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The High Price of High-Fashion Footwear*

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An Instructional Course Lecture, The American Academy of Orthopaedic Surgeons

Shoes have been an important part of attire since early civilization. Eons have passed since humans began to walk in an upright fashion, but the main purpose of footwear, protection of the foot, has remained virtually unchanged. The earliest footwear prototype was a primitive moccasin crafted from animal hide. Through the centuries, fashion has played an important role both in the manufacture of shoes as well as in the success of certain styles of shoes. Footwear has evolved a great deal — from the soft, flexible moccasins of early humans to the rigid, high-fashion footwear that is prevalent in Western society today.

It has been estimated that one in six persons (43.1 million people) in the United States has foot problems⁹. The prevalence of these foot problems dramatically increases in persons who are more than thirty years old, while foot problems are relatively infrequent in persons who are less than fifteen years old. Thirty-six per cent (15.5 million) of these persons have regarded the foot problems as serious enough to warrant medical attention⁹. In 1980, Gould et al. estimated that 12 per cent of the population of the United States had had an operation on the foot.

Proving a causal relationship between high-fashion footwear and foot problems has been difficult. Hundreds of published studies on the treatment of individual foot problems have reported a high proportion of female patients; however, most of these investigations covered a short period of time (one to two years) and were biased because they reported on one specific operative procedure only.

While the rate of foot problems in shoe-wearing societies is relatively high, investigations in societies where shoes are not worn have reported a paucity of foot problems^{11,13}. In studies involving barefoot natives of the Belgian Congo⁶, of West Africa¹, and of New Guinea¹⁶,

there was no demonstrable tendency toward the formation of a hallux valgus deformity in either men or women. Bunions did not occur as the individuals aged.

In a study from mainland China¹⁷, two groups (those who wore shoes [118 subjects] and those who did not [107 subjects]) were compared regarding the effects of footwear. Chinese natives who had worn shoes were reported to have a 33 per cent prevalence of bunions, while those who had never worn shoes had a 2 per cent prevalence of bunions. Kato and Watanabe reported on their experience with hallux valgus in Japanese women. Before 1972, very few operations for hallux valgus had been performed in Japan. After that date, such operations became much more frequent. Before 1948, Japanese women had worn a tabi, or thong, that did not constrict the foot. Following World War II, constricting leather footwear had been introduced in Japan and the tabi had fallen into disuse. The investigators concluded that the introduction of constricting footwear had made a marked difference in the prevalence of bunion formation and subsequent operations.

Some of the most incriminating evidence that foot deformities can be caused by compression of the foot comes from mainland China^{2,4,12,15}. For over 1000 years, the process of binding of the foot was performed on young (two to seven-year-old) Chinese girls in order to compress the foot to a smaller size. This painful process of wrapping the foot over time could reduce the length of the foot to a mere three inches (7.6 centimeters). While the bound foot was the object of great sensuality in Chinese society, binding caused severe deformities of the feet of young girls and created serious difficulty with walking in their later years. The process eventually came to be reserved for the wealthy, who had servants to carry the women around and to wait on them.

We think that the same process occurs, to a much more limited degree and at a slower rate, in Western society. The binding of feet in China could alter the shape of the foot over the course of three to four years in childhood, while the use of high-fashion footwear in Western society can cause deformities of the foot over several decades. The desire to make the foot appear smaller, daintier, and narrower is as prevalent today in

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TABLE I
INDICATIONS FOR OPERATIONS ON THE FOOT
IN ONE ORTHOPAEDIC PRACTICE, 1979 TO 1994

	Women	Men	Total	Prevalence in Women (Per cent)
Hallux valgus	785	53	838	94
Hammer toes	827	194	1021	81
Neuromas	278	36	314	89
Bunionettes	96	11	107	90
Degenerative osteoarthritis of the ankle	38	30	68	56
Ankle fractures	52	44	96	54

Western society as it was over 1000 years ago in Eastern cultures. High-heeled shoes tend to make the foot appear smaller because they place the foot in a more vertical position. Likewise, most shoes constrict the width of the foot by 1/2 to one inch (1.3 to 2.5 centimeters)⁷, making it appear narrower. Along with these considerations, it is not known what effect a positive familial history has on the development of hallux valgus or other foot deformities.

