Performing in-office orthotic modifications to enhance patient satisfaction

### The Orthotic Modification Matrix

<table>
<thead>
<tr>
<th>Medial Column Overload</th>
<th>Lateral Column Overload</th>
<th>Modifications to decrease metatarsal head pressure</th>
<th>1st MP/Jay modifications</th>
<th>Occupational situations</th>
<th>Misc. modifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extended metatarsal RF post</td>
<td>Vertical grind to lateral RF post</td>
<td>Request digital topcover, unglued or Pre glue shell and topcover</td>
<td>Morton’s and Reverse Morton’s</td>
<td>1 forefoot pressure from kneeling or squatting</td>
<td>Bunions</td>
</tr>
<tr>
<td>Kirby Skive, Blake Inverted</td>
<td>Peroneal tendinopathy</td>
<td>Extrinsic and intrinsic metatarsal raise</td>
<td>John Weed or Richie wedge for load on 1st or 2nd MTP joint</td>
<td>Patients who carry, push and pull loads on uneven surfaces</td>
<td>Shell Flexibility Tips</td>
</tr>
<tr>
<td>Medial Oblique Shell Indication</td>
<td>Cuboid pad</td>
<td>5th metatarsal pad</td>
<td>Hallux wedge</td>
<td>Patients who must stand for lengthy periods</td>
<td>Proximal of fascia planter spur to avoid/stop foot</td>
</tr>
<tr>
<td>Extended medial topcover</td>
<td>Sometimes an orthotic won’t be enough</td>
<td>Capsules/planter plate injury</td>
<td>The internal metatarsal rocker</td>
<td>If I have to describe a dress orthotic for a high-heeled shoe</td>
<td>Plantar fascia groove</td>
</tr>
<tr>
<td><strong>Summary</strong></td>
<td>Morton’s neuroma modification</td>
<td>Superfeet</td>
<td>Morton’s Novacoc</td>
<td>Heat application</td>
<td></td>
</tr>
</tbody>
</table>

---

Peter G. Guy  B.Sc., D.Ch.
Private Practice - Whitby & Peterborough, ON  [www.painfreefeet.ca](http://www.painfreefeet.ca)
Professor Chiropody Faculty - Michener Institute of Education at University Health Network, Toronto, ON
Professional Advisory Board - Paris Orthotics, Vancouver, BC
Acknowledgments

Andy Brown - In-Line Orthotic Solutions
Brian Cragg BSc Pod M
Andy Goff - Spinario Orthotics
Raynauld Henry – Bi-op Orthotics
Larry Huppin - Prolab Orthotics
Kevin Kirby DPM
Chris MacLean PhD - Fortius Sports & Heath
Paul Paris - Paris Orthotics Ltd
Doug Richie DPM
Jeff Root - Root Lab
Leif Royle - Paris Orthotics Ltd
Even the best designed and properly casted foot orthoses may require a modification.
The inability to perform an in-office modification can leave your patient dissatisfied and without their foot orthoses for days or weeks.
Patient satisfaction can be enhanced when the appropriate orthotic modification can be performed in-office in a timely fashion.
Podiatrists should strive to be experts at managing or altering the loads on the tissues of the foot and lower extremities with any orthotic postings, modifications or additions initially prescribed or modified after dispensing.
The main goal of foot orthotic therapy is to address the patient’s foot complaint by reducing the tissue stresses that cause tissue strain/injury/pain.
Any orthotic modification introduced will change the surface geometry, device stiffness or cushioning.

Prescription orthotic posting, modifications and additions all have an affect on tissue loads.

Cast modifications will affect the shape and contour of the positive.

- Expansions
- Fill
- Intrinsic forefoot position
- Heel expansion
- Heel pitch
- Arch contour
- Wedging
Shell modifications will modify the shape/contour and flexibility of the foot orthoses.

- Thickness and flexibility of material
- Arch flexibility
- Non beveled anterior edge
- 1st ray flexibility
- Arch reinforcement
- Low bulk grind
- Anterior edge length
- Hour glass design
- Forefoot width
- 1st ray cut out
- Heel post flare
- Heel raise
- Heel seat depth
- Heel raise
- Sweet spot
- Fascial groove
Top cover modifications that will alter or modify loads on foot tissues

- Type of fabric/material
- Thickness
- Length
- Met. dome
- Preload hallux
- Morton’s extension
- Reverse Morton’s
- Gluing of top cover
- Lesion accommodations
Other things to keep in mind
Relationship between shoe volume and foot orthotic modifications.

