How to Prevent and Even Reverse the Formation of Bunions Without Surgery

By Tom Michaud, DC

Even though the word bunion is widely used to describe the condition in which the big toe angles out while the first metatarsal angles in, the technical name for this condition is either hallux abductus or hallux abductovalgus, depending upon whether or not the great toe is rotated in the frontal plane (Fig. 1). The term bunion, which comes from the Latin word for "enlargement," actually refers to the combination of a thickened callus, a swollen bursa, and the bony prominence that forms on the inner side of the first metatarsal head (Fig. 2). The bursa is especially painful while wearing tight fitting shoes, as it gets trapped between the skin and the enlarged metatarsal head.

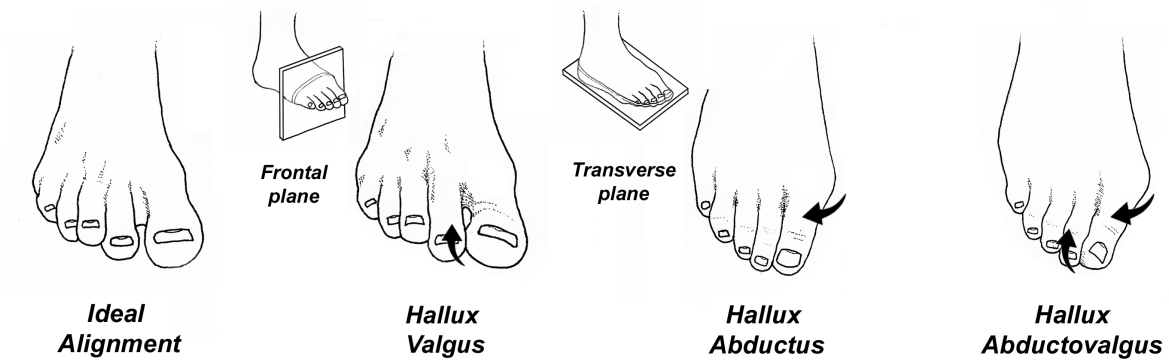


Fig. 1. In order to accurately describe motion, the body is divided into three reference planes. When the hallux (which is the Latin word for "big toe") is rotated in the frontal plane, it is referred to as hallux valgus. When the hallux is rotated in the transverse plane, it is referred to as hallux abductus. More commonly, the great toe is rotated both in the transverse and frontal plane and is referred to as hallux abductovalgus. For unknown reasons, the vast majority of medical journals incorrectly use the term hallux valgus when describing hallux abductus. Hallux valgus in isolation is relatively uncommon and rarely problematic.

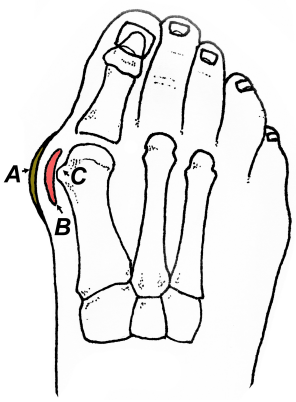


Fig. 2. The bunion consists of a thickened callus (A), an inflamed bursa (B), and a bony prominence forming on the inner side of the first metatarsal head (C).

The Manchester grading scale allows you to classify the severity of HAV by visually evaluating alignment of the first metatarsal and the big toe (Fig. 3). While mild HAV rarely causes problems, moderate and severe cases of HAV can compromise the stability of the entire foot, causing pain, poor physical performance, gait disturbances, and impaired balance (1). The balance deficits are particularly problematic in older adults, as they significantly increase the likelihood of falling (2).

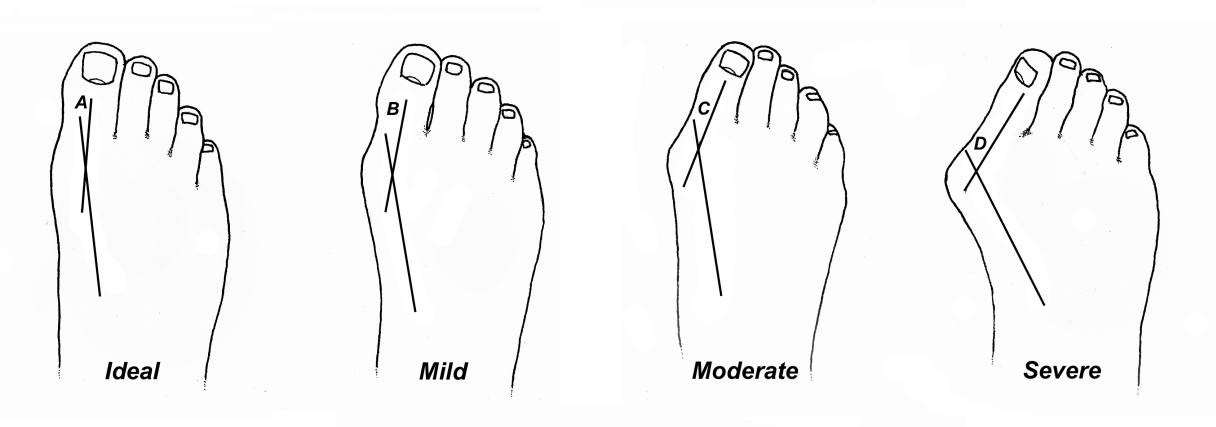


Fig. 3. The Manchester scale allows you to rate the severity of HAV based on its physical appearance. Despite its simplicity, this grading system is surprisingly accurate, achieving outcomes similar to x-rays (39). The severity of HAV is also categorized by the angle between the first metatarsal and the great toe (a.k.a. the hallux angle). Ideally, the angle will be less than 15°(**A**). HAV is rated as mild when the angle is between 15 and 20° (**B**), moderate when the angle is between 21 and 39° (**C**), and severe when the angle exceeds 40° (**D**)(39). (Image modified from references 39 and 41.)

HAV is surprisingly common. In a recent study of almost 500,000 people, Nix et al. (3) found that 8% of teenagers, 23% of adults, and 36% of people over the age of 65 suffer with this often painful condition. The authors of this study note that women are 2.3 times more likely to develop HAV, which many authors attribute to the regular use of poor fitting shoes. While some experts question the connection between poor fitting shoes and the development of HAV (4), a larger number of studies suggest that there is a strong connection (5-8). In one particularly interesting study, researchers from Poland (6) evaluated the feet of 150 women between the ages of 30 and 40 who routinely wore either flat shoes, shoes with low heels (~1.6 inches), or shoes with 4-inch heels. These women self-selected their shoe gear but a requirement to get in the study was that they had to wear the shoes for 8 hours per day, 5 days per week, for minimum of 5 years. While there was little difference in the presence of HAV between those wearing flat and low heels, the women who routinely wore 4-inch high heels were significantly more likely to have higher hallux angles, lower arches, and an inward rotation of their fifth toes.

