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Functional Orthoses: Hype or Help?

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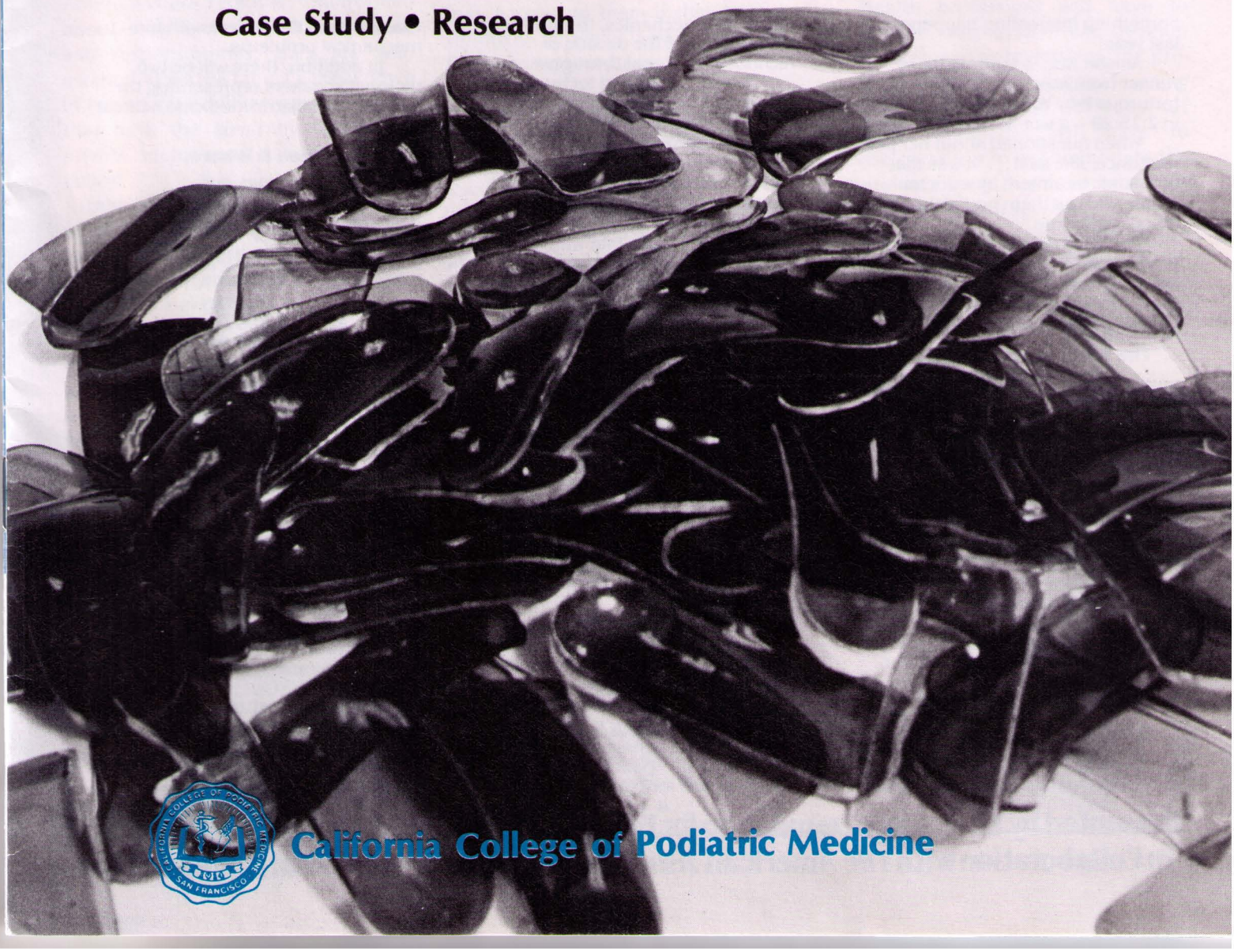


California College of Podiatric Medicine

Understanding Functional Orthoses

By Merton L. Root, D.P.M.
CCPM Class of 1952

In its March 1981 issue, Consumer Reports published an article entitled "What To Do When Your Feet Hurt." It was obviously prejudiced by deliberate distortions from the orthopedic specialists quoted in it. A subsection of the article was entitled "Orthotics: An Expensive Name for Arch Supports." It was this view of orthoses that motivated me to write this piece. The podiatrists interviewed by Consumer Reports obviously failed to justify their use of orthoses in the opinion of the author or authors of the article. Why?