Shoe Volume vs. Orthotic prescription variables

- Deep heel cup
- Full top cover
- Sweet spots
- Lesion accommodations
- Thicker shell
- Flanges
Is the prescribed foot orthotic shank dependent or independent?

A shank stiffens the shoe under the arch which makes the middle portion of the shoe more resistant to torsion and flexion.

EVA devices are shank dependent as well as most prefabs.

Plastic CFOs are shank independent.

If your lab offers specialized pathology devices you need understand what the lab standard is for these devices.
Over the past two decades, I have talked to several foot orthotic lab owner’s about orthotic modifications.
The top 5 adjustments requested within the first few months after manufacture:

1. Remove/lower met. pads
2. Lower/raise MLA height
3. Extend top cover to toes
4. Reduce shell width to fit shoes/trace/insole/old devices provided
5. Add EVA fill to stabilize device/increase rigidity
List of requested modifications received that could be performed in-office.

1. Remove RF post/strike plates
2. Trim top cover to match insole/shoe provided
3. Increase side cut/undercut
4. Remove/reduce met pads
5. Hourglass shells
6. Add 1st met cut-out
7. Trim top cover to sulcus or met’s (from full length)
8. Remove rigid 1st extension
9. Shell accommodations (plantar fascia, navicular, fibroma)
10. Extrinsic post modifications (skive in heel post, modify motion)
If you talk to a lab owner about successful foot orthotic therapy they will tell you…

Casting is Key

If you use heel bisections is your technique standardized?

Keep it simple!
What you need to get started.

Removes glue.
## The Orthotic Modification Matrix

<table>
<thead>
<tr>
<th>Medial Column Overload</th>
<th>Lateral Column Overload</th>
<th>Modifications to decrease metatarsal head pressure</th>
<th>1st MPJ/ray modifications</th>
<th>Occupational situations</th>
<th>Misc. modifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extended medial RF post</td>
<td>Vertical grind to lateral RF post</td>
<td>Request distal topcover_unglued or Pre glue shell and topcover</td>
<td>Morton’s and Reverse’ Mortons</td>
<td>↑ forefoot pressure from kneeling, or squatting</td>
<td>Bunion topcover</td>
</tr>
<tr>
<td>Kirby Skive, Blake Inverted</td>
<td>Peroneal tendinopathy</td>
<td>Extrinsic and intrinsic, metatarsal raise</td>
<td>John Weed or Richie wedgy for ↓ load on PI Fascia</td>
<td>Patients who carry, push and pull loads on uneven surfaces</td>
<td>Bottom cover</td>
</tr>
<tr>
<td>Medial Oblique Shell Inclination</td>
<td>Cuboid pad</td>
<td>5th met cutout</td>
<td>Metatarsal pad</td>
<td>Hallux wedge</td>
<td>Shell Flexibility Tips</td>
</tr>
<tr>
<td>Medial Oblique Shell Inclination</td>
<td>5th met cutout</td>
<td>Metatarsal pad</td>
<td>Hallux wedge</td>
<td>Last quarter in heel spur</td>
<td>Proximal pl.fasciitis/heel spur accomo/styloid</td>
</tr>
<tr>
<td>Extended medial topcover</td>
<td>Sometimes an foot orthotic won’t be enough</td>
<td>Capsulitis/Plantar plate injury</td>
<td>The internal metatarsal rocker</td>
<td>If I have to prescribe a dress orthotic for a high heeled shoe</td>
<td>Plantar fascial groove</td>
</tr>
<tr>
<td>Summary</td>
<td>Morton’s neuroma modification</td>
<td></td>
<td></td>
<td>Superthotic</td>
<td>Medial RF post</td>
</tr>
</tbody>
</table>
Shell Flexibility Tips
Understand the materials you choose alone or in combination when prescribing foot orthoses.

http://www.plasticsintl.com/images/hardnessScale.jpg
Posting the shell increases the rigidity of the shell.
The shape of the shell due to patient foot type and heel depth will dictate the flexibility of the shell. (increased radius of curvature)

Diagrams courtesy of Chris MacLean
Any type of shell accommodation molded into the shell will increase the stiffness of the shell.
Simple fix to increase shell flexibility is to lower the heel cup height.

Diagram courtesy of Jeff Root
To increase shell stiffness you can modify with an arch filler either medially or laterally.
Medial Column Overload
Extended Medial or Lateral RF post

- RF post extended anterior-medially towards the medial arch or
- RF post extended anterior - laterally into the lateral long arch
- Increased RF control through increased shell stiffness
Top cover valgus extension with or without valgus pad/D pad.