It's not just high heels that correlate with the development of hallux abductovalgus. Frey et al. (9) traced the feet of 356 women and compared these tracings to the shoes they routinely wore and discovered that 88% of women wore shoes that were on average 1.2 cm too small. The

authors noted that women who wore the tightest shoes were significantly more likely to suffer with pain and develop HAV, while the women who wore shoes that were 0.6 cm smaller had less discomfort and smaller hallux angles. The authors make the interesting observation that for unknown reasons, about 20% of women who wear poor fitting shoes do not develop discomfort or HAV. They state: “There must be some intrinsic factors that make some women more vulnerable to the deforming effects of shoes and cause a small percentage of unshod feet to develop HAV and other forefoot deformities.” This statement shows just how complex and poorly understood the development of HAV is.

In addition to high heels and poorly fitting shoes, other common factors associated with the development of HAV include a long first metatarsal, a rounded first metatarsal head, excessive rearfoot pronation, limited mobility in the ankle and/or great toe, foot weakness, and variation in the shape of the base of the first metatarsal (10-16). Of all of these factors, variation in the shape of the base of the first metatarsal may be the most important contributing factor (15,16) (Fig. 4). Recent research shows that nearly 75% of people with HAV possess a metatarsal base that is wide and flat, while individuals with well-aligned toes are more likely to have a three-facet configuration, often with a large bony prominence projecting on the outer side (15). According to Mason, et al. (16) the 3-facet articulations “promote stability,” explaining why so few people with multiple articulations develop HAV.

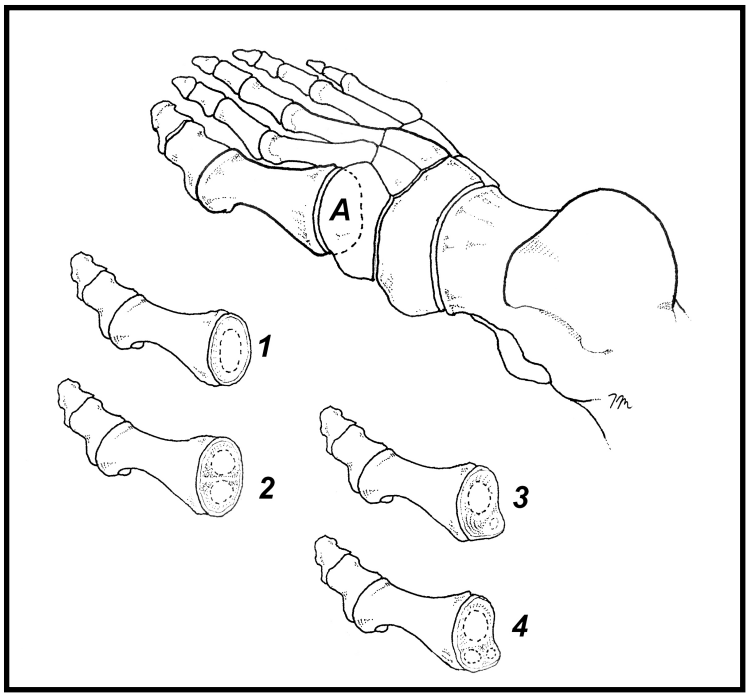


Fig. 4. The base of the first metatarsal (A) can form with a variety of different articular shapes. As demonstrated by Ji et al. (14), the first metatarsal can form with a single broad flat articulation (**1**), a flat double articulation separated by a ridge (**2**), a double articulation with a lateral bony projection (**3**), and even a triple articulation with a larger bony ridge (**4**). The greater the number of joints and the larger the bony projections, the more stable the first metatarsal is (16). Nearly 75% of people with HAV possess the broad flat articulation pictured in figure 1. This particular joint shape also correlates with the development of a more severe hallux abductovalgus (15).

While surgical reconstruction is often considered the only way to alter the bony alignment and reduce the degree of HAV, there is a growing body of evidence that shows you can prevent and even reverse mild to moderate cases of HAV with conservative interventions. Common treatment recommendations include custom and over-the-counter orthotics, toe separators, calf stretches, joint mobilization, night splints, and foot strengthening exercises. By far, the most frequently prescribed conservative intervention for managing HAV has been the use of custom and over-the-counter orthotics. Despite their popularity, there is limited evidence that orthotics by themselves can alter the hallux angle in the long-term (17-20). In one of the few studies to support use of orthotics, researchers from Chicago took 102 subjects who had active rheumatoid arthritis and foot pain and divided them into two groups: one group received orthotics, and another received placebo orthotics (21). Patients were followed for three years and those wearing orthotics were 73% less likely to develop HAV compared to the control group. Note that this population did not have HAV at the start of the study, suggesting orthotics might help in the prevention, but not in the treatment or reversal of HAV.

In one of the only studies in which orthotics had a successful outcome in reversing an already formed HAV, researchers from Taiwan custom fit semirigid orthotics with large thermoplastic toe separators that were wrapped in silicone (22) (Fig.5). After 3 months of regular use, the average hallux angle reduced 6.5°, which correlated with a significant reduction in pain and improved walking ability. Unfortunately, very few orthotic laboratories incorporate the custom toe separators used in this study, but it is possible to make custom toe separators with a two-part RTV silicone material. This specific type of silicone was recently shown to reduce the degree of HAV by almost 4° when worn as a night brace while sleeping (23). A great combination is to use a smaller custom toe spacer during the day (with or without an orthotic) and wear a larger one at night to splint the big toe into a more aligned position.

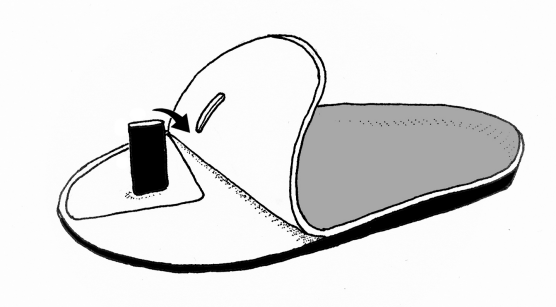


Fig. 5. Orthotic with custom toe separator. The authors of this study fabricated orthotics from foam box impressions and inserted a thermoplastic plate beneath the top cover so it would separate the first and second toe. When the top cover was folded down, the plate was wrapped in silicone and the top was bent to cover the second toe (**arrow**). Surprisingly, these orthotics were well tolerated as even after three months of continuous use, there was no evidence of skin irritation or blisters.

Perhaps the most promising conservative care for the treatment and prevention of HAV is the prescription of foot/leg strengthening exercises. In a 2015 study, researchers from Korea divided 24 people with HAV into two groups: one group received orthotics only, and the other group wore orthotics and performed a simple toe spread-out exercise 20 minutes per day, four days a week for eight weeks (24) (Fig. 6).

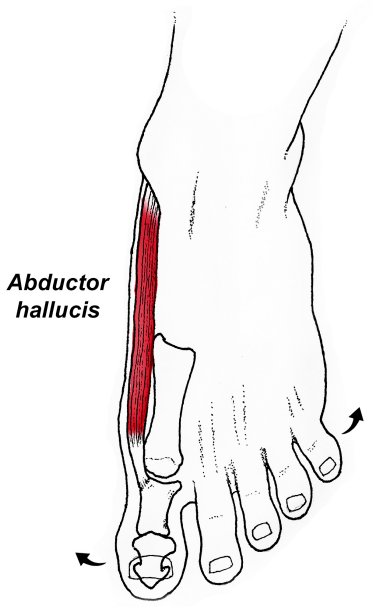


Fig. 6. The toe spread-out exercise. As originally described by Keller (42), this exercise is performed by simultaneously lifting all of the toes while maintaining the forefoot and heel on the floor. The subject then pushes the little toe down and out and the big toe down and in (**arrows**). Moving the big toe down and in specifically targets the abductor hallucis muscle, which is the only muscle that prevents the great toe from shifting laterally. A prior study confirmed that this specific exercise targets the abductor hallucis muscle better than conventional short foot exercises (43).

