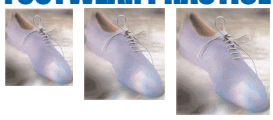

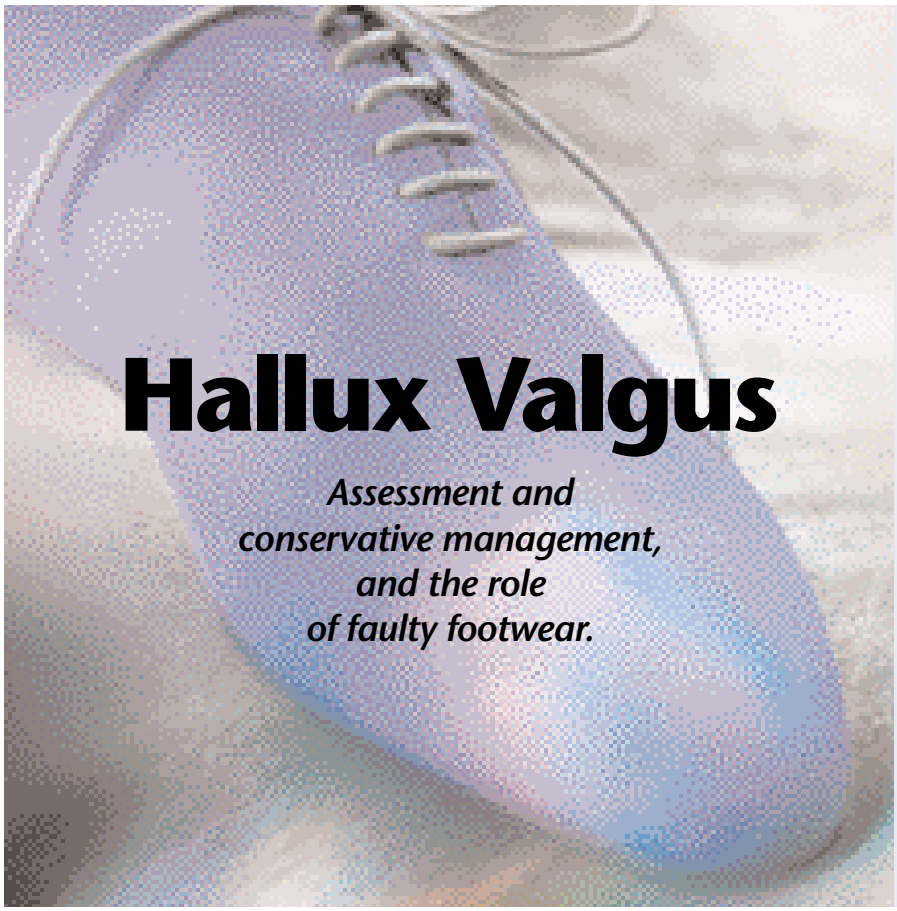

Hallux Valgus

Assessment and conservative management, and the role of faulty footwear.

Objectives

1) To be able to identify and evaluate the hallux abductovalgus deformity and associated pedal conditions

2) To know the current theory of etiology and pathomechanics of hallux valgus.

3) To know the results of recent empirical studies of the management of hallux valgus.

4) To be aware of the role of faulty footwear in the development of hallux valgus deformity.

5) To know the pedorthic management of hallux valgus and to be cognizant of the 10 rules for proper shoe fit.

6) To be familiar with all aspects of non-surgical management of hallux valgus and associated deformities.

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*Following this article, an answer sheet and full set of instructions are provided (p. 94).—**Editor***

By Ellen Sobel, D.P.M., Ph.D., C.Ped., and Steven J. Levitz, D.P.M.

Most of the literature on hallux valgus/bunion deformity is devoted to surgical correction, although most people with this common problem do not undergo surgery. Additionally, the major role of inadequate tight fitting footwear in the development of hallux valgus is well established and accepted by all.[1-5] This Continuing Podiatric Medical Education Article will focus on hallux valgus/bunion deformity and its non-surgical management with special emphasis on the role of footwear in the development and treatment of this common foot ailment.

Hallux valgus is an angular outward deviation of the proximal

Continued on page 76

Hallux Valgus...

phalanx of the hallux occurring in 2 to 15 percent of the U.S. population.[6-8] A bunion is any osseous-cartilaginous enlargement of the medial eminence often combined with swelling of the soft tissues.[9]

Etiology

Shoes are the most important extrinsic factor in the development of hallux valgus[1-5,10,11] and the major cause of forefoot pain.[5] It has been said that perfectly healthy feet are generally found only in young children and peoples that go barefoot.[12] In a survey of 905 cases, bunions occurred in females ten times more frequently than males, suggesting that females, who wear fashionable footwear more than men, developed hallux valgus and bunions due to the footwear.[13] Coughlin and Thompson[14] noted the extremely high prevalence of bunions in women in the fourth through sixth decade of life, once again suggesting that stylish constricting footwear causes hallux valgus.

Hallux valgus is found almost exclusively in societies where shoes are worn.[15-20] Yet many individuals wear fashionable footwear and hallux valgus does not develop.[15] Shine[21] examined 3,515 people on the island of St. Helena and found that the incidence of hallux valgus was 2 percent in those who went barefoot, and in those shod for 60 years, 48 percent of the women had hallux valgus and 16 percent of the men had hallux valgus. Sim-Fook and Hodgson[19] compared 107 barefoot and 118 shoe-wearing Chinese in Hong Kong and found that hallux valgus occurred in 2 percent of barefoot people and 33 percent of people who wore shoes. Similarly Maclennan[22] found only a 2 percent incidence of hallux valgus in 1,256 non-shoe wearing New Guinean natives. The Japanese have observed an increasing incidence of bunions as they have changed from traditional sandals to leather footwear.[23]

Hallux valgus is an angular outward deviation of the proximal phalanx of the hallux occurring in 2 to 15 percent of the U.S. population.

