to accommodate extra bulk of SCFO
 - For some devices, an extra thickness of material under the heel of the contralateral foot may be needed to “level out” or compensate for the thickness of the SCFO. In most cases, if the patient is using an FO on the contralateral foot, this will be sufficient.
- Trial Fitting
 - Brace should fit as designed (E.g. total contact for Arizona-style brace; sufficient clearance for articulating ankle joints of Richie Brace, etc.)
 - While brace may not feel “natural” to patient, it should in no way cause new pain or exacerbate any underlying problems/complaints.
 - Have patient around office for 10-15 minutes and then remove shoe, SCFO and sock and reinspect foot for red spots, etc. Adjust as necessary and retry until you and patient are satisfied.
 - Have patient demonstrate proper donning of device.

Conclusion

- SCFOs work and the research supports their use.
- Make sure you are getting everything out of your scope of practice that you can!
- There are a great many devices that pedorthists ignore because they think they are AFOs.
- Providing SCFOs can enhance your standing with patients and physicians.
- Exciting things on the horizon!

The End