Adjusting Foot Orthoses

Here's a useful guide to modifying devices for specific foot and ankle conditions.

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Objectives

Upon completion of this article the participant should:

1) Be familiar with the different types of adjustments of specific to rigid orthoses.

2) Be familiar with the different types of adjustments of specific to bulk orthoses.

3) Be familiar with the different types of adjustments for leg length, equinus, and functional hallux limitus.

4) Be able to read an orthosis and be able to plan the appropriate adjustment.

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*Following this article, an answer sheet and full set of instructions are provided (pg. 162).—**Editor***

Foot orthoses have been an important part of the podiatric armamentarium for close to a century. Because of the effectiveness and importance of these devices, other professions have started to include foot orthoses into their treatment plans. As podiatrists, we are the experts on the foot and foot orthoses, and the purpose of this paper is to help reaffirm that position. Adjusting these devices is an important part of managing a patient who requires orthoses, and the different types of adjustments will be discussed in this article.

What Orthoses Do

To understand how to adjust a foot orthosis, one must first understand how a foot orthosis can help a patient. First, a foot orthotic can change the way in which a foot functions. It changes the way the foot functions by preventing motions, pre-

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venting the need for, directing, or increasing motions.

Secondly, a foot orthosis can provide comfort by distributing the weight of the foot more evenly. This is the effect that a soft insole has inside a shoe. Thirdly, a foot orthosis can off-load structural problems. Paddings are a pure example of this off-loading. Finally, a foot orthosis can provide shock absorption. This becomes important for older patients and those who work all day on hard (cement) floors.

Types of Orthosis Shells

One classification is based upon the stiffness of the materials used. In this type of classification, there are three types of orthoses: rigid, semi-rigid, and flexible. It is important to note that no material used in the fabrication of orthotics is completely rigid or completely flexible. Additionally, the thickness of the material (thicker being stiffer), or the size of the orthoses (smaller being stiffer), or foot type (higher arch being stiffer), or the depth of the heel cup (deeper being stiffer) will change the stiffness of the orthosis, so materials are only one factor in the rigidity of the device but they can serve as a starting point.

Some examples of materials that have been used in the past and present for rigid orthoses are steel, fiberglass, Rohadur, plexiglass, graphite composites and polypropylene. Some examples of materials that have been used for semi-rigid devices are polypropylene and polyethylene (Ortholen and subortholen). Some examples of materials that have been used for flexible devices are: leather, felt, Plastazote®, Pelite, and cork.

Another classification is based on how the materials provide support. In this classification, there are two types of orthotics: rigid and bulk. An example of a rigid orthosis is steel, where the shape of the orthosis can support itself. It is not dependent on the shank of the shoes, so this class of orthotics has been called shank-independent. Bulk orthoses by their nature are flexible. An example of a bulk orthosis is a leather laminate device. This device requires the thickness of the material and a stable foundation to provide support. This class of orthotics has been called shank-dependent. Semi-rigid orthoses are hybrids between these two extremes. This classification is the most useful when making adjustments. The less rigid the orthosis, the more bulk-type adjustments are applicable. Since rigid orthoses are not completely rigid, they can be adjusted to increase or decrease the stiffness in the arch. Bulk orthoses are adjusted to increase or decrease pressure in an area.

The rigidity of an orthosis is based upon the material used and its thickness.

Examples of adjustments to rigid orthoses include heat molding and posting. Heat molding can be difficult to perform properly, as the area that is adjusted is usually larger than is intended, and there is the risk of losing the shape of the device. Additionally, top covers can easily become destroyed during the heating process.

Rigid orthoses support the foot using the principle of a beam. A beam is a structural element that is capable of withstanding load, primarily by resisting bending. The longer the span of a beam, the easier it is to bend. Posting works by decreasing the span of the orthosis and thereby making it more rigid. By grinding off the medial side of a rearfoot post and/or removing a forefoot post, the length of the span of the orthotic in contact with the ground is longer, and hence less rigid. Conversely, by adding a rearfoot post and/or adding a forefoot post, the length of the device in contact with the ground is shorter, and hence more rigid.

Bulk orthotics are adjusted by either adding or removing various amounts of materials in different parts of the orthoses to increase or decrease pressure in these areas.