Podiatrists have failed to motivate a large section of the public to use orthoses for at least two major reasons. The first and foremost reason for this failure is that most podiatrists are still using arch supports, but are calling them orthoses. I quote from the article: "But like podiatry itself, the arch support has recently assumed a more activist role. It even has a fancier name: the orthotic." Unfortunately, I find that I must agree with the Consumer Reports' opinion in this regard; only a small percentage of podiatrists are using orthoses for anything more than arch supports.

"A functional orthosis, if properly prescribed and made, will eliminate joint deformities."

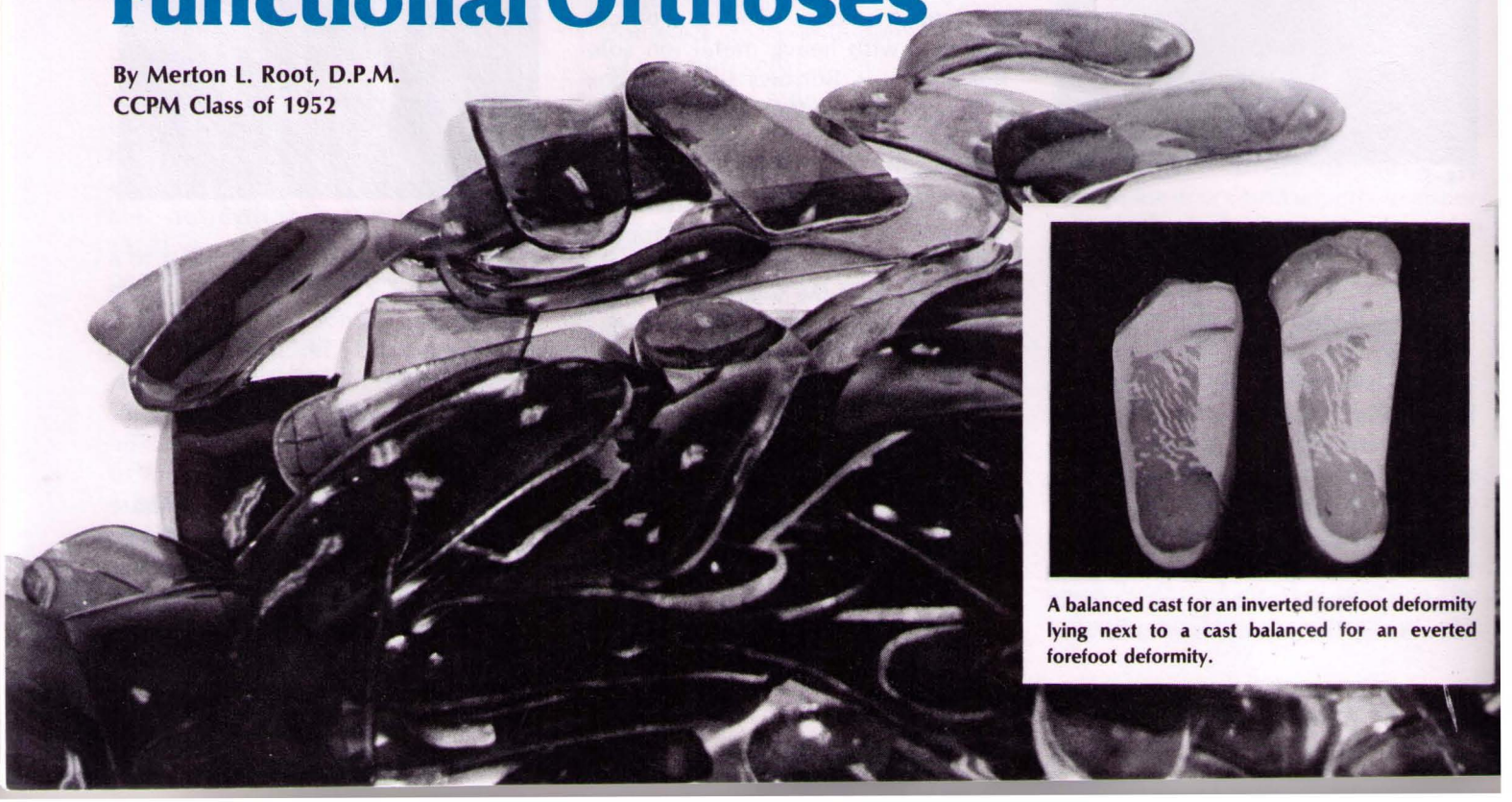
A second major reason for the failure of podiatry to convince the public of the value of its orthoses is that the profession is using gimmicky terminology and attempting to foist it on the public. Terms like "biomechanical imbalances," "optimal functional position," and "rebalance the foot" were used by Consumer Reports as direct quotations from podiatrists. Not one of these terms makes scientific sense, and the public is knowledgeable enough to reject such nonsense.