In contrast Gottschalk et al.[24] reported from South Africa that hallux valgus was present in both urban and rural Africans. Similarly Barnicot and Hardy[16] observed that hallux valgus did occur in barefooted Africans in both sexes. The conclusions that must be drawn from these data are that hallux valgus and bunions do seem to occur in nonshod individuals, but much less frequently than persons wearing shoes. As Myerson notes, approximately 4 percent of the world population develops hallux valgus deformity, regardless of type of footwear or lack thereof.[25]

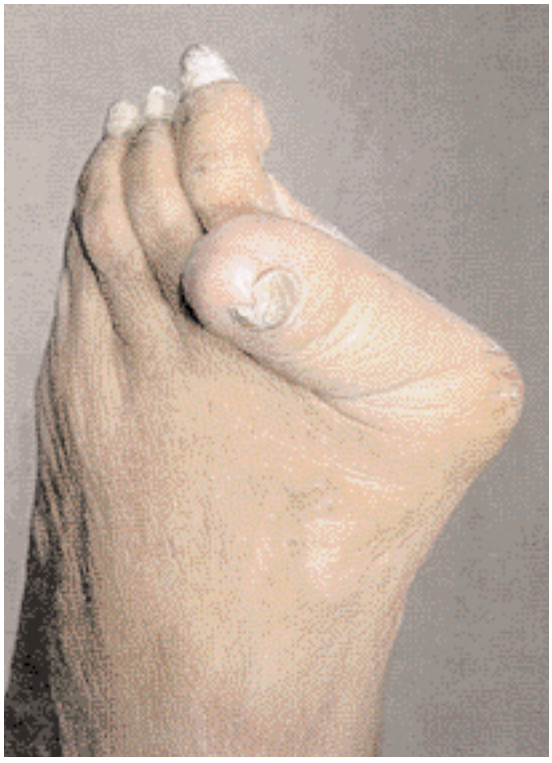

Figure 1. End stage hallux valgus. Tight extensor hallucis longus results in hyperextension of the hallux.

Many authors have described the relationship between pronation and hallux valgus.[26-37] However, this does not mean that the relationship is necessarily causal. Inman[36] felt that pronation was a predisposing factor to the development of hallux valgus only if significant heel valgus was present on weight bearing, but not if the arch alone was simply flattened. More recently Kilmartin and Wallace[38] found that there was no association in arch height between children with hallux valgus and unaffected children. Similarly, other recent studies have found no association between hallux valgus and pronation.[39,40]

Hypermobility of the first ray has been considered to be one of the causative factors of hallux valgus.[1,41] An average of 4.2° of motion has been reported to be present in the normal first metatarsocuneiform joint.[42] Clinical signs of first ray hypermobility have traditionally included the presence of a dorsal bunion, callus beneath the second metatarsal head and arthritis of the first and second metatarsocuneiform joint. Radiographically cortical hypertrophy along the medial border of the second metatarsal shaft has been thought to be diagnostic of first ray hypermobility.

In one recent study hypermobility of the first ray was assessed by increased thickness of the medial cortex at the midshaft of the second metatarsal on x-ray.[42] In this study there was found to be no correlation between clinically increased range of motion of the first metatarsocuneiform joint and 2nd metatarsal medial cortical thickness, placing into doubt whether increased 2nd metatarsal medial cortical thickening is a valid indicator of clinical hypermobility of the first ray.

First ray hypermobility may actually be a result of hallux valgus rather than an etiology of the condition. In a quantitative assess-

Continued on page 78

Hallux Valgus...

ment of sagittal plane motion of the first ray, Klaue et al.[43]found that the mean dorsal displacement at the metatarsal base averaged 2.6 millimeters in patients with hallux valgus and 1.5 millimeters in the control group, suggesting that patients with hallux valgus tend to have an increased passive extension of the first ray. Generalized ligamentous laxity has been reported to be associated with hallux valgus.[44]

The association between hallux valgus and metatarsus primus varus is controversial. Lapidus attributed the rigid metatarsus primus varus to the medial slope of the metatarsocuneiform joint.[45]He considered the apex of the metatarsus primus varus deformity to be the medial metatarsocuneiform joint. He observed that the intermetatarsal angle of a fetus is approximately 32˚ and reduces to 6.2˚ in normal adults. Therefore, he assumed that a high IM angle resulted from an arrest in development that congenitally predisposed patients to develop hallux valgus deformity.[45]

Hardy and Clapham[46] found a .71 correlation between the occurrence of metatarsus primus varus and hallux valgus.[46]

Truslow[47] was the first to theorize that metatarsus primus varus was a congenital abnormality which resulted in hallux valgus when the individual began wearing shoes. However, studies by Hardy and Clapham[46] and Craigmile[30] seemed to disprove this theory. The fact that in children the intermetatarsal (IM) angle remains stable for long periods of time while the hallux abductovalgus angle is found to increase until a certain threshold hallux valgus angle is reached, and then both the IM and hallux valgus angles both increase rapidly,[46,48] seems to indicate that

Continued on page 79

Figure 2A. Hallux valgus deformity.

Figure 2B. Significant pronation, part of hallux valgus deformity.

Figure 2C. Ankle equinus, frequently associated with hallux valgus.

Figure 2D. Forefoot supinatus with callosity under 2nd metatarsal head.

Hallux Valgus...

hallux valgus precedes metatarsus primus adductus. It would appear that once the medial capsule of the MTPJ is overstretched by a large hallux valgus angle, a longitudinal force on the tip of the toe easily produces metatarsus primus varus.[49]

Multifactorial inheritance is thought to be the mode of transmission in hallux valgus deformity[50] with a positive family history in 63 percent of patients with hallux valgus.[46] Coughlin[51] noted maternal transmission in the majority of juvenile hallux valgus patients with variable penetrance.