The Difference between Men's and Women's Shoes

In general, the outline of a man's foot is comparable to the outline of a man's shoe; the shoe conforms to the outer dimensions of the foot. As a result, the typical man's shoe does not compress or constrict the foot. One would thus expect the prevalence of compressive foot problems in the American male population to be relatively low. Hewitt et al., in a study of 23,000 military recruits, noted that there was an extremely small prevalence (less than 4 per cent) of bunions, hammer toes, and other deformities in this population.

In contrast, the typical woman's high-fashion shoe does not conform to the outer dimensions of a woman's foot. Frey et al. found that 88 per cent of 356 women (73 per cent of whom were patients in an orthopaedic office and 80 per cent of whom had foot pain) wore shoes that were an average of 1.2 centimeters narrower than the size of the foot. Women who wore shoes that had a discrepancy of only 0.5 centimeter had very few symptoms and less deformity. Frey et al. concluded that the deforming effects of improper shoes on a normal foot frequently can lead to hallux valgus, bunionette, hammer toes, and other problems.

Snow et al. reported markedly increased pressure beneath the forefoot when a shoe with an elevated heel was worn compared with when no shoe was worn. A low heel (1.9 centimeters) increased the peak pressure by 22 per cent in the forefoot, a five-centimeter heel increased the peak pressure by 57 per cent, and an 8.3-centimeter heel increased the peak pressure by 76 per cent. Those authors also showed that a narrow toe box places a laterally directed force on the hallux and a medially directed force on the fifth toe.

To investigate the relative frequency of foot disorders occurring in the practice of a busy foot surgeon, the over-all profile of patients who had had a forefoot operation between January 1979 and January 1994 was quantitated in the orthopaedic practice of one of us (M. J. C.). All of the cases of patients who had had operative correction of forefoot problems were reviewed. Patients who had rheumatoid arthritis and other systemic arthritic disorders were excluded from the study. During this fifteen-year period, the prevalence of hallux valgus, hammer toe deformity, interdigital neuroma, and bunionette in women was extremely high in comparison with that in men. In contrast, during the same period of time, an approximately equal number of male and female patients had an ankle arthrodesis or operative treatment of an ankle fracture, two procedures that are used to treat conditions that have little if any relation to footwear (Table I).

The age of the patient at the time of the onset of the forefoot deformities was evaluated as well. There was no increase in the prevalence of hallux valgus, hammer toe deformity, or neuroma formation in men with increasing age (Figs. 1, 2, and 3). In women, however, the prevalence of all of these conditions increased dramatically during the fourth, fifth and sixth decades.

Cost to Society

It is difficult to calculate the nationwide cost of the treatment of forefoot problems because of the extreme variations in hospital charges and physician fees across the country. No comparable figures are available on the frequency of bunionectomies, hammer toe repairs, neuroma excisions, and bunionette repairs in the United States; therefore, estimating the number of operative procedures performed is extremely difficult. For patients who are more than sixty-five years old, however, Medicare figures are readily available¹⁰. In 1991, 56,500 bunionectomies, 84,000 hammer toe procedures, 12,650 neuroma excisions, and 17,800 bunionette corrections were done for Medicare patients in the United States. In the present series, 27 per cent of hallux valgus repairs, 40 per cent of hammer toe repairs, 19 per cent of neuroma excisions, and 15 per cent of bunionette repairs were performed for Medicare patients. Applying these percentages to the total numbers of Medicare patients, it can be estimated that the following numbers of operative corrections on the forefoot were performed in the United States in 1991: bunionectomy, 209,000; hammer toe repair, 210,000; neuroma excision, 66,500; and bunionette correction, 119,000.

It is our best estimate that 75 per cent of these problems either result from or are greatly aggravated by the use of high-fashion footwear. The average cost per procedure (in hospital and physician charges) varies greatly, depending on the type of procedure, geographic location, and other factors. Use of \$3000 per procedure for simplicity's sake yields an estimated total direct cost