Extended the top cover medially in the shape of a valgus pad will apply a force via the shoe upper to help create supination moment.

Proprioception activation?
The Kirby STJ axis rotational equilibrium theory is the basis for the Blake Inverted, Kirby skive and medial oblique shell inclination cast modifications.
Medial heel skive and Blake inverted rearfoot.

Heel stabilizer
Kirby Medial Heel skive
Blake Inverted heel

Pictures courtesy Jeff Root, Root Orthotic Labs
Medial heel skive Korex modification

Photo courtesy of Larry Huppin DPM
Medial oblique shell inclination (MOSI) technique produces a perpendicular angle of force application compared to the Kirby skive.

The MOSI modification provides a more perpendicular application of force toward the STJ axis resulting in a larger supination moment.
Lateral Column Overload
Vertical grinds to lateral RF post can be an effective control of supination +/- EVA lateral arch fill.

Lateral sidewalls of the EVA heel stabilizer are ground perpendicular to the supporting surface.

Can be combined with Lateral Flange + Valgus FF posting extended to sulcus for supination control.

Picture courtesy Jeff Root, Root Orthotic Labs
Peroneal tendinopathy

2 mm - 4 mm lateral heel skive
Full length topcover
Increased intrinsic FF valgus correction
Flat rearfoot post
Korex lateral arch filler
Valgus 2-5 forefoot extension
3/16“ - 4/16” polypropylene shell

Pictures courtesy of Kevin Kirby DPM
The principle objective of this study was to evaluate the effects of two types of CFO on the muscle activity of the lower extremity while walking.
This study demonstrated that FOs with a lateral bar decreased the peak amplitude and mean activity in midstance/terminal stance of peroneus longus.
Lateral heel skive Korex modification

Photos courtesy of Larry Huppin DPM
5th Met Cut-Out

- Shell material removed at distal lateral aspect of shell
- Used to accommodate tailor’s bunion + 5th MPJ lesions
Sometimes a foot orthotic won’t work!

47 ♂
Owns landscape company
Pain in right ankle for past two years
Has been advised to get triple arthrodesis
Richie Articulated AFO

Richie Brace
Cuboid Pad

The cuboid raise is a very stabilizing and under-used orthotic modification for high arch foot types and for history of lateral ankle sprains.
If presented with lateral ankle instability or midfoot/1st ray/1st MPJ stiffness I will combine orthotic therapy with osteopathic manipulations.
Increased metatarsal head pressure modifications.
Distal End of Top cover Unglued

- Topcover is not laminated at the distal end of the shell or to any extensions/bottom covers
- Gives clinician ability to modify or add components such as met pads/bars, lesion accommodations, sulcus crests, neuroma pads
Top cover removed to allow for marking of plantar fibromas. Both the shell and top cover has been pre-glued.
Pre-glue top covers and shell to allow lesion accommodations.
Extrinsic Plantar Metatarsal Raise

3mm EVA applied to plantar aspect of distal shell edge and tapered on the dorsal surface

- Equal offloading from 1st to 5th MT heads by elevating distal end of shell
- Shell does not maintain its original MLA profile
Intrinsic (within shell) Metatarsal Raise

- Effectiveness dependent on shell material selection
- Maintains the MLA profile of the device unlike extrinsic met raise

Tapered distal edge

Full thickness distal edge creates drop off to equally off load 1 to 5 metatarsal heads
Capsulitis or plantar plate injury
If you cannot perform in-office orthotic modification but you need to offload an area of high pressure

1. Prescribe a 1/8 inch plastazote top cover
2. Dispense orthotic to patient to be used for one week
3. The high pressure areas will be imprinted on the top cover
4. Send back to the lab for offloading
Metatarsal pad to off load painful plantar metatarsal head or elevate

In most cases, I will get the patient to experiment where the best location to offload the metatarsal head.

The patient is provided with double sided tape and the top cover is only glued to the heel.
A Simple Cure for Morton’s Neuralgia by elevating the 4th and 5th metatarsal heads with 4mm lift.

Figure 2. Procedure of placing the 1/4-inch lift under the fourth and fifth metatarsal heads. A. Looking at the sole of the involved foot, mark the fourth and fifth metatarsal heads with lipstick or ink. B. Align the patient’s foot over an insole, and apply transfer the markings to the insole. C. Cut a patch of cork, leather, or rubber on the insole directly under the markings.