Semi-rigid orthoses are treated as hybrids. It is not unusual to see some plastic being thinned under a pressure point in a polyethylene orthotic or material placed under the arch to help support it.

A final classification is functional vs. accommodative. This classification, though commonly used, does not take into account that soft material can provide support. Also, a rigid shell does not provide enough flex at the metatarsal phalangeal joints, and therefore cannot extend beyond it. Without an extension, the orthosis cannot raise or relatively lower a metatarsal, and therefore cannot have a direct effect on the forefoot.

There are four functional imbalances that can be treated by foot orthotics.

Function

There are four functional imbalances that can be treated by foot orthotics. Foot orthoses can influence frontal plane imbalances, equinus, leg length, and functional hallux limitus.

Frontal Plane Imbalances

If you were to place a foot on

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the ground and supinate it, the calcaneus would invert and the arch would rise. This can, for want of a better term, be called initial supinatory correction. If you were to continue to supinate the foot, the calcaneus would continue to invert, the arch would rise, and the first metatarsal would start to come off the ground. This can be called, for want of a better term, terminal supinatory correction. Most patients can be made comfortable with just the initial supinatory correction—terminal supinatory correction is only rarely required. To apply terminal supinatory correction, two things must occur. First, the orthosis must end distal to the metatarsal heads to raise the ground to the foot in this position. Orthoses that end proximal to the metatarsal heads provide initial supinatory correction only. It is important to know that information when posting the forefoot in either a flexible device that ends distal to the metatarsals or a rigid device that has a top cover that ends distal to the metatarsals.

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Secondly, the correction at the rearfoot must be increased with the forefoot correction. Inversion of the forefoot relative to the rearfoot (supination around the longitudinal axis of the midtarsal joint) will result in a lowering of the arch (pronation of the oblique axis of the midtarsal joint). However, if the rearfoot is supinated along with the forefoot, then the forefoot varus post will aid in supination.

Thirdly, the first ray function needs to be looked at also. If we don't allow the first ray to plantarflex, we can develop functional hallux limitus with resultant late phase pronation.

It is interesting to note that Dr. Schuster's neutral position was different from Dr. Root's. Dr. Schuster's neutral was more supinated than Dr. Root's, and as a result, there were more forefoot posts applied to his orthoses. Neither Dr. Root nor Dr. Schuster addressed the first metatarsal phalangeal joint at push off. Understanding these apparently conflicting concepts helps to explain how Root, Schuster, and Dananberg are correct in their theories, and how we can apply all of their theories in our orthoses.

Finally, in those orthoses that are posted in the rearfoot and forefoot, we can add material in the arch. The arch of the orthosis in semi-rigid or flexible shells has more give than with rigid orthoses. When loaded, there is some deformation. Applying material under the arch will prevent the deformation and have the effect of raising the arch when under load. Knowing how much to stiffen the arch is an art. The key thing to realize is that the patient will feel as if there is a rock under the arch if the arch is stiffened even minimally too much.

Equinus

Equinus is corrected between the foot and the ground by a heel lift. To determine the amount of heel lift required, dorsiflex the neutral position foot until resistance is first felt. Make sure the patient is not assisting, as the anterior tibial muscle is not functioning at the time of maximum stance phase dorsiflexion. Compare this position to what you know as the position for a foot without equinus (each of us presses up either lighter or harder than someone else, and therefore gets a different result). The distance between the forefoot in the patient's foot and what you know to be normal is the height of the heel lift for equinus.

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In the foot, equinus is compensated for via dorsiflexion (a component of pronation) of the midtarsal joint around the oblique axis, and subtalar joint pronation. Prevention of this pronation in a patient with equinus will result in the compensation in another joint. Some patient complaints when the equinus needs to be corrected for are: Achilles tendinitis, fat pad syndrome of the knee, and low back pain.

Richard Schuster used to say, "When in doubt, raise the heel." Other possible adjustments are to decrease the arch of the orthosis via removing material from under the arch, removing the posts, or thinning the material of the shell (do not do this in a rigid type orthotic shell), and in rigid orthoses, carefully heating the arch with a heat gun and lowering the arch.