Biomechanics, which is a relatively new basic science of medicine, has particular value to podiatry because podiatrists primarily treat problems that are directly or indirectly caused by abnormal mechanics of the foot. Those podiatrists who have little or no knowledge of biomechanics but attempt to convince the public and the profession that they do, are distorting biomechanics, and will eventually destroy it as a valid scientific basis for understanding the foot. The science of biomechanics will continue to grow and flourish in other medical specialties but will die in confusion within the profession of podiatry.

It is only in the hands of a podiatrist who really understands biomechanics that functional orthoses prove their value.

Such a podiatrist can examine the lower extremities and identify those forces acting on a foot that cause malfunction. He can also determine whether or not there is a direct or indirect cause and effect relationship between the abnormal mechanics and the symptoms to be treated. He is also in the best position to determine which treatment method or combination of methods (medical, mechanical or surgical) will prove most beneficial to the patient.

When an orthosis is selected as a method of treatment, knowledge of biomechanics enables the practitioner to select the best casting posi-



A balanced cast for an inverted forefoot deformity lying next to a cast balanced for an everted forefoot deformity.

tion to resist the abnormal forces acting on the foot. The knowledge he has gained during examination also determines what he prescribes to have an orthosis made that will most effectively resist abnormal forces. Biomechanical knowledge also enables the practitioner to immediately evaluate the effectiveness of an orthosis just dispensed.

"Most orthoses do not perform as functional orthoses–sporthotics included."

What Orthoses Do– and Don't Do

An orthosis that is prescribed to resist specific abnormal forces identified by examination and is designed to promote improved function of the foot is called a functional orthosis. A functional orthosis does not support the arch of the foot. A functional orthosis does not "balance" a foot. A functional orthosis does not hold a foot in any position. A functional orthosis does not accommodate lesions or painful areas of the foot. A functional orthosis only resists abnormal forces and promotes improved foot function.

Functional orthoses were conceived on the basis of the following premise. Biomechanics indicates that a foot only moves abnormally when that foot is subjected to abnormal forces. Those forces that cause foot malfunction can be either compression or tension. There are no other forces acting upon a foot. Compression or tension forces can become abnormal when they vary from normal in either their direction or their strength within the foot.

"With adequate testing, forefoot posting of orthoses was found to have no value and many disadvantages."

Abnormal strength of forces can only be resisted slightly by orthoses of any kind. True bracing of the foot is the only mechanical method that can resist forces that vary from normal in strength.

However, the most frequent abnormal variant of forces is a variance in the direction of forces acting upon or within the foot. Functional orthoses are primarily designed to resist the abnormal direction of forces and to redirect those forces into a more normal direction within the foot.

Fortunately, with the exception of some neuromuscular diseases, pathological symptoms most commonly treated by the podiatrist are caused by abnormal direction of forces and thus are amenable to treatment by functional orthoses. Abnormal direction of forces causes the large majority of corns, calluses, bunions and other symptoms such as neuromas and heel pain, as well as many postural problems such as instability, knee, leg, hip and back problems. Therefore, the knowledgeable use of functional orthoses can alleviate the large percentage of these symptoms. Furthermore, recognition of the cause and effect relationship between such symptoms and abnormal mechanics allows the podiatrist to prevent the development of these symptoms by timely treatment with functional orthoses.

To be effective, the functional orthotic must be made to perform the following functions:

- It must support any forefoot deformity that causes the forefoot to be either inverted or everted from the ground. The exact number of degrees of inversion or eversion deformity must be supported to eliminate any retrograde force from the forefoot that would cause the rearfoot to function abnormally.
- It must resist any forces caused by rearfoot pathology that would cause the rearfoot to evert excessively with subtalar joint pronation.
- It must resist any extrinsic forces from the leg that would cause either abnormal pronation or lateral instability of the foot.
- It must provide enough pronation after heel strike for the foot to initiate normal shock absorption.

As these requirements indicate, most orthoses and other types of appliances do not perform as functional orthoses. Many appliances function only as arch supports with or without forefoot accommodations. Other or-

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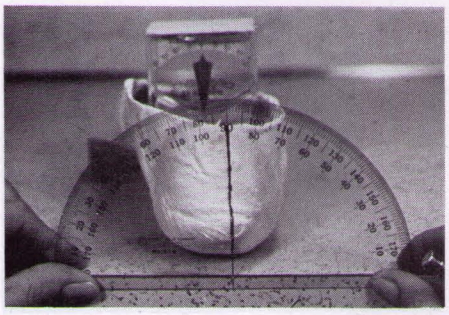

Checking the accuracy of pouring the positive cast.