At the end of the study, the individuals wearing orthotics and performing the toe exercises had a 3.4° decrease in their hallux angle along with a 24% increase in the volume of their abductor hallucis muscle. In contrast, individuals wearing orthotics only had no change in their hallux angle and had a slight reduction in the volume of their abductor hallucis muscle. The authors point out that despite the proven connection between abductor hallucis weakness and the development of HAV, very few studies have evaluated the most effective ways to strengthen this important muscle. While these authors used isometric contractions alone, strength gains would more than likely have been better if resistance was applied during the exercise. This can easily be accomplished by wrapping elastic bands around the base of the big toe while performing toe spread-out exercises, or by stabilizing the forefoot and pushing the toe inward against resistance provided by foam or any soft material.

In what has to be the most detailed study to date on the effect of conservative care on HAV formation, a researcher from Cairo (25) performed a variety of interventions, including various manual therapies, foot strengthening exercises, calf stretches, and the routine use of silicone toe separators to determine the effect these interventions would have on pain, function, and the radiographically measured hallux angle. The author took 56 women with moderate HAV and divided them into either a control or a treatment group. The control group took anti-inflammatory medications and performed normal activities. The treatment group received 36 sessions in which joints of the foot and ankle were mobilized and calf stretches were performed to increase ankle range of motion. The treatment group also received a series of foot strengthening exercises and were asked to wear silicone toe separators for a minimum of eight hours per day. At the end of this 12-week study, the hallux angle in the treatment group changed markedly, decreasing from 32° to 23.8°. In contrast, the control group had no change in their angle. The treatment group also had significant increases in their ankle range of motion (increasing from 9.5 to 15.2°) and their toe strength (which increased approximately 30%). Even better, individuals in the treatment program maintained the majority of these improvements one year later. Importantly, there were also significant improvements in pain and function in the treatment group.

The thing I like most about this study is as good as the outcomes were, they could have been much better. For example, while the treatment group received excellent manual therapy in which joints of the forefoot, midfoot and ankle were mobilized, the author failed to measure and/or specifically attempt to increase motion in the big toe joint. According to Clough (4), limited upward motion in the big toe is a primary cause of chronicity with HAV, as upon reaching the limited end range of motion, the base of the big toe drives the first metatarsal farther into adduction (Fig. 7). Clough claims that restoring big toe motion is one of the most important things you can do to prevent progression of HAV (4). A simple mobilization that effectively increases motion in this important joint is illustrated in figure 8.

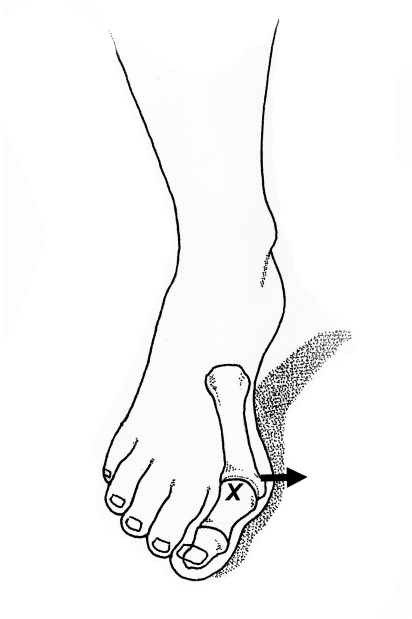


Fig. 7. When someone with limited motion in the great toe joint reaches their end range of motion (X), the proximal phalanx of the great toe pushes back on the first metatarsal, causing it to adduct (arrow). According to Clough (4), restoring upward motion in this joint will prevent the first metatarsal from being driven into adduction, which over time will result in a gradual improvement in the hallux angle.

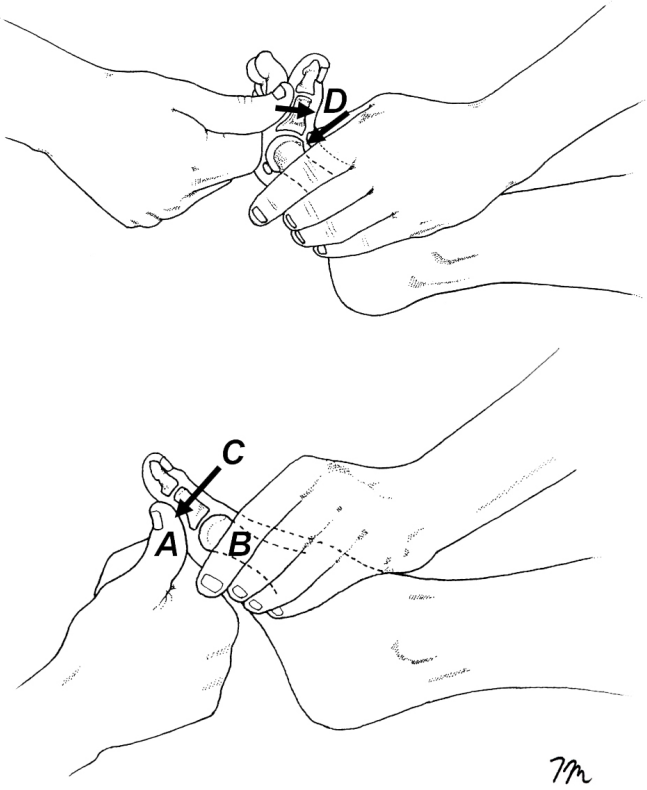


Fig. 8. An easy way to restore upward motion to the great toe is with a neutral position stretch. To accomplish this, place your thumb beneath the base of the great toe (**A**) while stabilizing the first metatarsal (**B**). In this position, the person pushes down into your thumb with mild force for approximately five seconds (**arrow C**). Next, you gently push the base of the great toe upwardly while simultaneously pushing down on the first metatarsal head (**arrows near D**). This position should not cause discomfort and is held for 10 seconds. The examiner then returns to position **A** and repeats the entire process four times. Research shows that contracting a muscle in a midline position prior to initiating a stretch produces rapid increases in tendon resiliency and range of motion (44). This maneuver should never be uncomfortable.

Another intervention that could have been improved was the stretch protocol, as the author had subjects perform 5, 15-second stretches three times per week to lengthen the calf muscles. While this was a common treatment protocol at the time, recent research shows that short duration stretches produce only temporary changes in muscle length and tendon resiliency (26). More recent research shows that in order to permanently change the resting length of a muscle (and improve function) stretches need to be maintained for a minimum of 60 to 90 seconds and performed for at least 15 minutes daily, five days per week (27). Although time-consuming, prolonged stretching routines can increase force output, physically lengthen the muscle (permanently changing its length for the better) and improve tendon resiliency (26,27). All of these factors would have made for a better outcome when managing people with HAV, as they tend to have limited upward motion at the ankle and reduced force output from the calves while walking.