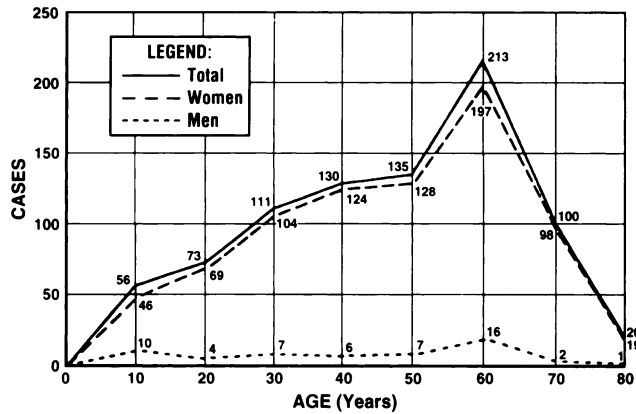


FIG. 1

Graph demonstrating the prevalence of hallux valgus. The peak prevalence occurs in the fourth, fifth, and sixth decades in women. There is no marked increase in men with increasing age.

of almost \$1.5 billion for the treatment of the 75 per cent of these four conditions that are caused by the use of high-fashion footwear. The indirect costs for these procedures (calculated as an average of four weeks off from work per person) approach an additional \$1.5 billion. When one considers that several other problems (soft corns, hard corns, claw toes, intractable plantar keratoses, sesamoid abnormalities, hallux rigidus, and toenail problems) were excluded from this calculation, an estimated total cost resulting from the wearing of high-fashion footwear of \$3 billion per year is undoubtedly a conservative one.

**Clinical Approaches:
How to Talk to Patients about Shoes**

When one looks at the rectangular shape of the foot and the triangular shape of the toe box in high-fashion footwear, it is obvious that the forefoot becomes constricted in the toe box. The addition of a high heel to this shoe increases the downward pressure with which the forefoot is forced into the constricting, triangular toe

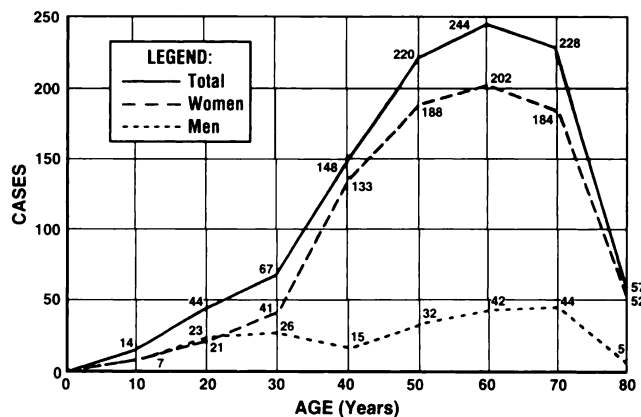


FIG. 2

Graph demonstrating the prevalence of hammer toes. The peak prevalence occurs in the fourth, fifth, and sixth decades in women. There is no marked increase in men with increasing age.

box. Over time, this deforming force leads to bunion deformity of the great toe and bunionette formation on the lateral aspect of the foot. As the lesser toes become contracted, hammer toes develop. This constriction of the forefoot can cause injury to the interdigital nerves and neuroma formation.

While operative intervention often is needed for the correction of these deformities, prevention is a reasonable objective. Preventive care can have a substantial effect on the reduction of the severity as well as the frequency of these problems.

The lower rate of foot problems in men demonstrates that forefoot problems can be reduced or even eliminated with the use of roomy, non-constricting footwear.

Achievement of this objective for many female patients means moving quickly into an area that many male orthopaedic surgeons often feel diffident about

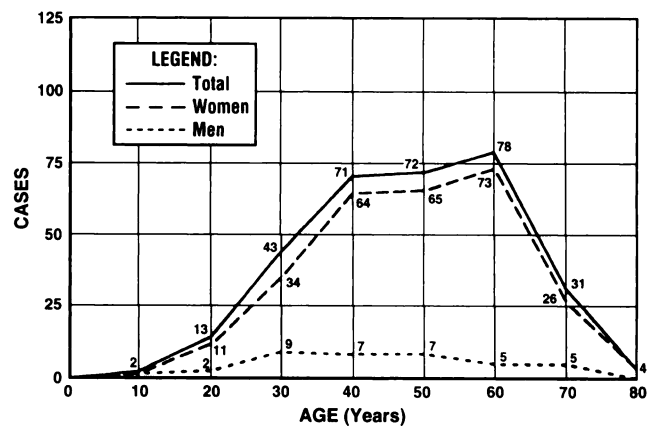


FIG. 3

Graph demonstrating the prevalence of neuromas. The peak prevalence occurs in the fourth, fifth, and sixth decades in women. There is no marked increase in men with increasing age.

broaching in detail; experience has shown them that female patients often roll their eyes heavenward, shrug, and tell them they just don't understand the problems of shoe fit and the cultural or work requirements of shoe style. The female one of us (F. M. T.) has been consulted on many occasions about this problem and will review here the techniques that have helped her to engage patients in a substantive discussion of the contribution that shoes make to pain and deformity.