The patient was brought into the operating room and given local anesthesia in the right foot in the form of a proximal field block at the midshaft of the fifth metatarsal, utilizing a total of 7.5 cc of 1 percent Xylocaine plain and 3 cc of 0.5 percent Marcaine plain. A pneumatic ankle tourniquet at 300 mm of mercury was used for hemostasis.

A 3 cm x 1 cm lenticular incision encompassing the lesion was made on the right foot. The incision was oriented along the long axis of the foot. With the use of sharp dissection, the skin and subcutaneous tissue as well as the lesion enclosed within the incision, were freed from the wound. At this time it was noted that there was apparently hypertrophied nerve tissue along the lateral aspect of the fifth digit, and with the use of sharp dissection this tissue was removed from the wound. At the plantar aspect of the wound, it was noted that there was bursa formation which apparently extended plantar to the fifth metatarsal head. This bursa was left intact.

The wound was flushed with copious amounts of sterile saline. Deep closure was obtained with the use of # 4-0 Dexon suture and superficial closure with # 5-0 Dermalon. A total of 0.5 cc of Celestone phosphate was injected into the surgical site and a mild compressive dressing applied, consisting of Betadine-soaked gauze, 4x4 gauze, and Kling. The patient tolerated the procedure well and left the California Podiatry Hospital walking independently.

POST SURGERY

The patient was seen one week after surgery for observation and redress. Two weeks after surgery, the sutures were removed without incident. The patient was seen again one month after surgery, with good healing of the wound noted.

MICROSCOPIC EXAMINATION AND DIAGNOSIS

The pathology report showed receipt of a specimen consisting of a skin strip measuring 4x1.3x0.8 cm and showing hyperkeratosis with depression in a central area 0.6 cm in diameter. Microscopic examination showed a focal area of thickened epidermis with islands of small cells with round nuclei and pale cytoplasm present within the epidermis and sharply demarcated from the surrounding epidermal cells.

The diagnosis was eccrine poroma of Pinkus.

Eccrine poroma is a benign cutaneous tumor thought to arise from the intraepidermal sweat duct. Pinkus, et al., described this tumor in 1956.

Eccrine poromas usually appear after age 40. However, they have also been reported in individuals as young as 15. Apparently, there is no sex or racial predilection. The tumors are usually solitary and most often located on the plantar or lateral surface of the foot, but also have been found on other body parts, including palms, face, back, chest, popliteal fossa, and thighs. The poroma generally begins as a small nodule which gradually enlarges and is usually not painful or tender.

Most eccrine poromas are protuberant and sit in a cupped shape invagination of the surrounding horny layer of the skin. The surface of the lesions is usually smooth and slightly lobulated, but if the lesion is located in a pressure point, there may be surface ulceration. The color of the lesion generally varies from that of the surrounding skin to purple, red, or dusky red.

Microscopic examination of eccrine poroma reveals a mass of well-circumscribed encapsulated epithelial cells. The characteristic cells of which the poroma is composed are small, round and very uniform in size, and have intensely basophilic nuclei with slightly eosinophilic cytoplasm. There is a finely dispersed chromatin pattern. This may at least partially account for the usual reddish color of the lesion.

TREATMENT OF CHOICE

Although eccrine poromas are very slow-growing, the treatment of choice is complete excision because they tend to recur following incomplete removal. □

Chemical debridement...from page 5

Patient acceptance and ability to properly use the medication was excellent. This high rating was probably received because the majority of patients had unsuccessful treatment previously with other medications including zinc oxide, betadine soaks, and other typical hospital preparations.

The Knoll Pharmaceutical Company of Whippany, New Jersey, assisted the College in providing funds and supplies for this study. The patient care and data collection were coordinated by Dr. William Jenkin, Chairman of the Podiatric Medicine Department at the California College of Podiatric Medicine, as well as Drs. Richard Stess and Peter Graf of the Veterans Administration Medical Center, San Francisco. □

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thoses partially support forefoot deformities and may contain rearfoot posts that are uniformly the same, varying neither in the amount of motion provided nor in their position relative to the center of the heel. All orthoses made in large mass production laboratories fall into this latter category - sporthotics included.

Working With Orthoses

What is required to provide functional orthotic therapy for one's patients?