The outcomes in this study may also have been better if the author used a different strengthening protocol, as Abdalbary had patients perform 10, 10-second isometric contractions while maintaining their toe joints in a midline position. The author was unaware of research by Goldman et al. (28), who proved the most effective way to strengthen toe muscles is by exercising them in a lengthened position. During a 7-week study, Goldman et al. (28) had subjects perform 4 sets of 5 three-second isometric contractions, 4-times per week. Instead of keeping the toes in a midline position, as in the Abdalbary study, Goldman et al. had subjects perform the isometric contractions while the toes were angled upwardly 25°. Using this novel technique, the authors noted that by the second week, toe strength had increased 40%. By the end of the 7-week study, average toe strength increased between 60% and 70%, which was 2 to 4 times higher than the strength gains associated with similar training protocols. The strength gains associated with this study had never been achieved before, which the authors attributed to exercising the toe muscles while they were lengthened, which is their position of function while walking and running. In the past 10 years, numerous papers have supported Goldman's research showing that exercising muscles while they are in their lengthened positions produces the best outcomes in strength and performance (29-31).

Perhaps the biggest shortcoming in the Abdalbary study was that the author failed to include exercises to strengthen peroneus longus. This oversight is significant because peroneus longus is the body's most powerful stabilizer of the first metatarsal (32). In a detailed analysis of muscle function associated with the development of HAV, researchers from Switzerland prove that peroneus longus is far and away the most important stabilizer of the first metatarsal because of its powerful attachments to the base of the first metatarsal and medial cuneiform (32) (Fig. 9). A strong peroneus longus is especially important in people possessing the single articulated metatarsal base described in figure 4, which is present in 75% of people with HAV. The authors state that because the ability of a muscle to generate force is dependent upon its cross-sectional area and its overall length, peroneus longus is the ideal muscle for stabilizing the inner forefoot. Clinically, it is easy to measure peroneus longus strength by placing a toe strength dynamometer beneath the first metatarsal head and noting resistance (Fig. 10). Ideally, you should generate at least 10% of body weight when performing this test. Although there are multiple ways to strengthen peroneus longus, my two favorite exercises are illustrated in figure 11.

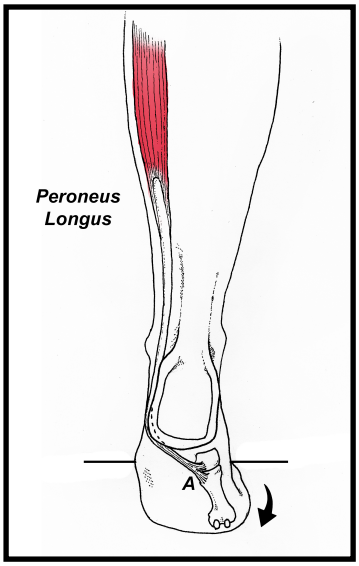


Fig. 9. Peroneus longus originates along the upper fibula and has two separate attachment points along the base of the first metatarsal and medial cuneiform bones (A). Because of its size and length, peroneus longus has the ability to stabilize the entire inner forefoot by pulling the first metatarsal downward (**arrow**).

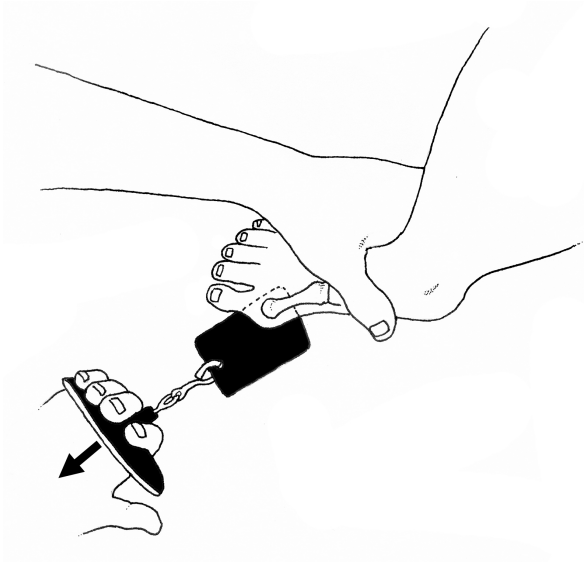


Fig. 10. Measuring peroneus longus strength with a toe dynamometer. The long end of the card is placed beneath the first metatarsal head as the examiner pulls outwardly (**arrow**). Ideally, the person being tested will generate at least 10% of their body weight during this test. Because no muscles attach directly to the first metatarsal head, this measurement allows you to reliably quantify strength of the peroneus longus muscle. The person is seated while performing this test.

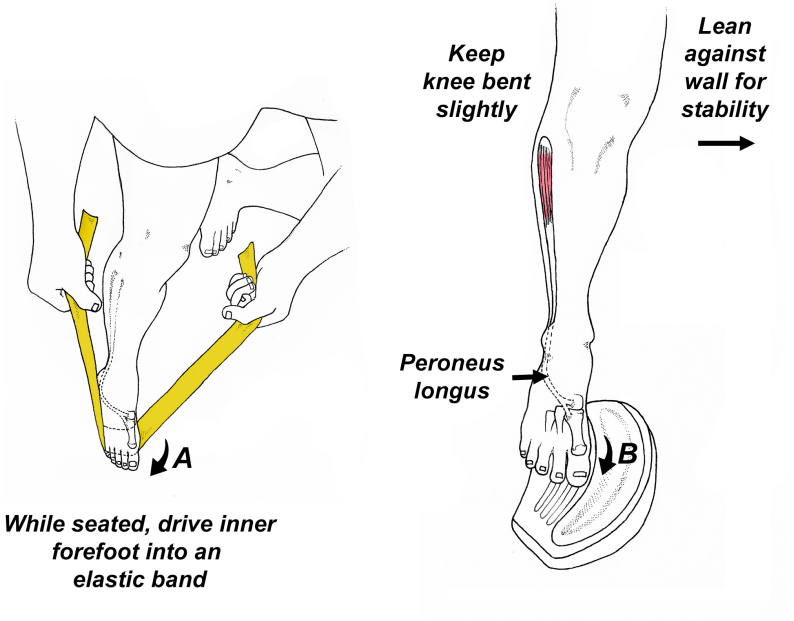


Fig. 11. Peroneus longus exercises. The easiest way to strengthen peroneus longus is to drive your inner forefoot into resistance provided by an elastic band (**A**). This is a great beginner exercise as it teaches you fire your peroneus longus without a lot of stress. As you get stronger, place a ToePro or balance pad next to a wall and lean slightly to the side so you are supported by the wall. Next, raise your heel and simultaneously drive your inner forefoot down vigorously into the foam (**B**). You'll feel your peroneus longus tense as it attempts to stabilize your first metatarsal.

Strengthening peroneus longus is particularly important when managing severe HAV, which is notoriously difficult to treat. The reason there are so few studies evaluating the efficacy of strengthening exercises with severe HAV is because once you pass a 45° angle of hallux abduction, strengthening the toe muscles is ineffective because of changes in lever arms associated with hallux abduction (33) (Fig. 12). This was first proven by Bojsen Moller (34), who in the late 70s demonstrated that when an individual with a 60° hallux angle attempts to push the great toe down into the ground, the long toe muscles create a retrograde force that pushes the first metatarsal inwardly with a force 1.7 times greater than the force pushing the toe down.