Step One: Observing a Discrepancy between the Size of the Foot and the Size of the Shoe

The starting point for a discussion of the patient's shoes is to observe the relationship between the size and shape of the foot and the size and shape of the shoes that the patient is wearing. Do this as you get the gist of the patient's chief complaint and examine her feet.

In the course of examining her feet, ask the patient to stand on a footstool. It is important for the patient to be in a weight-bearing position when you measure the width of the foot, so that the width will be the same

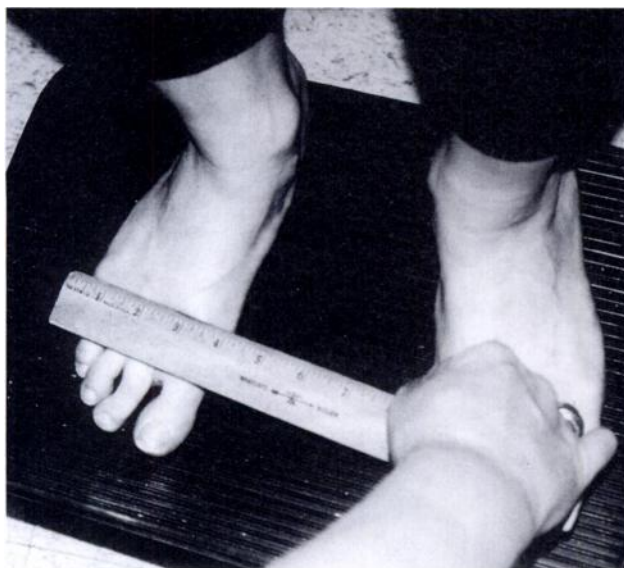


FIG. 4

Photograph demonstrating how to measure each weight-bearing foot with a ruler from the first to the fifth metatarsal. Announce the measurements to the patient and record the foot-width measurements in the chart.

as when the patient is bearing weight in a shoe.

Next, take an old-fashioned ruler and hold it over each foot (Fig. 4) and then announce your observation, "Let's see now, this right foot measures $3 \frac{3}{4}$ inches across, and this left foot measures $3 \frac{7}{8}$ inches across." Write down these measurements on the patient's chart.

Next, pick up the patient's shoe and turn it over so that both of you are looking at the sole, across the widest part of the toe box where the metatarsal heads

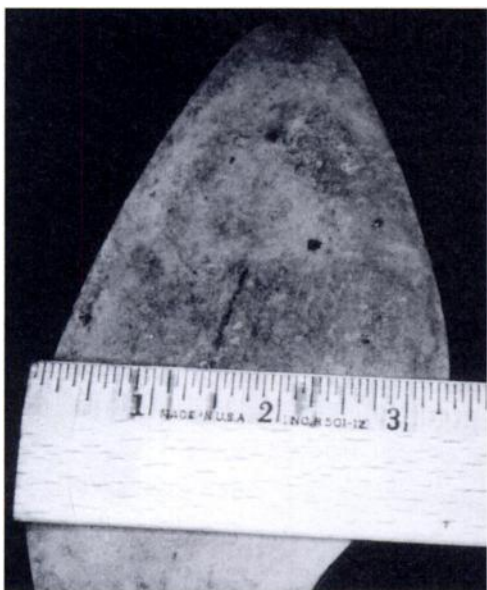


FIG. 5

Photograph demonstrating how to measure the patient's shoe across the sole at the widest part. Announce the measurement to the patient and record the shoe-width measurement in the chart.

lie (Fig. 5). Place the ruler across the shoe at that point and announce your observation, "This shoe measures $2 \frac{7}{8}$ inches across." Write this measurement on the chart. If she came in with both dress shoes and sneakers, measure both types.