Leg Lengths

Structural leg length discrepancies can be corrected by a heel lift on the short side placed under the rearfoot post. Cut a piece of 1/8" Korex a little larger than the post with one end straight. Use contact cement (Barge, XL-8, or Master's cement). Apply a thin layer on the sides you want to adhere.

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Since these adhesives are toluene-based, it would be advisable to have an exhaust fan where the gluing is taking place. Wait until the solvent has evaporated, and then line up the straight end of the Korex with the anterior end of the post and press hard together. Trim off the excess with a scissor and then grind it smooth. There are many ways to determine how much heel lift is required. One way that takes out the guess work is to initially apply a 1/8 inch heel lift to the functionally/anatomically short side and increase weekly by 1/8" until the asymmetrical symptoms abate. The vast majority of leg length discrepancies in patients are functional in nature and are beyond the scope of this article.

Functional Hallux Limitus

Functional hallux limitus is a term popularized by Howard Dananberg, DPM. In his articles on sagittal plane biomechanics, he discusses three sagittal plane restrictions: ankle equinus, forefoot equines, and loss of motion at the metatarsal phalangeal joints. Functional hallux limitus is a restriction that occurs in gait, but is not seen non-weight-bearing. The restriction can be duplicated by moving the first metatarsal phalangeal joint through a range of motion, and then repeating this movement with pressure placed under the first metatarsal head. This can be treated by either adding material under the second through fifth metatarsals or by removing material under the first metatarsal head. The material can be added as either a bar or a wedge.

Distributing the Weight of the Foot More Evenly (Comfort)

The weight of the foot can be distributed more evenly by adjusting the orthosis based upon patient complaints. The patient tends to be a poor historian of where the pressure is, so it is better to look at the orthotic device. To prove this point, have the patient close his eyes and touch a side of a toe with the wooden end of a cotton swab, and have the patient tell you where you are touching. Repeat this on the other side of the toe.

Sometimes the patient experiences an edge effect, which results from too much pressure on the edge of the orthosis. A bulla or rubor may be noticeable on the foot. In orthoses with top covers, place the orthosis next to the foot and mark the area of irritation. The way to adjust the orthosis is to allow the edge to fold over, thereby increasing the width. The way this is done is to grind from the outside in below the top cover, thereby thinning the orthosis below the edge. In orthotics without top covers, add a cushioned top cover.

Padding

Padding is a means of off-loading structural pathology, and can be incorporated into an orthosis.

The commonly-used metatarsal pad helps off-load the metatarsal heads. The pad is made so that it terminates just behind the metatarsal heads with a length of approximately two inches. Medially, it commences at the first interspace and laterally, it terminates at the fourth interspace. It is beveled for approximately 1/2 inch, and has a secondary skive from the second metatarsal laterally. Metatarsal pads are useful in off-loading the metatarsal heads, especially in older patients, and with interspace neuromas of the forefoot. In orthoses that have a shell, the metatarsal pad has to be placed on the dorsum of the shell.

A toe crest is a pad placed under the proximal phalanges of the second through fourth toes. It should be made in a curvilinear shape. The height will vary depending on the pathology and size of the patient. It is best to add these to the orthosis after the patient has worn it enough to show wear patterns. It functions to off-load the distal portion of the toe and to help off-load the metatarsal heads.

Shock Absorption

Older patients and people who work on cement floors require additional shock absorption. This can be accomplished by changing the top cover, the posts, or both. If the patient requires more shock absorption and has acrylic posts, then try changing the posts to Korex, Thermocork, or crepe. If the orthoses do not have a top cover, then try applying a Poron or Spenco top cover. Plastazote is a poor choice for shock absorption, as it bottoms out.

Parts of Orthoses

We can make adjustments to orthotics at the heel, the mid-foot, or the forefoot. Adjustments to the heel include changing the rearfoot post, softening the plantar calcaneal region, changing the thickness of the posterior cup, and changing pronatory moments.

We change the rearfoot post by either adding a wedge of material, removing a wedge of material, or a combination. To increase a rearfoot post, we can add material in a wedge on the medial side, or conversely remove material in a wedge shape on the lateral side. This will help decrease pronation of the rearfoot.