Hallux valgus is found almost exclusively in societies where shoes are worn.

Pathomechanics

The pathomechanical process begins with wearing narrow, pointy, short, and possibly high heeled shoes for many years. Creep deformation forces resulting from the shoe produce a slow deformation over time resulting in stretching of the abductor hallucis muscle with the proximal phalanx of the hallux starting to drift laterally and abducting. The normal forces of walking with forefoot pronation stretch the medial collateral ligament and capsular structures and push the hallux into a valgus position.[40]

After a certain threshold degree of abductus and valgus of the hallux is reached, a retrograde force from the distorted position of the hallux pushes the first metatarsal into a varus position and off the sesamoids. The sesamoid bones are located within the two tendons of the flexor hallucis brevis and function similarly to the patella, serving as a fulcrum to add mechanical advantage to the pull of the FHB and FHL during toe-off. The sesamoids are firmly attached to the adductor hallucis and the deep transverse metatarsal ligament and insert on the plantar lateral base of the proximal phalanx and do not follow the medial migration of the first metatarsal. With medial migration of the first metatarsal head, the medial joint capsule becomes attenuated and the abductor hallucis tendon is pulled plantarward becoming a flexor. Adduction of the first metatarsal with an increasing intermetatarsal angle results in a wide splayed forefoot.[25]

Shoe friction and irritation of the medial collateral ligament of the first metatarsophalangeal joint lead to chronic inflammation of the overlying bursa and further proliferation of fibrotic and osteoblastic activity. As the deformity progresses the axis of pull of the adductor hallucis, the flexor hallucis brevis, extensor hallucis longus, and the abductor hallucis all become lateralized, increasing the abductor force on the hallux. The hallux may be held in extension away from the ground due to the bowstring effect of the extensor hallucis longus (Figure 1). With pronation and hypermobility of the first metatarsal the flexor hallucis longus muscle contracts to plantar flex the great toe and balance the first metatarsophalangeal joint. With increased use of the FHL to balance the joint, FHL tendinitis may result.[52] Finally when the lateral collateral ligament and sesamoid ligaments are disrupted and the entire joint capsule weakens, dislocation of the metatarsophalangeal joint occurs with end stage hallux valgus deformity.[25]

Usually less than 50 percent of the metatarsal will articulate with the proximal phalanx. The clinical appearance of the medial prominence is due to the displacement of the hallux laterally uncovering the medial aspect of the metatarsal head. The metatarsal head hypertrophies laterally and an overlying inflammatory bursa can occur (the bunion). During the propulsive period of gait individuals with hallux valgus widen the forefoot, increasing deformity with each step, in contrast with the forefoot narrowing with propulsion in people who do not have hallux valgus.[53]

More than 50 percent of the weight-bearing force during gait passes through the first metatarsophalangeal joint.[9] Gait analysis of the individual with hallux valgus reveals that the great toe has a diminishing role in weight bearing of the forefoot.[54] As the hallux abductus angle increases, the pressure beneath the hallux decreases.[55-57] The center of pressure is a mathematical representation of the summation of

Continued on page 80

Figure 2E. In spite of severe hallux valgus, pronation, ankle equinus, and forefoot supinatus, the heel is straight.

Hallux Valgus...

forces through which load on the foot acts in the stance phase of gait.[55] There is a characteristic lateral shifting of the center of pressure in patients with hallux valgus which is similar to the center of pressure measurements of patients who have undergone hallux amputations.[54] The effectiveness of various treatments can be determined by the reestablishment of the weight bearing of the first MTP joint utilizing in-shoe plantar pressure devices.

In one recent study hypermobility of the first ray was assessed by increased thickness of the medial cortex at the midshaft of the second metatarsal on x-ray.

Clinical Presentation

Patients with hallux valgus generally complain of pain in the first metatarsophalangeal joint mostly when walking in tight shoes. The clinical presentation of hallux valgus is unmistakable, with severe deformity (Figure 2A), significant pronation (Figure 2B), ankle equinus (Figure 2C), and forefoot supinatus with callosity under the second metatarsal head (Figure 2D), yet the weight bearing heel position remains relatively straight (Figure

Continued on page 81

Figure 3. Gouty arthritis with swelling of 1st metatarsophalangeal joint physically appears as bunion deformity.

TABLE 1
DIFFERENTIAL DIAGNOSIS OF HALLUX VALGUS
(Adapted from Williams RC: J Musculoskel Med, 1991)

DISEASE	CLINICAL FEATURE	LABORATORY/IMAGING
Gout	Men 40 to 70 years Acute monoarthritis of 1st MTPJ Should not last more than 1 week Skin may peel over toe	Serum uric acid level elevated in 75% of patients Urate crystals in leukocytes attack; Radiographic changes occur 7-10 years after first attack
Infection Septic arthritis	Red hot, swollen joint	Synovial fluidshows leukocytosis Gram stain may be positive Joint fluid/blood cultures positive Bone scan may be positive
Osteoarthritis	Affects multiple MTP joints Enlarged but not warm and tender Painful passive range of motion	Exostoses; Interphalangeal narrowing on x-ray ESR normal
Hallux rigidus	Clinically no motion at MTP joint No acute redness or warmth dorsal bunion	Marked bony overgrowth Ankylosis on x-ray with hallux rigidus
Hallux valgus with Rheumatoid Arthritis	Generally symmetrical Fibular deviation of all digits May be more severe than isolated hallux valgus Loss of passive range of motion of joint may be clinical indicator	Stage 4 hallux valgus with completed subluxated joint on x-ray Severe deformity with ankylosis demonstrated on x-ray
Hallux valgus with neuromuscular disease	General presentation of Hallux valgus more severe	Signs of systemic neuromuscular disease, I.e., spasticity

Hallux Valgus...