You can easily observe this in people with large HAV angles by having them attempt to push their big toe down while standing: you can see an immediate worsening of the degree of HAV as the first metatarsal adducts. Because people with severe HAV are unable to safely generate force beneath their big toe, the best exercise intervention when managing severe cases of HAV is to strengthen the peroneus longs muscle. This powerful muscle can improve the generation of force beneath the first metatarsal head without contribution from the big toe.

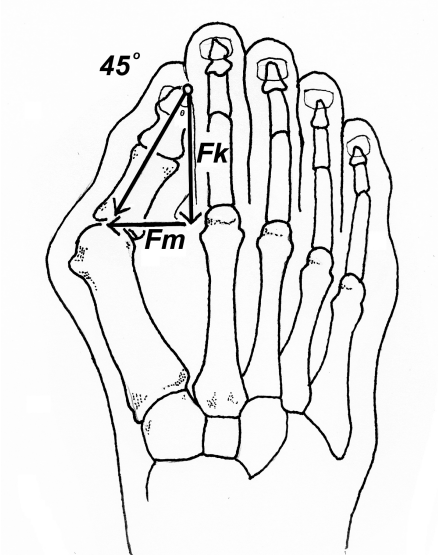


Fig. 12. Mechanical changes in muscle function as the hallux angle increases. As noted by Glasoe et al. (33), forces generated beneath the tip of the toe will have the medially directed component (**Fm**), which displaces the first metatarsal inwardly, and a downward component (**Fk**), which pushes the great toe into the ground. Once the hallux abducts more than 45°, the forces pushing the first metatarsal inwardly exceed the forces pushing the great toe into the ground.

In a pilot study performed at Temple University, Song et al. (35) had 25 people perform a variety of exercises using the ToePro exercise platform, one of which was the peroneus longus exercises illustrated in figure 11. The authors noted that patients who completed 25 sessions in less than 10 weeks were able to generate significantly more force beneath the medial forefoot while walking over a force plate. This finding confirms it is possible to stabilize the medial forefoot with strengthening exercises alone.

Based on the latest research, the following section reviews a detailed rehabilitation program for the management of all stages of HAV. People with large hallux angles should do these exercises while wearing toe separators and should consider wearing custom silicone night braces while sleeping. Of course, appropriate shoe gear should be recommended and the routine use of high-heel shoes should be discouraged, especially if they are four-inches or higher. In order to monitor

progress, you can download an app called *Angle Meter* on your iPhone and take a photo over the top of your forefoot and measure your hallux angle every 6-8 weeks. Several studies have shown that digital photographs provide comparable measurements to x-rays, making them a safe and inexpensive alternative for monitoring HAV progression (36, 37).

While surgical correction is often necessary for complex cases (Fig. 13), the majority of people with mild to moderate degrees of HAV respond well to conservative interventions. Ideally, these exercises should be initiated early in life, as research shows that weakness of the abductor hallucis begins decades before the development of HAV (38), and unlike many medical interventions, there are no dangerous side effects to strengthening your toes. Strong toes have been shown to correlate with improved athleticism, increased vertical jump height, and can even reduce the likelihood that you will fall as you get older. Although the stretches and exercises in this program can take about 30 minutes a day to complete, it's a small price to pay given the possible benefits.

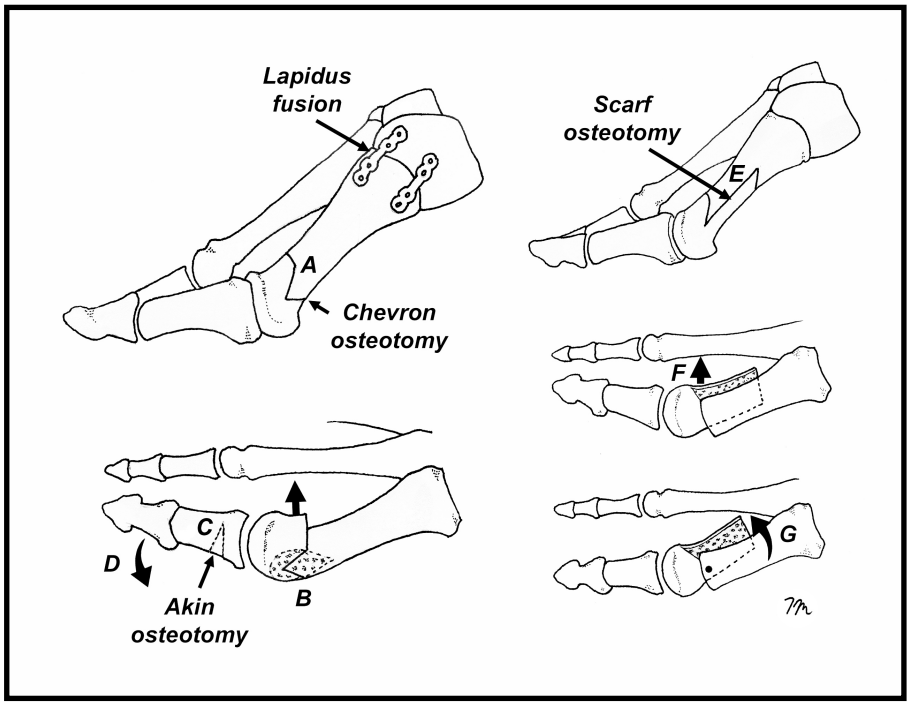


Fig. 13. Common surgical techniques for managing HAV. Although there are over 150 surgical techniques for managing this common condition, the more popular surgical techniques include the Lapidus procedure in which the first metatarsal is fused to the medial cuneiform, and various osteotomies. In the Chevron osteotomy, a V-shaped incision is cut into the end of the first metatarsal head (**A**), and the head of the metatarsal is then pushed inwardly (**arrow**). The bony prominence on the inner side of the first metatarsal head is removed (**B**), and the base of the big toe is often treated with another osteotomy, the Akin osteotomy, in which a wedge shaped piece of bone is removed (**C**) allowing the tip of the great toe to angle inwardly (**D**). Another popular surgical technique is the Scarf osteotomy. As illustrated, a horizontal cut is placed through the shaft of the first metatarsal (**E**) and the lower half of the first metatarsal is then pushed inwardly (**F**). To improve alignment, the lower section of the first metatarsal is then rotated to allow the great toe to line up with the second toe (**G**). A recent 2023 analysis of the five-year success rate of osteotomies showed that these procedures have a 64% recurrence rate when the threshold for correction is a hallux angle less than 15°, but a 90% success rate when the threshold for correction was a hallux angle between 20 and 25° (45). Five years after surgery, only 5% of people had a hallux angle greater than 25°, which is an impressive statistic given the complexity of this condition.