An additional correction to decrease pronatory moments is to remove a part of the lateral portion of the rearfoot post. At heel contact, the lateral part of the shoe contacts the ground and this force is transferred up to the lateral post, resulting in an increased pronatory moment. Reduction of the lateral

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part of the rearfoot post works on the same principle as a calcaneal osteotomy, in which medial translation reduces pronatory moments. Care must be taken so as not to remove too much of the rearfoot post in semi-rigid orthoses, as the integrity of the lateral portion of the heel cup is partially dependent on the lateral rearfoot post. Conversely, a rearfoot post with an intact lateral half will increase the pronatory moment and aid a condition where this is warranted (i.e., chronic ankle sprains).

The lateral part of the heel cup is important in preventing lateral sliding of the calcaneus within the fat pad. As the rearfoot post is increased, the calcaneus is forced by gravity to slide down the wedge. This results in an abductory moment on the calcaneus which leads to oblique axis mid-tarsal joint pronation. The lateral part of the heel cup prevents the sliding, and hence the pronation.

The fat pad cushions the calcaneus. Failure of the first layer of muscles to maintain the fat pad can result in infra-calcaneal bursitis. A sufficient heel cup aids in maintaining the fat pad below the calcaneus. To increase this effect, grind the post under the plantar edge of the calcaneus. Grind through the shell, but not through the top cover, until an area the size of a nickel remains. Fill in this area with any soft material and grind it flat with the post. For additional cupping, apply 1/8 inch Korex™ as a 1/4-1/2 inch "U" pad with beveling from the periphery to the center with the full thickness of the Korex™ on the periphery.

The "U" pad should commence at a point in line with the most anterior part of the calcaneus and progress around the calcaneus ending at a point in line with the most anterior part of the calcaneus. In cases where the patient exhibits medial plantar fasciitis, the Korex™ should end proximal to the area of maximal discomfort, thus turning the "U" pad into a "J" pad.

The lateral part of the heel cup is important in preventing lateral sliding of the calcaneus within the fat pad.

At the posterior part of the heel cup, we can add Korex™ to push the foot away from the posterior counter of the shoe. This is required in Haglund's deformity. In Haglund's deformity, the superior half of the posterior of the calcaneus makes an angle less than 10 degrees to perpendicular to the ground as seen in a lateral radiograph. The posterior of the counter of the shoe also makes a 10 degree angle with the ground. Having less than 10 degrees in the posterior superior calcaneus can result in undue pressure at the Haglund's deformity. To off-load it, we can push the foot forward with an addition of Korex™ in the posterior part of the heel cup.

Usually 1/8 inch is sufficient, but in some cases up to 1/4 inch of Korex™ is required. Conversely, if a heel is popping out of a shoe, then a good place to start is to thin out the posterior part of the heel cup so the calcaneus is grabbed by the heel counter. Thinning the posterior of the heel cup lends an uneven look to the orthosis, so it is better to grind down the heel cup and then reduce the posterior thickness.

Pain in the posterior plantar calcaneus is usually related to a trigger point in the gastrocnemius. Sometimes adding material to the plantar posterior part of the post or the central third of a "U" pad will be helpful in non-rigid orthoses.

Arch adjustments consist of lengthening or shortening the rearfoot and/or forefoot posts, and/or adding or subtracting material under the arch or the medial rearfoot post. Orthotics fabricated from partial weight-bearing casts tend to have additional pressure at the proximal medial arch, while orthotics fabricated from non-weight-bearing casts tend to have additional pressure at the 1st metatarsal cuneiform joint. If there is a combination of too much pressure in one of these areas and there is a need to decrease pronation, then material can be added to the arch with the exception of the area that is being irritated. Runners and other athletes tend to require more range of motion, which is best seen as irritation plantar to the 1st metatarsal cuneiform joint. This can occur even in orthoses fabricated from partial weight-bearing casts.

The lateral arch requires support and a reverse arch pad can be applied plantarly in semi-rigid orthoses. This will not only support the calcaneal cuboid joint and 5th metatarsal cuboid joint, but will also assist in providing ankle stability.