Put your thumb on the ruler to mark the greatest width of the foot, hold it up and say, "See, this is how wide your foot is when you are standing on it." Then put the ruler, thumb in place, across the metatarsal area of

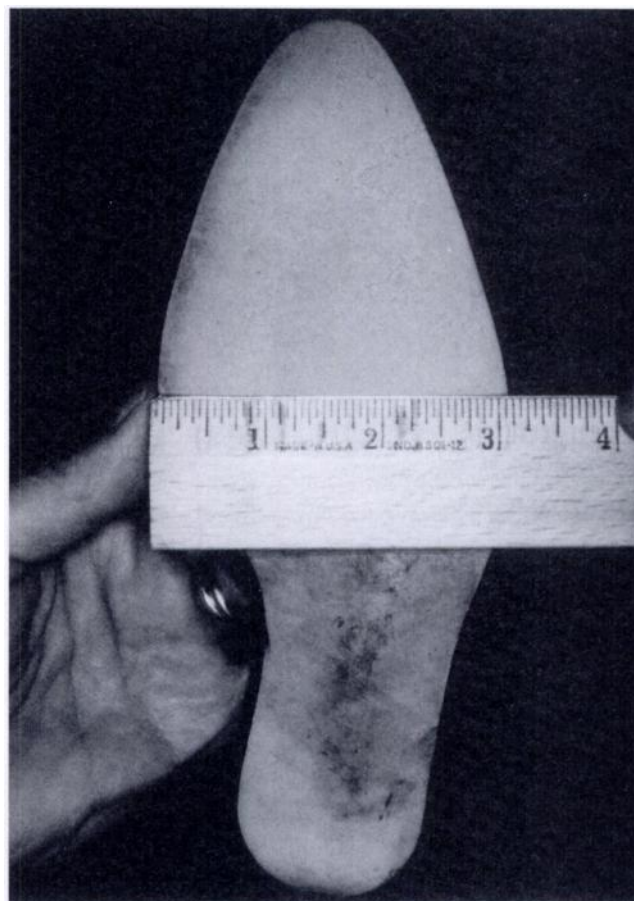


FIG. 6

Photograph demonstrating how to place the ruler against the shoe, with your thumb on the ruler at the patient's foot width, and to note the difference.

the sole of the shoe (Fig. 6) and say, "Look, this is how wide your foot is, and this is how wide your shoe is. There is an inch of difference."

At this point, there can be no disagreement: her shoes are smaller than her feet.

Step Two: Discussing What We Know about Shoe-Width Discrepancy, Foot Pain, and Deformity

Tell the patient about the findings of the Council on Women's Shoewear survey regarding women's feet, foot pain, foot deformity, and shoe width⁷. The average foot width was found to be $3 \frac{2}{3}$ inches (9.3 centimeters) (range, three to $4 \frac{1}{2}$ inches [7.6 to 11.4 centimeters]).

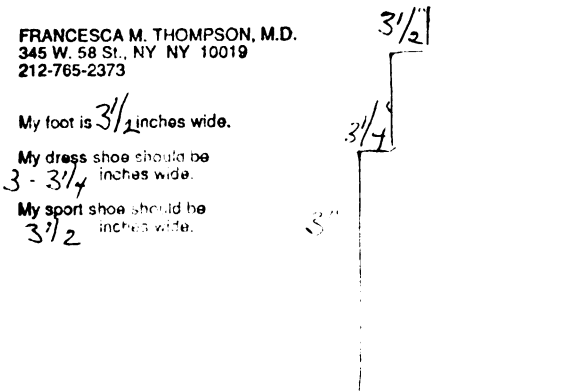


FIG. 7-A

Figs. 7-A, 7-B, and 7-C: Photographs showing the shoe sizing card, a simple three by five-inch (7.6 by 12.7-centimeter) index card over-printed as shown.

Fig. 7-A: Mark the card to the patient's foot width and draw a line down, stepping in two 1/4-inch (0.6-centimeter) increments.

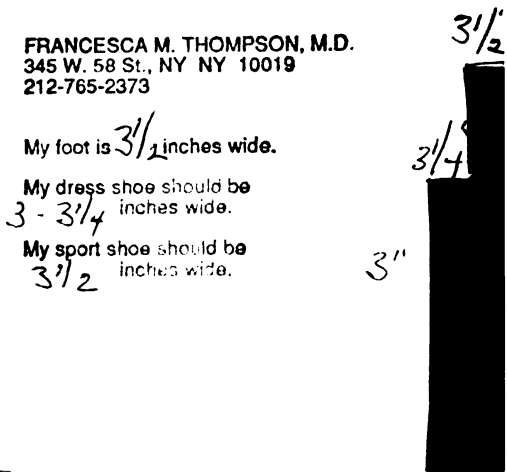


FIG. 7-B

Cut the card along the line and give it to the patient.