The Hallux Abductovalgus Treatment Protocol

1. Custom or over-the-counter orthotics. Even though research shows orthotics do not reduce the hallux angle (46,47), orthotics can be invaluable when managing people with painful bunions. Roddy et al. (48) recently demonstrated that wearing an over-the-counter orthotic in a shoe with a wide toe box produced significant reductions in pressure beneath the first metatarsal head, as the orthotics transferred pressure away from the metatarsal head into the center of the arch. Reducing pressure beneath the first metatarsal head is a great way to reduce discomfort, especially when there is an inflamed bursa. The only downside to distributing pressure into the arch is that it can compress the abductor hallucis muscle, causing it to gradually weaken over time. One study found that 12 weeks of regular orthotic use produced a 17% atrophy of the abductor hallucis muscle (49), which can be disastrous when managing HAV. Fortunately, it is easy to keep your arch muscles strong by performing foot strengthening exercises when wearing orthotics.

While there are countless over-the-counter orthotics available, a company called Tread Labs offers affordable over-the-counter orthotics that are available with 4 different arch heights. In theory, the greater the arch height, the greater the distribution of pressure away from the first metatarsal head. By selecting 1 of 4 arch heights, you can choose the exact arch height that feels most comfortable to you. These orthotics are also three-quarter length, which is important as full-length orthotics tend to lift up the forefoot too much, aggravating symptomatic bunions (50).

Because several studies have shown that people with HAV often present with excessive rearfoot pronation (51,52), people with extremely low arches should consider wearing custom orthotics fabricated with varus posts. Varus posts are angled wedges placed beneath the inner side of an orthotic that decelerate the velocity in which your foot rolls in. Although expensive, custom orthotics can be manufactured with 2 or 4° varus posts, deep heel counters, and excessive arch elevation to offload the first metatarsal head. They can also be made out of extremely thin plastic or graphite shells that can even be custom molded to a specific pair of shoes. As with over-the-counter orthotics, foot strengthening exercises should be prescribed when wearing custom orthotics as excessive arch elevation can weaken the abductor hallucis muscle (49).

2. Wear small silicone toe separators throughout the day and a larger one while sleeping. While people with small hallux angles can purchase over-the-counter toe separators, people with moderate to severe hallux angles often require custom toe separators made out of two-part RTV silicone. This soft medical grade silicone molds to the complex contours present between the first and second toes, which improves comfort and makes it less likely to move around throughout the day. Although often fitted by a podiatrist or other healthcare professional, you can make your own custom toe separator by mixing the two-part silicone as illustrated in figure 14. At first, the toe separators should just reposition your big toe slightly until you get used to the change. Once accustomed to the position, you can remake larger toe separators that separate your first and second toe even more.

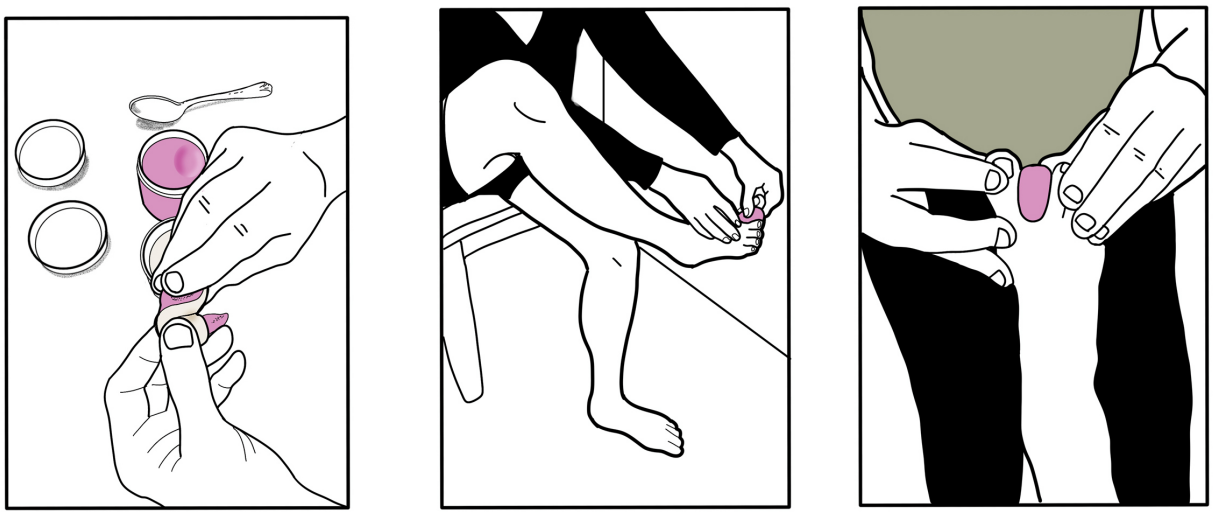


Fig. 14. Making a custom toe separator. Mix the 2 parts of the RTV silicone *Bunion Putty* in equal amounts. A standard toe separator usually requires about half a tablespoon of each component. Mix the 2 portions thoroughly and then let it rest for 1 minute as the material hardens. When slightly firm, place the silicone between the first and second toe, keeping them slightly separated for the 2 minutes it takes the silicone to harden. When firm, remove and place it aside as it will take another 5 minutes for it to completely cure. After that, it's ready to use.

3. Stretch your calves. Tightness in your calf muscles, particularly the medial gastrocnemius, is notorious for causing not just HAV pain, but forefoot pain in general. As demonstrated by DiGiovanni et al. (53), tightness in the medial gastrocnemius muscle causes the heel to leave the ground prematurely while walking, driving the forefoot into the ground with more force. By measuring ankle range of motion and correlating it to specific injuries, DiGiovanni et al. (53) proved that people with tight calves are more likely to develop hallux abductovalgus, plantar fasciitis, Morton's neuroma, and metatarsal stress fractures. As a result, people with calf tightness must improve flexibility with specific stretches. As previously mentioned, the most effective way to lengthen muscles is with prolonged static stretching. The stretches illustrated in figure 15 target the medial gastrocnemius muscle, and each stretch should be held for a minimum of 60 seconds and performed 5 times per day, 5 times per week.

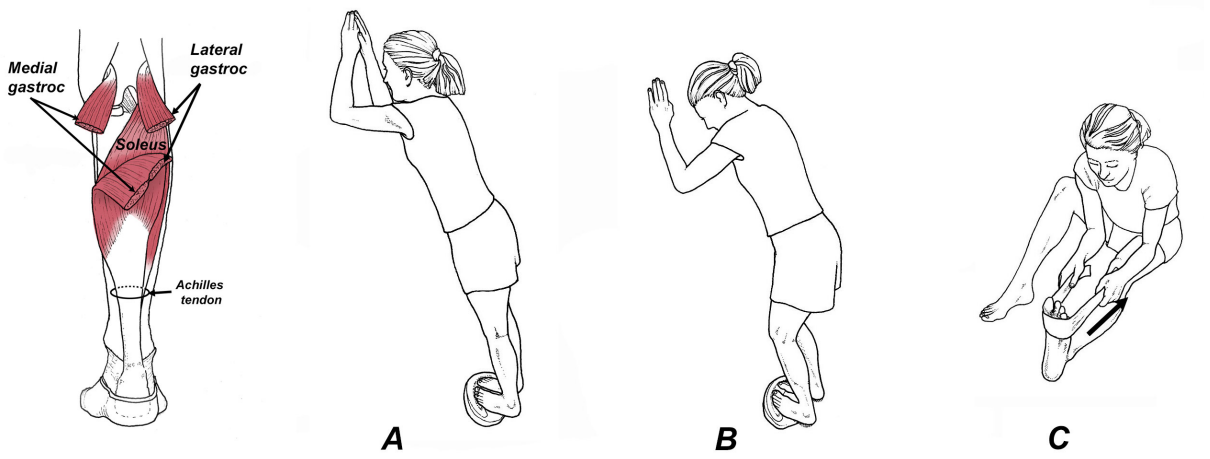


Fig. 15. Prolonged stretches to improve calf flexibility. To lengthen the medial gastrocnemius, point your toes in slightly while performing straight leg calf stretches **(A).** The soleus muscle is stretched when your knees are bent **(B),** and both heads of the gastrocnemius are stretched in position **C,** and you can target the medial head by pulling with more force on the outer hand **(arrow).**