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rections are made directly underneath the metatarsal just past the shell. The most common forefoot posts are either a 2-5 bar post, or a 2-5 bar + forefoot varus post. Less frequently, a forefoot varus or valgus post is required. Plastazote® or Korex™ can be glued distal to the shell and ending proximal to the digits. Medially, the material should end at the first interspace, where it should be beveled. The 2-5 bar or the 2-5 bar + forefoot varus post requires Plastazote® or Korex™ to extend the entire width of the orthosis.

The wedge under the 2nd through 5th metatarsals should be in line with the rearfoot post. If a 2-5 bar + forefoot varus post is required, then after grinding, there will be no material left under the 5th metatarsal head. Half of the material under the first metatarsal should then be ground down. Off-loading metatarsals are best performed by reading the orthosis.

Fitting Orthotics to Shoes

Partial length rigid and semi-rigid orthoses are placed on top of the insole, so these devices take up room in the shoe. There are two adjustments that are sometimes required to fit them in the shoe and both have to do with thinning the orthotic. The first adjustment is thinning underneath the calcaneus by grinding through the center of the post and into the shell. This can be ordered from most orthotic laboratories in advance and is called an intrinsic rearfoot post. When thinning the rearfoot post down to the shell, it is a good idea to see where the shell first shows. If the shell comes through dead center in the rearfoot post, there is a 0° rearfoot post; if the shell shows through medially, there is a valgus rearfoot post; and if the shell shows though laterally, there is a rearfoot varus post.

The other adjustment is thinning the forefoot. If there is any ledge or drop-off at the front of the orthosis, this should be eliminated by grinding the bottom of the orthosis in the forefoot until the ledge is eliminated. This will also help with the feeling of an edge at the front of the orthosis.

Full-length orthotics with a foam top cover are the most difficult and the most comfortable devices to fit to a shoe, when done properly. They require a shoe that has a removable insole. Some insoles require a little effort to remove, and in some athletic shoes, it is easier just to remove a layer of the Texon insole with the cushioned insole. Since full length orthoses take up the space of most cushioned insoles, they end up taking very little space. In fitting full length orthoses, first remove the insole, preferably in one piece to use as a template. Trace the front of the insole on the bottom of the orthoses and add 1/4 inch to be on the safe side. Using a scissors cut the material at the line. Now bevel the front edge. Beveling softens the edge, so it will be easier to put in a shoe, as it can roll up. Place the orthosis in the shoe and place your hand inside the shoe to feel where the orthosis does not contact the upper. If the front does not contact the front of the shoe and the orthosis does not fit into the shoe, then the problem is on the sides. If the orthosis fits into the shoe, but it is difficult to place in the shoe, then it is only slightly long.

An easy way to shorten slightly is to bevel the top of the top cover and use the starting point of the bevel as the line to shorten to.

An easy way to shorten slightly is to bevel the top of the top cover and use the starting point of the bevel as the line to shorten to. If the heel does not fit into the shoe, make sure that the width of the rearfoot post is not too wide. If it is, then narrow the post until it is the same width as the space in the shoe. If the forward lateral part of the orthosis is preventing placement into the shoe, and there is space medial to the hallux, then the problem may be the forefoot post, or the width adjacent to the first metatarsal head may be too wide. Undercutting on the medial side should remedy this issue.

One other thing to keep in mind is that when there is compression of the top cover in the shoe, the material will become denser. Developing a feel for this denseness at the front edge of the orthoses in the shoe will give information as to where to shorten the orthosis. If the heel pops out of the shoe, then thin the rearfoot post, and thin out the posterior part of the heel cup. The best way to do this is to lower the heel cup first, which results in a visible thickness to the posterior heel cup, and then grind off the excess on the posterior part of the heel cup.

As the height of the heel increases, the shank develops a more extreme bend. The arch of the orthosis needs to be ground down until the shell can flex. There is a limit to how much this adjustment can be performed. For higher heels, it would be better to consider a dangle cast.

Off-load Structural Problems

Hallux valgus, in milder cases, can be helped with orthotics. A medial flare ending just proximal to the first metatarsal head can offload the head of the first metatarsal. Additionally, allowing the 1st metatarsal to plantarflex (by thinning under the first or adding a 2-5 bar post) also results in abduction of the first metatarsal at the first metatarsal cuneiform joint. Finally, an interdigital spacer between the first and second toes will help the soft tissue component of the HA angle. It will not change the proximal articular set angle or the distal articular set angle.