Figure 3. Diagram showing the effect of a lift under the fourth and fifth metatarsal heads. This lift markedly increases the distance between the third and fourth metatarsal heads, thus freeing the entrapped nerve.
1st MPJ/Ray modifications
Morton’s extension and Reverse Morton’s extension
Plantar fascia accommodation cork onlay
Plantar fascia accommodation shell grind

Photos courtesy of Larry Huppin DPM
Marking the plantar fascia prior to casting.

1) Place subtalar joint in neutral, and fully pronate midtarsal joint
2) Dorsiflex hallux to resistance
3) Look for bowstringing of plantar fascia
4) Estimate height of fascia at apex of bowstring
5) Palpate fascia for tension (firmness)
6) Mark outer margins of fascia, if prominent
7) Accommodate when prominent, especially if firm (typically 2 to 6 millimeters in depth)
8) Lines will transfer to plaster cast, or can be drawn on cast or Rx form
A 5°(5mm) hallux wedge pre-tensions the plantar fascia and is an alternative to plantarflex the 1st ray when other modifications don’t appear to be effective.
The valgus onlay by John Weed is a good in office modification to use to try to salvage an orthosis that isn’t providing enough valgus correction/support in the forefoot.
John Weed valgus onlay modification helps to stabilized the MTJ.

John Weed observed some patients pronated excessively off of their orthoses, he theorized these patients were not controlled well enough since they were pronated at STJ hence the MTJ was unstable.

The valgus inlay directs the forefoot into valgus position.
“Richie wedgy” helps to offload the plantar fascia.

Use 1/8 inch Korex and skive all three sides except lateral with height point under mid shaft of the fifth metatarsal.
The Sarrafian twisted plate represents the rearfoot supinated and forefoot pronated and the plantar fascia is relaxed.
Lateral forefoot wedges reduce the strain on the plantar fascia.
Case of the Internal Metatarsal Rocker
Combination of poly-carbon stiffener and EVA rocker.
There are also prefab carbon spring plates with the rocker built into the spring plate.
Orthotic modifications for various occupational environments
Jobs that involve carrying, pushing and pulling loads on uneven surfaces require stabilization.

- High top boots provide most of stabilization
- Steel shank if using ladders or shovels
- Orthotic device with flat posts, deeper heel cups and wider shell
- 3mm neoprene or Poron/leather top cover
Jobs involving standing in place for lengthy periods require offloading from calcaneus and metatarsals heads.

- Shell to be inversely flexible to the firmness of the shoe and the surface
- Other factors: foot stiffness, amount of equinus, weight and age
- Polypro, EVA or Plastazote #3 shell
- Deep heel cups and wide shell with congruent medial and lateral arch contour,
- Non bevelled anterior edge or met bar
- 3 to 6 mm neoprene or PPT/leather top cover

These orthotic designs have been helpful for this occupational group.
Jobs that involve kneeling, stooping or squatting require the proximal transfer of pressure off of the metatarsal heads.

- Minimum cast fill
- Positive cast inversion
- Flexible to semi-flexible polypropylene or EVA
- Non beveled anterior edge or Poron metatarsal bar
- Deep parabola of anterior edge
- 3-6 mm neoprene or PPT/leather top cover with or without Poron forefoot extension to sulcus
- Offloading of any overloaded plantar metatarsal head
This is my device of choice for a dress shoe
The Superthotic is an excellent choice for workers in extreme conditions such as mining, forestry, foundry, etc.
Bottom covers help to stiffen top covers to allow for easy transfer in/out of a work boot.

- Agoflex, vinyl, 1.5mm cork/puff bottom covers are effective.
- Bottom covers also create sandwich effect at distal end of shell which improves component durability via improved lamination.
Miscellaneous Modifications

Custom foot orthotic with deep heel cup and cushioned area at the bottom of the heel seat
Top cover bunion accommodation.

Pictures courtesy of Brian Cragg BSc(Pod Med), DCh
Heel bursitis/heel spur and styloid accommodations.

Custom foot orthotic with deep heel cup and cushioned area at the bottom of the heel seat.

Orthosis

Styloid accommodation

Plantar heel bubble filled with Spenco or PPT

Picture courtesy of Kevin Kirby DPM
You can also grind the inside edge of heel cup rim with dremel burr.
Medial RF post only

- Reduces device control at heel strike but maintains medial control through midstance
- Reduces device volume, often effective in design of dress devices

Lateral half of lab standard extrinsic RF post is removed along with strike plate.
Successful orthotic therapy occurs by addressing the patient complaint via the load management of tissues, however, sometimes this requires an orthotic modification post dispensing.
The ability to provide in-office modifications will increase patient satisfaction and word of mouth referrals to your practice.
Thanks for listening