- The doctor must have a sufficient background in biomechanics to be able to identify the abnormal forces that cause a foot to malfunction.
- The doctor must be able to prescribe the variations in functional orthoses that are necessary

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to manufacture an orthosis that will resist those abnormal forces.

- The doctor or his assistant must be capable of taking a good neutral position cast.
- The doctor must employ a laboratory technician, or use a prescription laboratory that employs technicians who are trained to fabricate functional orthoses with all the prescribed variances.
- The doctor must be able to evaluate the extent of functional control when the orthosis is first dispensed and later during follow up visits.

Prescription Variances

What prescription variances are necessary for the maximum use of functional orthoses?

- Balancing the forefoot of a cast varies for specific deformities and balancing the cast requires different levels for different pathologies. It may be necessary to prescribe balancing metatarsals 1 to 5, 2 to 5, 1 to 4, or 2 to 4 depending on the pathology or combination of pathologies present in a given forefoot.
- Using—or not using—a filler between balance platforms also influences the extent of functional control with orthoses in certain cases.
- Variations in heel cup heights for functional orthoses are extremely important. Functional control of feet subjected to abnormal forces originating from rearfoot pathology or from pathologies extrinsic to the foot requires variations in heel cup height. Heel cup height must be higher medially and lower laterally in certain cases or must be higher laterally or lower medially in other cases. Medial or lateral flaring of rearfoot posts may also be required in these cases.
- Variations in the height of the posting elevator are necessary to properly accommodate variances in foot gear when using rearfoot posting.
- Variations in the rearfoot posting position and in the amount of rearfoot post motion are necessary when the subtalar joint axis is inclined or declined significantly from the average sagittal plane inclination angle.
- Even the position in which the cast is poured can be critical to controlling function of a foot in certain cases. Most casts are poured with the calcaneus vertical, but in some cases it is necessary to prescribe an inverted pouring position, and in other cases an everted pouring position. The exact number of degrees for either an inverted or everted pouring position must also be prescribed.
- Numerous other variations are required in certain cases when prescribing functional orthoses. These include 5th metatarsal cutout, cuboid filler, and fascial accommodations.
- Prescribing the thickness of acrylic to be used in the construction of functional orthoses is also important. Too much flexibility or too much rigidity will decrease the control potential of a functional orthosis.

Note that I have made no reference to forefoot posting. With adequate time testing, forefoot posting of orthoses was found to have no value and many disadvantages. I have worked for the past seven years with more than 50 practicing podiatrists. All have discontinued using routine forefoot posting as their knowledge of prescribing functional orthoses improved. It is rare that one of these podiatrists uses a forefoot posted orthosis.

Evaluating The Orthosis

When a functional orthosis is first dispensed, its effectiveness controlling foot functions can be visually detected immediately. Watching a patient walk while wearing shoes without orthoses, and again with them, should reveal immediate functional improvement. If a significant functional improvement is not discernible as the patient first walks while using orthoses, there will never be improvement from that pair of orthoses.

During locomotion, an effective functional orthosis will allow a foot to pronate normally after heel strike. Before heel lift, however, the orthosis will guide the foot back to a neutral or slightly supinated position. Furthermore, the foot will continue to supinate at the midtarsal joint throughout propulsion until toeoff.

A functional orthosis will also alter an abnormal shoe wear pattern to a more normal pattern after a patient has worn the orthosis for a while. Dramatic resolution of symptoms that are caused by abnormal mechanics is another indication of the effectiveness of functional orthoses.

An arch support, with or without a rearfoot post, and regardless of the type of material from which it is constructed, will frequently relieve some symptoms, for a time at least. An arch support, however, almost never eliminates major symptons; it only lessens the discomfort symptoms cause.

A functional orthosis, if properly prescribed and made, will eliminate many symptoms and will frequently decrease or eliminate joint deformities. The longer a patient wears a good functional orthosis, the better the foot becomes and the better a patient feels.

In the interest of the future of podiatry, and in the interest of better patient acceptance of podiatry, I feel it is time for podiatrists to mature to the point where they will admit their limitations. They should either try to learn biomechanics, and practice orthopedics honestly and conscientiously; or they should tell their patients that they are dispensing arch supports rather than calling them by a fancier name: the orthotic. □

Merton L. Root, DPM, introduced biomechanics into podiatry and devised the techniques and instruments used to examine the lower extremity for biomechanical abnormalities. He has also defined and classified approximately 25 deformities of the foot and lower extremity which were previously unrecognized and undefined. Root practices and leads seminars in podiatric biomechanics in San Jose, California.