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Hallux rigidus requires a decrease in the need for motion of the joint. A forefoot post under the metatarsal that is beveled acts as a rocker platform within the orthosis. Additionally, a varus forefoot post also induces the patient to use the low gear of the foot, thereby off-loading the first metatarsal phalangeal joint.

Tailor's bunion is helped by thinning the material under the 5th metatarsal. This not only provides more space, but the plantar flexion of the 5th metatarsal is associated with adduction at the 5th metatarsal cuboid joint. This adjustment is also used for a plantar-flexed 5th metatarsal.

An enlarged base of the 5th metatarsal is seen in metatarsus adductus. There is a tendency in children to outgrow some of this over time. A lateral flange that terminates behind the base of the 5th metatarsal will help off-load it. Sometimes, additional material can be added to the flare to provide for more off-loading.

When the running boom started, semi-rigid orthoses became popular, as they allowed more motion of the foot. Patients started developing cuboid syndrome due to the lack of support in this area. To combat this problem, the arches of semi-rigid orthoses for runners were filled in with material, similar to a bulk device. The important part of the bulking was the area under the cuboid which increased the stiffness of the lateral arch of the orthosis. Unilateral cuboid syndrome is commonly seen on short leg sides with an equinus, so a heel lift in addition to additional support in the lateral arch should be applied if indicated.

Orthoses can act as an adjunctive procedure in the treatment of chronic ankle sprain. The orthotic should have a 0 degree rearfoot post, a cuboid pad, and a 2-5 bar post. Also, the front edge of the shell should be straight from the first to the fifth metatarsal rather than curved, as this provides additional stability at push off.

Every six months to one year, a patient with this type of device may need to have the arch or the orthosis made more rigid via adding material in the arch.

Over time, the arch in the shell of a polyethylene orthosis will sag. Every six months to one year, a patient with this type of device may need to have the arch or the orthosis made more rigid via adding material in the arch. Patients with plantar fasciitis may tell you that they were doing fine for several months and then the pain started to come back. Add 1/8 inch of Korex™ from the rear foot post distally to the forefoot post. Grind a flat plane from the rearfoot post to just behind the metatarsal heads. If there are no posts on the orthosis, add the Korex™ from the back of the orthosis distally to just behind the metatarsal heads. Grind off excess form the sides of the orthosis, then grind the sub-calcaneal area to the shell, and grind a flat plane from this point to just behind the metatarsal heads.

Off-loading plantar-flexed metatarsals is best performed by reading the orthosis. Foams tend to compress and mold over time. The pressure of metatarsals can be seen as both a depression on the top of the top cover, and when turned over, the molding is seen as an elevation in the area of the plantar-flexed metatarsal head.

If the material is thick enough, it can be ground down until level with the rest of the forefoot. If the top cover is not thick enough, a piece of Plastazote® or Korex™ can be glued to this area, and the elevated area can be ground down. Be careful not to deform the shape of the top cover when placing the additional material on the orthosis.

For plantar-flexed second metatarsals, keep in mind that functional hallux limitus can result in a functional metatarsus primus elevatus with excessive pressure under the head of the second metatarsal. A 2-5 bar post is a useful addition in this case (after removing the material sub-second metatarsal head, the result of which is a 3-5 bar post). Another addition is a metatarsal pad. The pad is made so that it terminates just behind the metatarsal heads with a length of approximately two inches. Medially, it commences at the first interspace; and laterally, it terminates at the fourth interspace. It is beveled for approximately 1/2 inch and has a secondary skive from the second metatarsal laterally. Metatarsal pads are useful in off-loading the metatarsal heads, especially in older patients. In orthoses that have a shell, the metatarsal pad has to be placed on the dorsum of the shell. Carefully peel back the top cover (be prepared to replace it if it tears), apply the metatarsal pad, then have the patient try it. If it is in the correct spot, then glue down the top cover.

Off-loading plantar-flexed metatarsals is best performed by reading the orthosis.

Digits can also show increased pressure by reading the top cover. The top cover will show where

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there is additional pressure at the distal end. By decreasing the material where the depressions are, the patient will feel more comfortable, and report that the foot is not slipping as much on the orthosis. Sometimes a toe crest will need to be applied to the plantar aspect of the top cover.