4. Evaluate and restore upward motion to the great toe. As illustrated in figure 7, limited motion in the great toe can perpetuate HAV by driving the first metatarsal farther into adduction. While doctors evaluate range of motion using a goniometer (Fig. 16), you can also take this measurement at home by taking a photo using the Angle Meter app with your big toe pulled upwardly. If you have less than 55° of motion, you should work on restoring that range using the mobilization described in figure 6 and/or doing the home stretch illustrated in figure 17.

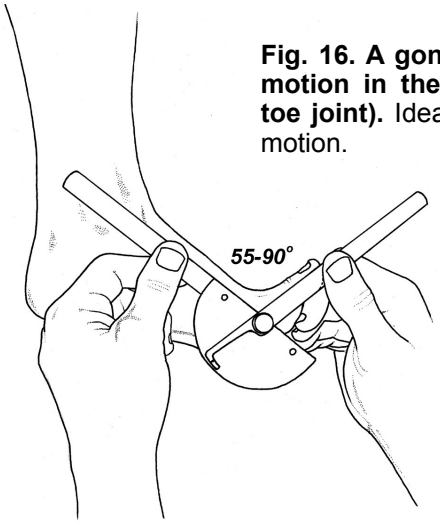


Fig. 16. A goniometer is used to measure upward motion in the metatarsophalangeal joint (the big toe joint). Ideally, you will have a minimum of 55° of motion.

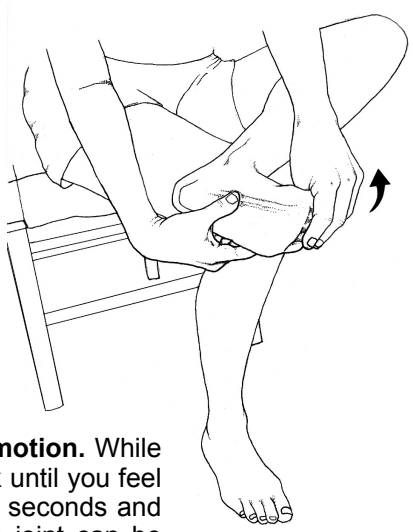


Fig. 17. Home stretches to improve great toe motion. While massaging your arch, gently pull your big toe back until you feel slight resistance **(arrow)**. Hold this position for 30 seconds and repeat 10 times per day. Because motion in this joint can be limited by bony spurs on the top of the metatarsal head, you should consider seeing a healthcare provider if this stretch causes discomfort or if there is a persistent limitation in motion.

5. Strengthen your feet and arches. Because people with HAV often have extremely weak toes, strengthening exercises should be performed with very light resistance. This is easily accomplished with elastic bands, and these exercises are not so much about maximizing strength gains, as they are about teaching you to recruit specific muscles properly. To strengthen the abductor hallucis using elastic bands, start by doing 2 sets of 25 repetitions of the exercise illustrated in figures 18 A and B. By changing the position of the hand holding the elastic band, you gradually increase stress into the abductor hallucis muscle. Next, do 2 sets of 25 repetitions of the peroneus longus exercise illustrated in figure 18C. Once finished with this exercise, do 2 sets of 20 repetitions of the toe spread-out exercise. As you get stronger, you can add resistance during this exercise by wrapping small bands around your toes (Fig. 19). With or without the resistance bands, this exercise is harder than it looks and requires some concentration to recruit the muscle properly.

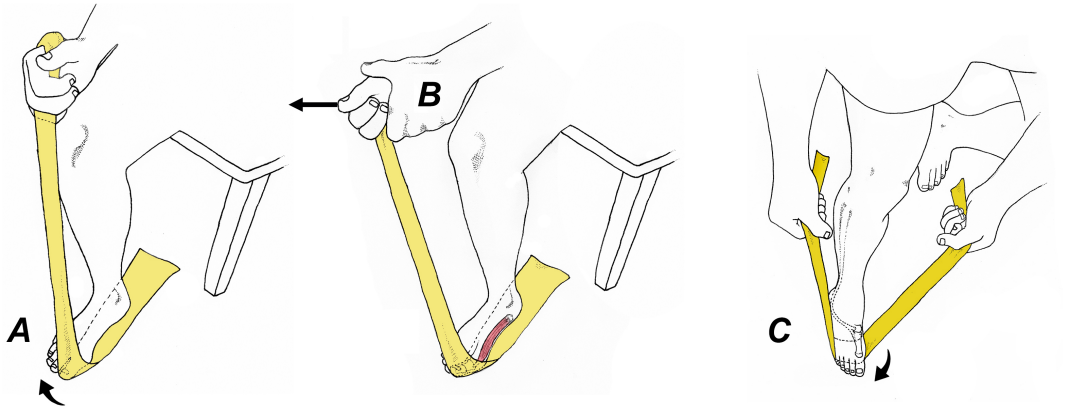
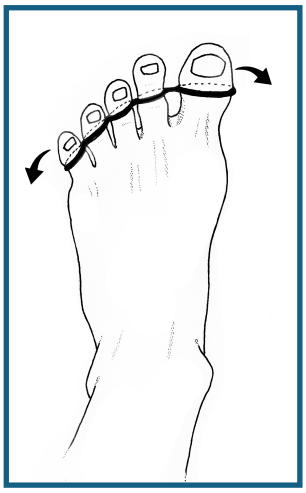


Fig. 18. Elastic band exercises to strengthen your feet. Begin by placing an elastic band beneath your foot and wrap it under the great toe as illustrated in **A.** While holding the opposite end of the band, raise and lower the big toe against resistance provided by the band **(arrow)**. As you get stronger, move the upper portion of the band sidewards, as this increases resistance placed on the abductor hallucis muscle **(B)**. Peroneus longus is exercised while seated by driving your inner forefoot downward into the band, as illustrated in **C**.

Fig. 19. The toe spread-out exercise can be performed with elastic bands wrapped around each toe to increase resistance. The typical prescription is to perform 2 sets of 20 isometric contractions, with each contraction held for approximately 10 seconds.