2E). It should be kept in mind that empirical studies have found the normal weight bearing calcaneal stance position of the heel to be about 5° valgus.[58,59]

Patients with severe bunion deformity frequently develop callosities under the lesser metatarsal heads because of a lack of weight bearing of the first ray. Callus may also develop under the second, third, or fourth metatarsophalangeal heads. Hammer digits with overlapping or underlapping digits result from the laterally deviated hallux. Painful corns result from the shoe upper. Soft corns commonly occur with bunions between the first and second toes and even between the lesser toes because more pressure is placed on the toes from the hallux valgus deformity. Hallux rigidus is a common problem associated with the bunion. Sesamoid pain is common with the progression of bunions. As the first metatarsal migrates and the sesamoids are no longer in place, incongruity and osteochondrosis of the sesamoids develop.

In bunion patients who have excessive pronation with heel valgus, associated Achilles tendon tightness increases the valgus forces on the hallux during propulsion. Excessive pronation presenting with bunion deformity may also be associated with posterior tibial tendinitis and peroneal spasm.[52] Arthritis may rarely develop in the first metatarsal cuneiform joint as a result of instability of the first metatarsal.[52] Stress fractures can occur in the second or third metatarsals during pronation as stresses are transferred to the second and third metatarsals and the lateral fibula. Increased pressure between the lateral metatarsals may also result in Morton's Neuroma.

Radiographic Criteria

According to Gerbert's Textbook of Bunion Surgery, the normal hallux abductus angle is 10-15°[60] and the normal intermetatarsal angle is 8-12°.[60] However, significant hallux valgus can exist with an intermetatarsal angle of 8-12°.[61] Therefore, some favor a more stringent criteria and values of 9 or higher are considered to be abnormal.[6,15,18]

Figure 4B. Late gouty arthritis. Joint is destroyed.

Differential Diagnosis

At first glance the diagnosis of hallux valgus does seem quite simple from the presentation of obvious clinical deformity. Perhaps the early inflammatory stage where hallux valgus and bunion deformity may resemble gouty arthritis and infection are most problematic. Enlargement of the first metatarsophalangeal joint with acute monoarthritis of the first metatarsophalangeal joint is also present in gout (figure 3).[62,63] Patients present with intense pain, heat, erythema, and swelling of the 1st metatarsophalangeal joint.[64] Exquisite

Figure 4A. Early gouty arthritis. Joint surface intact.

Continued on page 82

Hallux Valgus...

tenderness is present dorsally and laterally with inflammation and generally resolves spontaneously within one week. Non-steroidal anti-inflammatory medication will reduce symptoms within two to three days.[64] Radiographs reveal only soft tissue swelling or osteopenia.[65]With recurrence of disease, tophi may develop and calcify.

The articular surfaces of joints are generally spared in early gout (Figure 4A), but advanced joint disease produces a narrowed joint space much like that in osteoarthritis (Figure 4B). If gouty arthritis lasts for too long or does not respond to nonsteroidal anti-inflammatory medication, the diagnosis of gout becomes less certain (See Case Presentation Figure 5A/B). The intense inflammatory response may resemble a cellulitic process. There may be desquamation of the overlying skin and blood tests will reveal a mild peripheral leukocytosis with an infectious process.

Figure 5A/B. Case Presentation. This 55 year old male presented with a 2-week history of pain and swelling in dorsum of the left foot (Figure 5A). The patient had hallux valgus deformity of the left foot only and a history of gouty arthritis. The problem failed to resolve after 2 weeks and in fact showed some signs of increased pain and swelling after he walked on it. There was no history of trauma; however, plain radiographs revealed fracture of the 2nd metatarsal (Figure 5B). Unilateral hallux valgus did not account for this patient's pain and swelling. Similarly, although the patient had a history of gouty arthritis, the pain and swelling was lasting 2 weeks without showing signs of improvement, which is unusual for gout. Although this patient had no history of trauma, plain radiographs revealed a healing fracture of the second metatarsal which might have become more symptomatic with walking on the foot.

Figure 6A. Dorsal bunion.

Figure 6B. Osteoarthritis of the first metatarsal phalangeal joint.

Hallux rigidus with osteoarthritis of the first metatarsophalangeal joint may present with a dorsal bunion (Figure 6A/B). Passive dorsiflexion of the 1st MTPJ is restricted or absent. Osteoarthritis of the 1st MTPJ produces pain during passive and/or active motion, and compression over the bunion area produces minimal tenderness.

Compression of the medial dorsal digital sensory nerve may produce

Continued on page 84

Hallux Valgus...

tenderness along the dorsal-medial aspect of the foot which results in a radiating or "shooting" pain that travels toward the toe or ankle.

Skin irritation is usually from shoes and will resolve as soon as the shoes are removed.

Hallux valgus is the most common foot deformity in rheumatoid arthritis.[66] Hallux valgus associated with rheumatoid arthritis is frequently bilateral and presents with subluxation of the first metatarsophalangeal joint and fibular deviation (Figure 7). After a while the bones of the foot in rheumatoid arthritis may become entirely fused (Figure 8). See Table 1 for a summary of the differential diagnosis for hallux valgus.

Figure 7. Bilateral hallux valgus with joint subluxation and fibular deviation associated with rheumatoid arthritis.