We can also cause separation of digits with orthoses. This is useful not only for aiding the soft tissue component of the HA angle in hallux valgus, but also in the case of an interdigital keratosis.

Look for where the distal aspect of the toes are wearing on the orthoses and plantarly thin out the material under the tips of the toes and proceed proximally until the sulcus. Leave 1/8 inch of material full thickness between the toes. Additionally, make a piece of Plastazote® or Korex™ 1/8 inch wide and the length of the digital interspace. Bevel all the edges. This can be glued on the plantar aspect of the top cover between the two digits.

Morton's neuroma is helped by a metatarsal pad with additional material placed under the fifth metatarsal head to off-load the 4th metatarsal.

While rigid orthoses do not change their shape, semi-rigid and flexible orthoses made of polyethylene will have creep deformation. Look for a twisting of the shell of the orthosis. This can be seen by turning the orthosis upside down and sighting from the plane of the rearfoot post distally and comparing its plane to that of the forefoot post or front edge of the orthosis. Twisting is an indication of an improperly functioning foot.

If the forefoot is inverted relative to the rearfoot, this can be an indication to either decrease the rearfoot varus post or increase the varus of the forefoot post, so that the posts end up in the same plane. If the forefoot is everted relative to the rearfoot, this can be an indication to either add material laterally on the forefoot post or increase the varus of the rearfoot post, so that the posts end up in the same plane.

Let the symptoms of the patient guide you in deciding the best way to make the correction. If the symptoms are of too much pronation (e.g., medial plantar fasciitis), then increase the varus post to be on the same plane with the forefoot. If the symptoms are of not enough pronation (e.g., peroneal tendinitis), then balance the forefoot to the rearfoot. If one forefoot is inverted relative to the rearfoot, and the forefoot is everted on the opposite foot, this is in indication of an asymmetry.

Another sign in reading an orthosis is to look for shearing in the heel cup.

Functional hallux limitus can be seen in the orthosis by a lack of pressure under the first metatarsal head, and/or additional pressure under the interphalangeal joint of the hallux, and/or additional pressure under the second metatarsal head. This can be corrected by either adding material under the second through fifth metatarsals or by removing material under the first metatarsal head. The material can be added as either a bar or a wedge. Make sure that the edges of the material added are beveled on the proximal, medial, and distal edges.

Another sign in reading an orthosis is to look for shearing in the heel cup. If the calcaneus is sliding laterally, there will be a wearing out of the top cover in the lateral part of the heel cup. Stand the patient up on the orthotics to see how the foot sits in the device. If there appears to be a sufficient heel cup, then adjusting the orthosis will be helpful. In semi-rigid or flexible orthoses, sight down the plantar aspect of the rearfoot post and you will see the elevation of the lateral heel cup. Adding Korex to this area and smoothing it to level it to the rest of the post will help to stabilize the lateral heel cup. Stand the patient up in the orthosis again and check for the improvement. If there is none, then additional material may be added. If this still does not have the patient sit well in the orthoses, then consider lowering the supinatory corrections, having the patient purchase a shoe with a firmer counter, or fabricate a new pair of orthotics with a deeper heel cup.

Orthoses are an important part of the podiatric armamentarium. Learning to properly adjust orthoses will help you manage your patients who require them. **PM**

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Continuing Medical Education

SEE ANSWER SHEET ON PAGE 163.

1) Orthoses can help a patient by:
   A) Changing the way the foot functions
   B) Off-loading structural problems
   C) Providing shock absorption
   D) All of the above

2) The rigidity of an orthosis is based upon:
   A) The material used
   B) The thickness of the material used
   C) A and B
   D) None of the above

3) Shock absorption is important for:
   A) Younger patients
   B) People who work on hard surfaces
   C) A and B
   D) None of the above

4) Orthoses can be classified as:
   A) Rigid, Semi-rigid, and Flexible
   B) Rigid and Bulk
   C) Functional and Accommodative
   D) All of the above

5) Heat molding is an adjustment mainly performed on:
   A) Rigid orthoses
   B) Semi-rigid orthoses
   C) Flexible orthosis
   D) All of the above