After a few weeks of doing these light exercises, you can progress to the more aggressive exercises illustrated in figure 20. The abductor hallucis exercise performed on the ToePro is the most difficult, and you will feel that muscle strain as it attempts to drive your big toe down into the foam. What makes this particular exercise so effective is that abductor hallucis is maintained in a lengthened position the entire time, which can increase strength gains by as much as 400% compared to conventional exercises (28). As you get stronger, you can hold onto a weight or push against a wall to increase resistance. Start by doing 2 sets of 15 repetitions, and gradually build to 2 sets of 25 repetitions. Once finished, turn the ToePro sidewards and perform the peroneus longus exercises illustrated in figure 11B. Because HAV is so often associated with excessive rearfoot pronation, people with flat feet should consider strengthening their tibialis posterior muscle using either the *Twist Disk,* or by using elastic bands as illustrated in figure 21. The *Twist Disk* is nice because you can also strengthen your hip rotators by rotating in the opposite direction, and some evidence suggests that weakness of the hip external rotators can amplify rearfoot pronation (54).

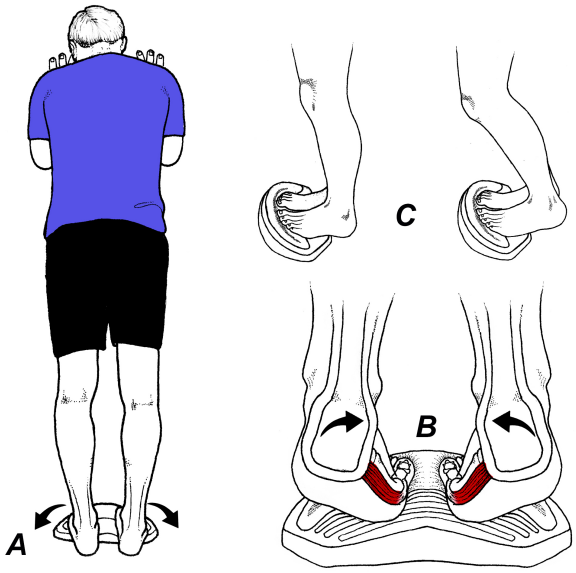


Fig. 20. ToePro exercises to target abductor hallucis. Place a ToePro next to a wall and perform 2 sets of 15 repetitions going through a full range of motion. You start the exercise with your heels tilted outwardly, as in **A**, and as you progress, you roll your heels inwardly applying pressure directly over the abductor hallucis muscle **(B)**. You should do one set with knees straight and one set with knees bent **(C)**.

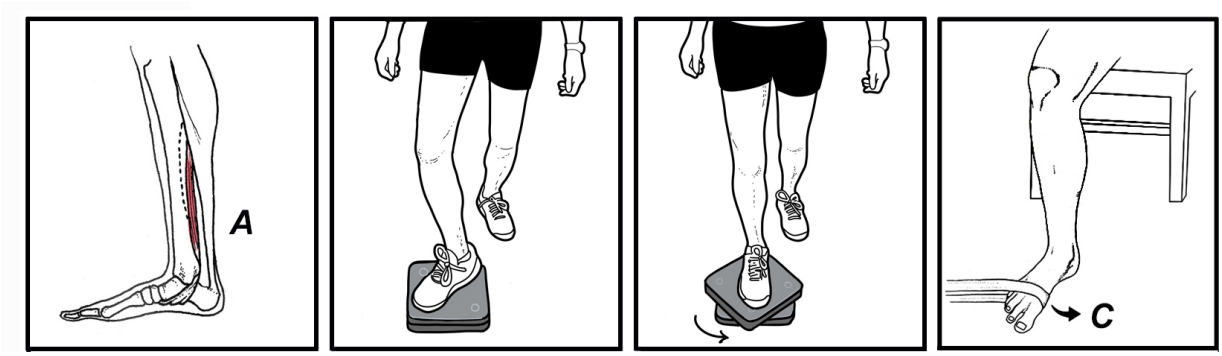


Fig. 21. Because the tibialis posterior muscle (A) controls rearfoot pronation, it is important to strengthen this muscle in people with low arches. The easiest way to strengthen tibialis posterior is with a product called the *Twist Disk*. A spring-loaded mechanism located between the 2 plates applies resistance as you rotate your foot back and forth **(B).** Tibialis posterior can also be exercised with elastic band exercise illustrated in **C.** The typical prescription is to do 2 sets of 25 repetitions, 5 times per week.

6. Choose the right shoes. The most important thing to consider when choosing shoe gear is the fit. In their study of 150 women, Frey et al. (9) found that 88% of women were wearing shoes that were on average 1.2 cm too small. The authors recommend having the length and width of your feet measured at the end of the day when your feet are slightly swollen from prolonged standing. The authors also recommend that the shoe upper be made of a flexible material, so it does not wrinkle with flexion of the toes, and that the end of the longest toe of the biggest foot should be within ½ inch ("a fingers breadth") from the end of the toe box. They also recommend that you pick a shoe with a relatively snug heel counter. Regarding specific models, Courtney Conley, the founder of Gait Happens, has tested hundreds of shoes on thousands of clients with HAV and her favorite models are listed in Table 1. She also recommends that people wearing thin-soled shoes should consider adding North Sole memory foam inserts to improve cushioning.

In addition to conventional shoe gear, women who prefer dress shoes with heels also have options. The company Scarlett Chase patented an interesting technology in which a polyurethane platform is placed beneath the forefoot and angled so that it can't be seen from above. This slight forefoot elevation changes the pitch of the shoe, making them more comfortable by reducing the heel-to-toe drop. The footbeds of all of their models are made with open-cell urethane foams with high arch elevation to distribute pressure away from the first metatarsal head. All of their shoes are designed with soft, high-quality uppers and the heel counters are padded to improve comfort. The heel bases are slightly widened for stability and the majority of heels are less than 2 inches, which is significantly less likely to result in the formation of HAV (6). Popular models designed specifically for people with HAV are listed at the end of this article.

Of course, even the best made high-heel shoes can be problematic for people with HAV, and the latest research shows that in addition to choosing proper shoe gear, the best way to manage this complex condition is through a multifaceted approach in which you strengthen your legs and arches, improve calf flexibility, and increase mobility in the joints of your feet and ankles. This is especially true if you continue to wear high heels. If you have a large hallux angle and/or a painful bunion, you should set up an appointment with a podiatrist or other foot care specialist, who will review the latest surgical and nonsurgical treatment options with you.

Table 1. SHOE RECOMMENDATIONS FOR HALLUX VALGUS

BRAND	MODEL
ALTRA RUNNING	LONE PEAK OLYMPUS ESCALANTE RACER
TOPO ATHLETIC	PHANTOM ST-5
XERO	NEXUS KNIT
BE LENKA BAREFOOT	BAREBARICS
TOLOS	ARCHETYPE 2.0
MINNEMALS	STIMULUS
LEMS	PRIMAL 3 PRIMAL ZEN

Courtesy of Dr. Courtney Conley at GaitHappens.com

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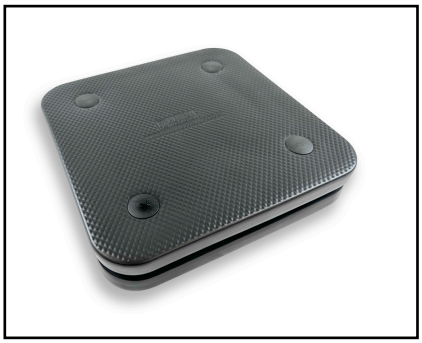

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