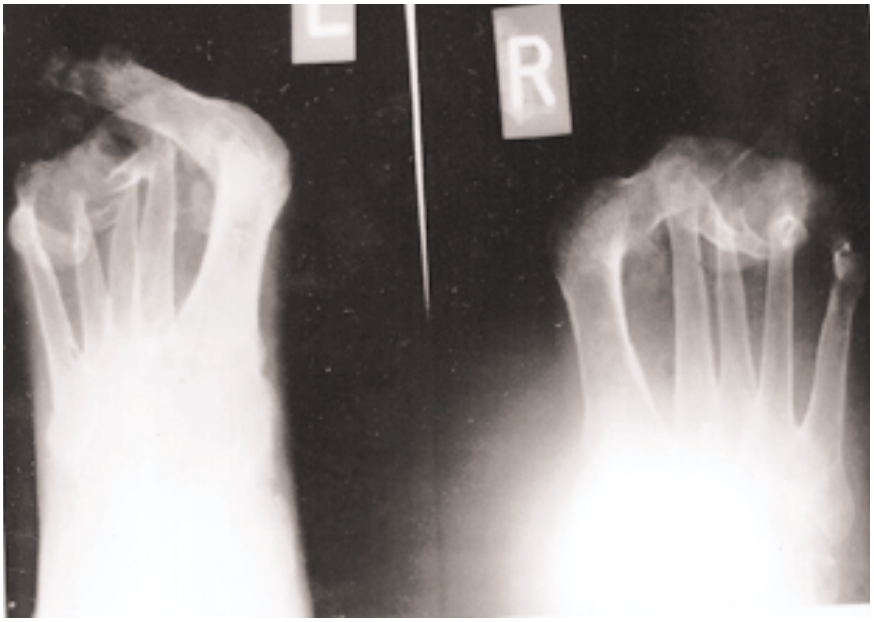

Figure 8. Bilateral hallux valgus with complete fusion of all joints associated with rheumatoid arthritis.

Management of Hallus Valgus and Foot Orthoses—Current Research

There are only three recent empirical studies which involve randomized clinical trials dealing with the effect of foot orthoses on the progression of hallux valgus and the relief of symptoms.

One prospective randomized clinical trial evaluated the effect of Functional Foot orthoses on the progression of the hallux valgus angle in adults with rheumatoid arthritis.[67] Fifty rheumatoid arthritis patients in the treatment group wore Rohadur functional foot orthoses with appropriate posts, and 52 patients with rheumatoid arthritis in the control group wore placebo leather unposted orthoses. After wearing the foot orthoses for the 3-year study period, 5 patients wearing the functional foot orthoses versus 12 patients wearing the leather orthoses demonstrated progression of the hallux valgus deformity on x-ray. Progression of hallux valgus deformity was defined as a 5˚ increase or more in the hallux valgus angle. Those authors concluded that foot orthoses slowed the progression of hallux valgus deformity in patients with rheumatoid arthritis.[67]

Multifactorial inheritance is thought to be the mode of transmission in hallux valgus deformity with a positive family history in 63 percent of patients with hallux valgus.

In the only randomized clinical trial on the effect of functional foot orthotics on the progression of hallux valgus in healthy children, 93 children with hallux valgus aged 9-10 years were followed for a three year period.48 Approximately half were randomly assigned to wearing a functional posted foot orthosis for 3 years and the remaining half served as the control group. At the end of the

Continued on page 85

Hallux Valgus...

three year study period the 1st metatarsophalangeal angle increased approximately 2˚ in the control group and 2.5˚ in the treatment group. However, the difference between the control and treatment group was not significant. In the nonaffected foot the hallux valgus angle increased approximately 4˚ in both the treated and the control group, which was a highly significant difference. It should be noted that the intermetatarsal angle remained the same over the entire three-year study period. During the study, hallux valgus developed in the unaffected feet of children with unilateral deformity, despite the use of the orthosis.[48]

A recent randomized controlled trial published in the *Journal of the American Medical Association* (May 16, 2001) compared the effectiveness of surgery, orthotic treatment and no treatment in patients with mild to moderate hallux valgus.[68] There were approximately 70 adult patients in each of the three groups who were followed for one year. Patients were randomly assigned to surgery (distal chevron osteotomy), orthosis, or a one-year period of watchful waiting (control group).

The effectiveness of various treatments can be determined by the reestablishment of the weight bearing of the first MTP joint utilizing in-shoe plantar pressure devices.

At the time of 6-month follow-up, patients in the surgery and orthosis group had less pain and were more satisfied with the treatment than in the non-treated control group. At the time of 1-year follow-up, pain intensity decreased more in the surgical than in the orthotic group or the control group. The number of painful days, cosmetic disturbance, and footwear problems were least in the surgical group and functional status and satisfaction with treatment were best in the surgical group.[68] The authors concluded that foot orthoses were effective for short term relief in the mild to symptomatic bunion patients, but that surgical

Continued on page 86

TABLE 2
10 RULES FOR PROPER SHOE FIT

[Adapted from the Pedorthic Footwear Association (PFA), the National Shoe Retailers Association (NSRA) and the American Orthopaedic Foot and Ankle Society (AOFAS)]

1) The patient should not select a shoe by SIZE since sizes vary according to style and shoe company. The shoe must be selected according to fit.

2) The shoe should be similar to the shape of the foot.

3) The size of the foot increases with age so foot size should be measured periodically. The Brannock device is used to measure the length of the foot from heel to toe, the width of the foot and the arch length. The arch length (heel-to-ball length) is measured from the heel to the first metatarsal head. The shoe size is based on the arch length, not the overall length of the foot, because the arch length ends at the first metatarsal head which is the widest part of the foot.

4) Both feet should be measured and the shoe is fit to the largest foot.

5) Shopping for a new pair of shoes should be done at the end of the day when feet are the largest.

6) The patient should be standing during the fitting/measuring process.

7) There should be 3/8 inch to 1/2 inch from the longest toe to the end of the shoe.

8) Shoes should not feel tight when purchased and be expected to be "broken in." The ball of the foot should fit snugly into the widest part (ball pocket) of the shoe.