6) The four functional imbalances that can be treated by foot orthoses are:
   A) frontal plane imbalances, equinus, leg length, and functional hallux limitus
   B) frontal plane imbalances, equinus, leg length, and metatarsal arch imbalances
   C) equinus, leg length, functional hallux limitus, and metatarsal arch imbalances
   D) frontal plane imbalances, equinus, functional hallux limitus, and metatarsal arch imbalances

7) Toe crests:
   A) Are best put in by the orthotic laboratory
   B) Help to off-load the distal portions of the distal phalanges
   C) Help to off-load the distal portions of the metatarsal heads
   D) B and C

8) Functional hallux limitus can best be treated with orthoses by:
   A) Using a functional orthotic
   B) Letting the first metatarsal drop relative to the other metatarsals
   C) Thinning out the rearfoot post
   D) Adding a metatarsal pad

9) Adjustments to the heel region of the orthosis to decrease pronation include:
   A) Increasing the rearfoot post by adding material to the medial side of the post in a wedge shape
   B) Removing a part of the lateral portion of the rearfoot post
   C) Removing the entire rearfoot post
   D) A and B

10) A sufficient heel cup:
   A) Maintains the fat pad below the calcaneus
   B) Prevents the calcaneus from sliding laterally
   C) A and B
   D) None of the above

11) Haglund's deformity can be treated with orthoses by:
   A) Using a neutral position orthosis
   B) Adding material to the posterior aspect of the heel cup
   C) Adding a rearfoot varus post
   D) Adding a forefoot valgus post

12) Stiffening of the lateral arch by placing additional material under it helps treat:
   A) cuboid syndrome
   B) ankle instability
   C) A and B
   D) Haglund's deformity

13) Off-loading metatarsals is best done by:
   A) Having the lab make the accommodations in the orthoses
   B) Trial and error
   C) Valgus posting the forefoot
   D) Reading the orthoses and making the adjustments accordingly

14) Difficulty in fitting partial length orthoses can be made easier by:
   A) Ordering intrinsic posting
   B) Thinning the center of the plantar calcaneal region of the orthoses
   C) Removing a ledge at the forefoot by thinning plantarly
   D) Any of the above

15) Hallux valgus can be treated in milder cases by:
   A) A medial flare on the orthosis and allowing the first metatarsal to drop
   B) A spacer between the 1st and 2nd toe for the soft tissue component of the HA angle
   C) A and B
   D) None of the above

16) To treat a chronic ankle sprain, an orthosis should have:
   A) A rounded distal edge of the shell of the orthosis
   B) A rearfoot varus post
   C) A cuboid pad
   D) None of the above

Continued on page 162

17) A forefoot post:
- A) Always prevents pronation
- B) Always causes pronation
- C) Can cause the foot to function in low gear
- D) Can cause a foot to function in high gear

18) When grinding a rearfoot post to the shell of the orthosis, a varus grind is noted:
- A) If the shell comes through dead center in the rearfoot post
- B) If the shell shows through medially in the rearfoot post
- C) If the shell shows through laterally in the rearfoot post
- D) None of the above

19) Morton's neuroma is best treated by orthoses when:
- A) A metatarsal pad is added to the orthosis
- B) Additional support is placed under the 5th metatarsal head
- C) A and B
- D) None of the above

20) To increase shock absorption in an orthosis:
- A) Change the acrylic posts to Korex posts
- B) Use a Poron top cover
- C) Use a Plastazote top cover
- D) A and B

SEE ANSWER SHEET ON PAGE 163.

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EXAM #5/14
Adjusting Foot Orthoses
(Beekman)

Circle:

1.	A	B	C	D	11.	A	B	C	D
2.	A	B	C	D	12.	A	B	C	D
3.	A	B	C	D	13.	A	B	C	D
4.	A	B	C	D	14.	A	B	C	D
5.	A	B	C	D	15.	A	B	C	D
6.	A	B	C	D	16.	A	B	C	D
7.	A	B	C	D	17.	A	B	C	D
8.	A	B	C	D	18.	A	B	C	D
9.	A	B	C	D	19.	A	B	C	D
10.	A	B	C	D	20.	A	B	C	D

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2) The educational objectives were accomplished ____

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A B C D

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