Women who had no pain or deformity tended to wear shoes that were about 1/4 inch (0.6 centimeter) narrower than the foot. Women who had pain and deformity tended to wear shoes that were more than 1/2 inch (1.3 centimeters) narrower than the foot. The study concluded that "an inch of pinch" is enough to cause foot pain and deformity. We recommend that a woman should wear sports shoes that are the same width as her foot and dress shoes that are no more than 1/4 to 1/2 inch (0.6 to 1.3 centimeters) narrower than her foot.

Step Three: What You Can Do for Your Patient

Your patient needs a shoe sizer. Although the metal shoe sizer, called the Brannock device, that is found in stores looks official and has a lateral flare that is marked A, B, C, and so on, there is absolutely no relationship between the width of any shoe and the width of the foot as indicated by the Brannock device. The patient needs some way of determining whether the shoe proffered in the store or the shoes in her closet meet the basic re-

quirement of being within 1/4 to 1/2 inch (0.6 to 1.3 centimeters) of the foot width for a dress shoe and the same width as the foot for a sports shoe.

We recommend that the orthopaedist make a shoe sizer for the patient. A stamp may be made that says, just below the orthopaedist's name and address:

My foot is ___ inches (___ centimeters) wide.
 My dress shoe should be ___ to ___ inches (___ to ___ centimeters) wide.
 My sport shoe should be ___ inches (___ centimeters) wide.

This can be imprinted on a three by five-inch (7.6 by 12.7-centimeter) index card, with the width of the patient's foot drawn on the card and the card marked to that width (Fig. 7-A). Two lines should be drawn to indicate the range from 1/4 to 1/2 inch (0.6 to 1.3 centimeters) smaller than the foot width, and the card should be cut off at these lines (Fig. 7-B). The patient should be shown how to use the shoe sizer on the shoe that she is wearing (Fig. 7-C).

Give this customized card to the patient, saying, "This is your shoe sizer; put it in your wallet and keep it with you at all times in case you get a shoe-buying attack. But first take it home and check all the shoes in your closet. If they don't measure up, put them in the back of the closet until you are ready to throw them away."

Step Four: Stepping Out of the Heel

Many patients will be quick to point out that when they wear wider shoes, their heels lift out and they step out of the shoe (Fig. 8). They think that they are the only one with this problem and that it is a sign of abnormal feet. This is the most common problem that Amer-

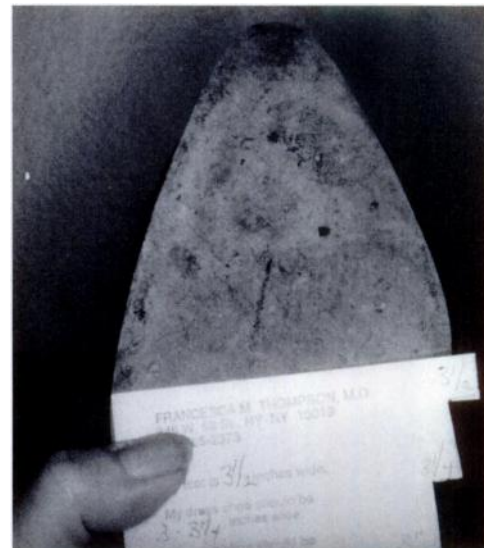


FIG. 7-C

Show the patient how to use the sizer against the sole of the shoe to see if it is within 1/2 inch (1.3 centimeters) of the width of her weight-bearing foot, but preferably closer to the actual size of her foot.

TABLE II
HANDOUT ON THE SUBJECT OF WIDE FEET

Wide Feet and Your Shoes

Many common foot problems that orthopaedic surgeons see are caused or aggravated by improper size and fit of shoes.