9) There should not be heel slippage.

10) The patient should walk in the shoes before purchasing them.

Hallux Valgus...

management was ultimately more beneficial.

Foot orthoses are helpful for associated transfer metatarsalgia, to pad metatarsal callosities and to limit excessive pronation. Sanders and Hegemeir[70] have suggested foot orthoses for hallux valgus patients with instability of the first metatarsocuneiform joint. They state that these patients complain of generalized foot pain with activity, and incorrectly assume that the pain is due to their bunion. They suggest full length foot orthoses fabricated from trilaminar or multilaminar materials with longitudinal arch support and medial forefoot posting.

Compression of the medial dorsal digital sensory nerve may produce tenderness along the dorsal-medial aspect of the foot.

Shoe Wear

The pedorthic objectives for relief of hallux valgus include relieving direct medial pressure over the bunion and addressing transfer metatarsalgia in the lesser metatarsals. Symptomatic pronation should also be addressed. Bunion pain may be caused by direct pressure over the medial eminence or pain originating from joint motion. If the pain is due to direct pressure over the bunion then the patient will have no difficulty ambulating barefoot. Wide roomy shoes will be most helpful when the pain is caused by direct pressure over the medial eminence. Shoes can be stretched to relieve pressure. Remember that it is necessary to leave shoes overnight for a proper stretching procedure. If the problem is coming from within the joint, a stiff-soled shoe or rocker bottom sole may help to by-pass the painful metatarsophalangeal joint.

The typical women's foot has a wide forefoot and narrow heel. The average women's foot is 3-1/4 to 3-3/4 inches wide. The width of the fashion shoe is usually not more than 3 inches wide (Figure 9A/B). A

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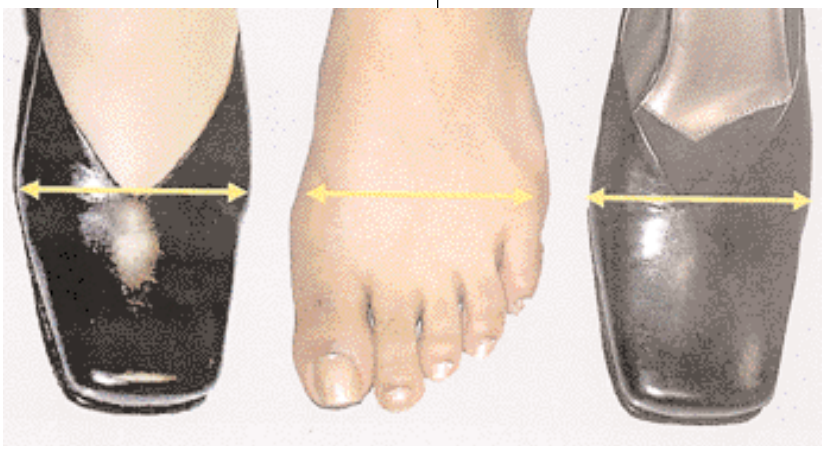

Figure 9A. Fashion shoes with narrow forefoot and square pointy low toe box.

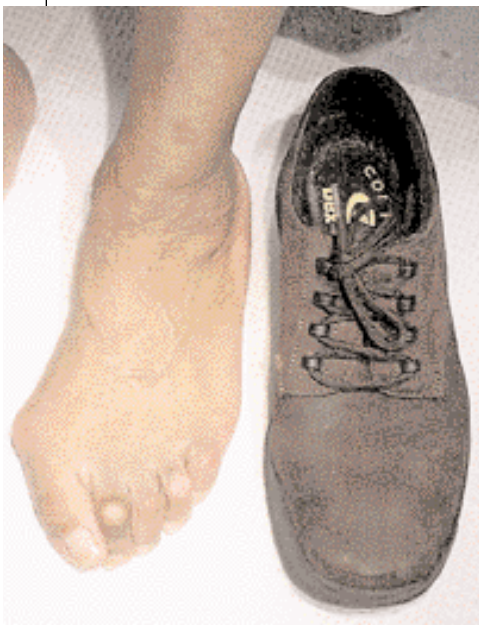

Figure 9B. This shoe is too narrow for this patient even though it is a low heeled oxford blucher shoe.

Figure 10A. Shoe with cutout for bunion.

Figure 10B. Shoe with cutout for overlapping toe.

combination last provides for a narrow rearfoot and a wide forefoot to prevent heel slippage. Finally, sometimes it is necessary to cut a hole into the shoe (Figure 10A/B). See Table 2 for the 10 rules for Proper Shoe Fit.

The heel height should be low (Table 3). By the age of 16, over 50 percent of girls wear heels some of the time. As compared with no heel, forefoot pressure increases by 22 percent when wearing a 3/4-inch heel, 57 percent for a 2-inch heel, and 76 percent for a 3-1/4 inch heel.[71]

TABLE 3
THE HEIGHT OF THE HEEL OF THE SHOE
(Adapted from Sander M, Hagemeir KW: Conservative treatment and shoewear options for hallux valgus. Foot Ankle Clin 2(4): 639-53, 1997, December.)

Flat Shoe	3/4 inch heel height or less
Low Heel	3/4 inch heel height to 1-3/4 inch heel height
Mid Heel	1-3/4 inch heel height to 2-1/4 inch heel height
High Heel	2-1/4 inch or higher

Bunion Splints

Bunion splints are an under-utilized yet highly effective treatment for hallux valgus bunion deformity. Although no splint will actually correct hallux valgus deformity, stretching and realignment of the first MTPJ performed by the splint may provide the patient with dramatic symptomatic relief. The classic latex bunion shield may be specially molded to the patient's foot to accommodate a bunion deformity (Figure 11). There are a number of commercial bunion splints which pad the bunion, straighten the hallux valgus deformity and can be used at night for sleeping and even during the day as long as the hallux valgus deformity is at least partially flexible. Some come with attached toe splinting and toe spacers. A toe spacer between the first and second toe is often necessary since the ab-

Continued on page 88

Hallux Valgus...

ducted hallux pushes against the second digit. Apex Foot Health Industries has combined a relatively thick soft foam toe spacer with a soft bunion pad for accommodation of hallux valgus and bunion deformity (Figure 12). The popular Jacoby Bunion Splint from Angus Marketing is commonly used for patients with Hallux Valgus (Figure 16).

The hallux valgus night splint (also from Apex) (Figure 13) places the hallux in a 1st class lever system which stretches and adducts the deviated hallux. We have found that many patients with deformity find relief by wearing the splint at night. This splint has also been reported to be effective postoperatively after bunion surgery.[72] Darco International, Inc. has a very comfortable cloth bunion splint which not only exerts a corrective force on the hallux, but comes with adjustable velcro straps to splint hammer digits and tailor's bunions (Figure 14).

Pedifix's Hallux Valgus Soft-Splint™ also provides comfortable and effective post-op splinting. It is designed for ambulatory or non-ambulatory use after bunion surgery to maintain ideal hallux positioning and constant MP joint alignment (Figure 17).

Wide roomy shoes will be most helpful when the pain is caused by direct pressure over the medial eminence. Shoes can be stretched to relieve pressure.

Debridement of associated digital corns and plantar callosities should be done periodically. Foam, rubber, or silicone toe sleeves (Silipos) are used to separate or cushion contact points between the hallux and the second toe (Figure 15). Corn pads and metatarsal pads can be used for associated deformities of the digits and plantar callosities.

Figure 11.Latex bunion shield.

Figure 12. Hallux valgus bunion shield with large toe spacer. (Apex Foot Health Industries)

Metatarsal pads have been shown to reduce pressure under the metatarsal heads in 100 percent of asymptomatic female volunteers.[73] Similarly in another study of the effect of metatarsal pads on plantar weight bearing pressure in asymptomatic individuals, walking with insoles with metatarsal pads resulted in peak load decreases in the forefoot region and peak load increases in the midfoot region under the metatarsal shafts.[74] Also available from Silipos is their soft padded Bunion Shield, which is excellent for both daytime and nighttime use.

Physical therapy may consist of superficial and deep heat treatment such as ultrasound and exercises to stretch the toe twice daily for one minute per foot (10 to 15 repetitions) for the first month, then once daily for 3 months. Intraarticular injection for patients with painful range of motion are a final option (1 ml of 50 percent corticosteroid and 1 percent lidocaine) prior to surgical intervention.

There has recently been emphasis on clinical staging of hallux valgus.[75] Garrow and associates[75] felt that since hallux valgus is the most instantly recognizable deformity of the foot, they developed a staging system based on clinical photo alone. Table 3 reviews the authors' clinical staging for hallux valgus deformity and management for each of the associated four clinical stages.

For more information about these products mentioned in the preceding article, circle the corresponding number on the reader service card in this magazine.

Apex Bunion Shield—Circle #148

Jacoby Bunion Splint (Angus)—Circle #149

Apex Night Splint—Circle #150

Darco Abductor Splint—Circle #151

Silipos Bunion Shield—Circle #152

Silipos Toe Sleeve—Circle #153

Pedifix SoftSplint—Circle #155 ■

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Continued on page 90

Figure 13. Hallux valgus abductory night splint. (Apex Foot Health Industries)

Figure 14. Hallux valgus abductor splint with attachments for splinting hammer digit and Tailor's bunion (Darco International, Inc.).

Figure 15. Soft silicone toe sleeve (Silipos, Inc.)

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Figure 16. The popular jacoby Bunion Splint from Angus Marketing

Figure 17. Pedifix's SoftSplint™

Continued on page 92

TABLE 4
CLINICAL STAGING OF HALLUX VALGUS DEFORMITY AND TREATMENT

STAGE I: Inflammatory
Pain, heat, swelling, erythema Very little deviation of the toe, but large medial prominence at the MTP joint Pain from inflammation of small bursa formed over the medial eminence Thickening of the bursal wall accentuates the prominence Must be distinguished from gout, infection, inflammation
STAGE II: Mild Deformity
Asymptomatic The proximal phalanx begins to drift laterally and into valgus position No associated lateral subluxation of the sesamoid bones on radiograph Congruent MTP joint
STAGE III: Moderate Deformity
The first metatarsal head is pushed into a position of varus, off the sesamoids Lateral sesamoid is displaced about 75% from beneath metatarsal head Medial capsular structures are stretched while the lateral structures become increasingly contracted Some loss of MTP joint congruity
STAGE IV: Severe Deformity
Significant metatarsus primus varus Complete dislocation of the sesamoids Pronation of the great toe Overlapping of the second toe Marked soft tissue contracture Congruity at the metatarsophalangeal joint completely lost Often associated with rheumatologic or neuromuscular disease

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Hallux Valgus...

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Bunion splints are an underutilized, yet highly effective treatment for hallux valgus bunion deformity.

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EXAMINATION

See answer sheet on page 95.

1) What is the percent of adults with hallux valgus in the United States?
- A) Less than 1 percent
- B) 2 to 15 percent
- C) 25 to 33 percent
- D) 50 to 75 percent

2) What is the relationship between wearing shoes, wearing fashionable footwear and development of hallux valgus?
- A) Bunions are NEVER found in individuals who are unshod.
- B) Bunions are ONLY found in individuals who wear fashionable footwear.
- C) Bunions are found much more frequently in individuals who wear fashionable footwear, but also occur with much less frequency in individuals who do not wear fashionable foot wear, but do not occur in unshod individuals.
- D) Bunions are found much more frequently in individuals who wear fashionable footwear, but also occur with much less frequency in individuals who do not wear fashionable foot wear, and also occur to some extent in unshod individuals.