Women's Shoe Survey

The Council on Women's Shoewear of the American Orthopaedic Foot and Ankle Society recently reported on a series of 356 women. The width of the bare foot while the woman was standing was compared with the width of the shoe that she was wearing at the time that she was seen. The authors found that 88 per cent of those studied had shoes that were more narrow than the foot by more than 1/2 inch (1.3 centimeters). Eighty per cent of the women stated that they had some foot pain. Of those who had no pain, the shoe measured only 1/4 inch (0.6 centimeter) smaller than the width of the foot, on average. Seventy-six per cent of the women had some forefoot deformity such as a bunion, hammer toes, calluses under the metatarsals, or some other deformity. Of those who had no deformity, the average discrepancy between weight-bearing foot width and shoe width again was only 1/4 inch (0.6 centimeter). The average foot width was 3 2/3 inches (9.3 centimeters), with a range of three to 4 1/2 inches (7.6 to 11.4 centimeters).

Do American women have a Cinderella Complex when it comes to high-fashion shoes? This is a tempting analogy, but most women state that the shoe has to be snug in the front to stay on the back! This makes sense anatomically, because the foot has only one bone in the heel, and this bone does not enlarge after the growth of the foot is complete (between the ages of twelve and fourteen years). Therefore, the heel stays narrow throughout life. The front of the foot, in contrast, is made up of many bones connected by ligaments. Over the years, these ligaments stretch; as a result, the front part of the foot widens, the arch may sag, and the foot becomes longer as well. The women's shoe survey revealed that with every decade, more women noted that their foot size had increased. Remember that the average foot width was 3 2/3 inches (9.3 centimeters) and the range of widths was three to 4 1/2 inches (7.6 to 11.4 centimeters). As it is very hard to find shoes that measure more than three inches (7.6 centimeters) in width, many women have a problem buying proper shoes.

A person's feet vary in width and length from foot to foot. The women's shoe survey found that 66 per cent of the women felt that one foot was bigger than the other, divided equally between right and left feet.

Every trip to the shoe store is a compromise; some guidelines may help in shopping for shoes. Know the width of your weight-bearing foot. Take a six-inch (15.2 centimeter) ruler to the store with you. Fit the larger foot. Shop at the end of the day when whatever swelling may occur will be present. Buy shoes that are within 1/4 to 1/2 inch (0.6 to 1.3 centimeters) of the width of your foot. Avoid shoes that have seams in painful areas. Exercise shoes should be as wide as your foot. Often boy's or men's shoes are cut more generously in the forefoot. There is no standardization of sizes, so you must measure the shoe you are offered in the store and try it on. Shoes don't "break in," but feet do.

High Heels

What happens when high heels are worn? Irish orthopaedic surgeons recently studied the effect of heel height on the forefoot. They compared the metatarsal loading of sixty feet when the subjects were barefoot, wearing a shoe with a 3/4-inch (1.9-centimeter) heel, and wearing a shoe with a 1 3/4-inch (4.4-centimeter) heel. They found that the higher heel increased the pressure under the ball of the foot by 50 per cent, and, in addition, in many feet, the pressure was shifted from the middle of the foot to the bunion area.

*Frey, C.; Thompson, F. M.; Smith, J.; Sanders, M.; and Horstman, H.: American Orthopaedic Foot and Ankle Society women's shoe survey. *Foot and Ankle*, 14: 78-81, 1993.

*Corrigan, J. P.; Moore, D. P.; and Stephens, M. M.: Effect of heel height on forefoot loading. *Foot and Ankle*, 14: 148-152, 1993.

ican women have with shoes, because the size and shape of their foot changes decade by decade: the heel does not widen, but the forefoot does. Shoes should fit the forefoot rather than feel snug in the heel. Manufacturers

who split sizes (that is, those who make shoes that have a narrow heel and a wider toe box) should be sought out. These shoes are made on what is called a combination last. Tell your patients that shoes with laces, straps, or buckles on the vamp (the top part of the shoe) also will stay on better.

Step Five: Where to Buy Shoes

This is information that you and your staff can compile over time for your local area. Start by collecting brand names and shoe store names from patients themselves. Whenever you find a patient wearing a shoe that measures at least 3 1/4 inches (8.3 centimeters) across, and especially one that measures 3 1/2 inches (8.9 centimeters) across, note the brand and ask the patient where she bought the shoes. In this way, you can develop a "Wide Shoe List" that you can give to every patient, along with the shoe sizer. Describe this as only a place to start, and warn her that she should anticipate shopping at a number of stores in order to find the appropriate shoes.

You should find out what facilities in your area are staffed by certified pedorthists; call the Pedorthic Footwear Association at 1-800-673-8447 for this information. In addition to being able to fit prescriptions for specialized orthoses, these stores tend to have a selection of off-the-shelf wide or extra depth shoes, or both, that



FIG. 8

Patients frequently observe that if the shoe fits the forefoot, it is too loose at the heel, as shown in this photograph.