3) In hallux valgus deformity, what is the most common position of the heel when the patient is standing?
- A) 5° of valgus
- B) Significant heel valgus
- C) Significant heel varus
- D) The greater the hallux valgus deformity the more heel valgus is present

4) It has been observed that as the Japanese have changed from traditional sandals to leather footwear, the incidence of hallux valgus has:
- A) Increased
- B) Decreased
- C) Remained the same
- D) There is no data pertaining to this subject

5) What is the cause of the widened splayed foot deformity in hallux valgus?
- A) Pronation
- B) High hallux valgus angle with subluxation
- C) High intermetatarsal angle
- D) Forefoot pronation

6) The most common EXTRINSIC etiologic factor producing hallux valgus deformity is:
- A) pronation
- B) hypermobility of the first ray
- C) shoes
- D) genetics

7) The fact that in children the intermetatarsal angle remains stable for long periods of time while the hallux abductovalgus angle is found to increase until a certain threshold hallux valgus angle is reached, and then both the IM and hallux valgus angles both increase rapidly, would seem to:
- A) Prove that a high intermetatarsal angle is the cause of hallux valgus
- B) Disprove that a high intermetatarsal angle is the cause of hallux valgus
- C) Prove that the a high intermetatarsal angle is inversely proportional to the hallux valgus angle
- D) Prove that the intermetatarsal angle is not related to the hallux valgus angle

8) The cause of the laterally displaced sesamoids in hallux valgus deformity is:
- A) Drifting of the fibular sesamoid
- B) Dislocation of the 1st metatarsophalangeal joint
- C) Medial migration of the first metatarsal head
- D) The abducted position of the hallux

9) The clinical appearance of the medial prominence in bunion/hallux valgus deformity is due to:
- A) Displacement of the hallux laterally uncovering the medial aspect of the metatarsal head
- B) Dislocation of the 1st metatarsophalangeal joint
- C) Inflammatory arthritis
- D) Bursitis

10) What were the findings of the recent randomized controlled trial published in the Journal of the American Medical Association (May 16, 2001) comparing the effectiveness of surgery, orthotic treatment and no treatment in patients with mild to moderate hallux valgus?
- A) No treatment (watchful waiting) was equally effective in pain reduction as compared to foot orthoses and surgery for mild to moderate bunion patients.
- B) Foot orthoses were the most effective treatment in patients with mild to moderate bunion deformity as compared to surgical treatment and the control group (no treatment).
- C) Surgical management was the most effective treatment in patients with mild to moderate bunion deformity as compared to surgical treatment and the control group (no treatment).
- D) Foot orthoses and surgical management were equally effective in treatment in patients with mild to moderate bunion deformity with both modalities more effective than the control group (no treatment).

11) A shoe last that might be helpful to a patient with a bunion deformity would be:
- A) Board last
- B) Slip last
- C) Chukka boot
- D) Combination last

12) What is the effect on pressure in the forefoot when wearing a 2-inch high heeled shoe?
- A) Forefoot pressure is not affected
- B) Forefoot pressure is reduced
- C) Forefoot pressure is increased approximately 22 percent
- D) Forefoot pressure is increased approximately 50 percent

13) Foot orthoses have been found to slow the progression of hallux valgus deformity in people with rheumatoid arthritis.
- A) True
- B) False

14) A shoe with a heel height between 1-3/4 inches and 2-1/4 inches would be considered:
- A) Flat shoe
- B) Low heel
- C) Mid heel
- D) High heel

Continued on page 94

Continuing Medical Education

EXAMINATION

(cont'd)

15) Which would be INCORRECT as to shoe wear?
- A) Both feet should be measured and the shoe is fit to the largest foot.
- B) The ball of the foot should fit snugly into the widest part (ball pocket) of the shoe.
- C) The patient should be sitting during the fitting/measuring process.
- D) There should be 3/8 inch to 1/2 inch from the longest toe to the end of the shoe.

16) Which is NOT in the differential for hallux valgus deformity?
- A) Gouty arthritis
- B) Osteoarthritis of the 1st metatarsophalangeal joint
- C) Compression of the medial plantar nerve
- D) Infection

17) A review of recent empirical studies on the relationship of pronation and hallux valgus reveals that:
- A) Pronation is one of the main causes of hallux valgus
- B) It is unknown whether excessive pronation is an extrinsic cause of hallux valgus
- C) There is no correlation between subtalar joint pronation and hallux valgus
- D) Pronation of the subtalar joint results in hypermobility of the first ray which leads to hallux valgus deformity

18) According to recent literature what is the role of a hypermobile 1st ray in the etiology of hallux valgus deformity?
- A) Hypermobility of the 1st ray is a pre-existing factor and a major cause of hallux valgus
- B) Hypermobility of the 1st ray is not the cause, but may actually be a result of hallux valgus
- C) It is not clear whether a hypermobile 1st ray is the cause of the result of hallux valgus
- D) It has recently become known that a hypermobile 1st ray is neither the cause nor the result of hallux valgus deformity

19) What is the indication and main function of the bunion splint?
- A) To correct a rigid deformity to be used at night only
- B) For accommodation and realignment of flexible deformity and postoperatively
- C) To correct a flexible deformity and relieve pain in rigid deformity
- D) Hallux valgus splints can only be used at night and postoperatively

20) Which is generally NOT part of the clinical presentation of severe hallux valgus deformity?
- A) Forefoot supinatus
- B) Heel valgus of 5°
- C) Pronated foot type
- D) Plantarflexed first ray

See answer sheet on page 95.

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Hallux Valgus
(Sobel/Levitz)

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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
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