TABLE III
TEN POINTS OF PROPER FOOTWEAR
PROVIDED BY THE AMERICAN ORTHOPAEDIC
FOOT AND ANKLE SOCIETY*

1. Sizes vary among shoe brands and styles. Don't select shoes based on the size marked inside the shoe. Pick the shoe by how it fits your foot.
2. Select a shoe that conforms as nearly as possible to the shape of your forefoot.
3. Have your feet measured regularly. The size of your feet may change as you grow older.
4. Have both feet measured (often one foot is larger than the other). The shoe should be fitted to the larger foot.
5. Have your shoes fitted at the end of the day when your feet are the largest.
6. Stand during the fitting process because the foot lengthens as you are standing. There should be one fingerbreadth (1/2 inch [1.3 centimeters]) between your longest toe and the end of the shoe.
7. The ball of your foot should fit snugly into the widest part of the shoe, but the shoe should not be too tight.
8. If the shoes don't fit, don't purchase them. Don't expect them to "stretch to fit."
9. Your heel should fit comfortably in the shoe with a minimum amount of pistoning.
10. While you are still in the shoe store, walk to make sure that the fit feels correct.

*Brochures are available from the American Orthopaedic Foot and Ankle Society, 701 16th Avenue, Seattle, Washington 98122.

might give your patient at least one pair of shoes that she can wear every day or when she must spend a long time on her feet. You can also give the patient a prescription for a bunion last shoe that will more easily accommodate a severe bunion deformity. You should point out to the patient that seams in the toe box that press on the dorsomedial aspect of the first metatarsal will irritate a bursa in that area. Softer leather such as suede also conforms to the shape of the foot more readily than does patent leather or plastic, and cushioned inner soles decrease pressure in the metatarsal area. All of these elements will create a more comfortable shoe.

Many women whose feet are wider than average will be more comfortable in men's sports shoes, which usually are two sizes smaller; a woman's size 9 is a man's size 7.

Step Six: High Heels

As already noted, elevation of the heel increases forefoot pressure markedly. Advise your patients to limit the time that they spend wearing high heels, par-

ticularly those that elevate the heel more than two inches (5.1 centimeters). In New York City, it has been common for years for women to commute to work in running shoes, carrying their high heels with them.

Your patient must understand that you are talking about something real: the discrepancy between the width of her foot and the width of her shoe (Step 1). Next, you must convince her that there is clinical relevance to this finding (Step 2). Then, you must give her a shoe sizer to help rectify the problem (Step 3). Acknowledge the difficulty of keeping the shoes on her heels, and suggest ways of getting around this problem (Step 4). Give her a list of specific stores and brands of shoes that other patients have found that seem to meet the basic requirements, as well as a list of stores in your area where there are certified pedorthists to help with fitting (Step 5). Finally, recognizing that she may not be able to give up high heels entirely, suggest that she wear them sparingly (Step 6).

This information may be summarized in a handout on the subject of wide feet, like the one shown in Table II. You may use this as your handout or modify it as you see fit to help your patients.

The American Orthopaedic Foot and Ankle Society has developed ten points of proper footwear that can educate the public to the importance of a well fitting shoe (Table III). These steps will add no great cost to the price of shoes but will make it clear that tight shoes have a long-term deleterious effect on foot comfort and on a person's ability to walk.

In conclusion, there is a much greater frequency of forefoot problems in women than in men. These problems peak in the fourth, fifth, and sixth decades. Studies of barefoot populations have demonstrated no tendency toward forefoot problems in women, and we conclude that the shoe-wearing patterns in the United States have a distinct and unequivocal influence on the development of forefoot problems in women. Changing societal footwear habits requires an awareness of the dangers of and damage done by ill fitting, tight shoes. Proper shoe fit is critical for good foot health. Increased public awareness is the most important preventive step in reducing the prevalence of foot problems in women and in decreasing the huge expenditure of health care dollars for these forefoot problems. Finally, direct, informative discussions can provide female patients with insight into these problems and with practical guidance in the purchase of appropriate footwear.

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19. *United States Health and Welfare 1991 Medicare Figures*, courtesy of The American Academy of Orthopaedic Surgeons [computer disk].