

AN INTRODUCTION TO FOOT AND LEG BRACING

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The podiatric physician is generally familiar with foot orthoses as well as the utilization of shoes and shoe modifications. Unfortunately, a familiarization with the use of leg bracing is not common. Knowledge of leg bracing techniques can be an extremely beneficial adjunct to the podiatric physician in both the nonoperative patient as well as in situations where postoperative splinting and bracing systems may be needed. A review will be presented here to familiarize the practitioner with the basics of foot and leg bracing.

TERMINOLOGY OF BRACING

As in any field of specialty, a basic language and familiarity with its definitions is necessary to adequately correspond and converse with specialists in the field. A familiarization with basic terminology is necessary to help understand the foot and leg brace. The term AFO stands for Ankle Foot Orthosis. The term KAFO stands for Knee Ankle Foot Orthosis. The term HKAFO stands for Hip Knee Ankle Foot Orthosis. These basic eponyms relate the proximal extent of the leg bracing system.

The terms free, fixed or stops relate to the degree of motion permissible at any articulation within the brace. For example the ankle may be fixed, not allowing any motion to take place, whereas the knee may be free permitting motion. Devices such as stops and springs and other types of mechanisms to assist joint motion may be utilized where muscle weakness is present. The orthotist is the fabricator of these bracing systems. A close relationship between the ortho-

tist and the podiatric physician is important to help relate the goals of the bracing system with the practical applications.

PRESCRIBING THE BRACE

Five basic steps are necessary in assisting the physician on prescribing the brace. These five steps include: Patient assessment; Goal setting; Orthotist consult; Writing the prescription; and Evaluation.

The patient assessment portion of the process involves full evaluation of the foot, knee, ankle and hip ranges of motion, as well as muscle function. A thorough gait evaluation (not only on level walking surfaces, but on stairs, and observing the patient arise from a chair) may be necessary to aid the physician in total patient evaluation. Associated conditions such as hand, shoulder or spinal deformities should also be noted. Certain upper extremity deformities or problems of the patient may necessitate associated modifications of ambulatory aids such as walkers and canes.

Goal setting becomes the next step in the logical progression of prescribing a brace. At each level of the leg, certain specific goals may be set for the brace to accomplish in order to assist the patient in independent ambulatory function. If muscle weakness is present, certain springs or other mechanisms may be needed to help assist in muscle function. Where painful range of motion is present, other mechanisms to limit range of motion to a pain free zone may be applicable. Structural malalignments may be compensated for by utilizing various straps and mold-

ing techniques within the brace to help maintain alignment in the various body planes. Depending upon the degree of deformity and patient expectations, certain combinations of the modifications at different levels of the brace, may be necessary.

The next step in the prescribing process is the orthotist consult. The orthotist is an invaluable member of the team involved in foot and leg bracing. He fabricates, from the various hinges and braces systems, a unique brace for the patient. His knowledge of the current mechanical systems available to assist in patient function will be of importance to the practitioner in the prescription process. Logical discussion in terms of the patient and unique goals related to a specific patient is critical. It is not the function of the orthotist to evaluate the patient in terms of muscle function and range of motion, although his training has made him familiar with these processes. It is the podiatrist's job as the prescribing physician to establish the goals of the bracing system.

Once the goals have been established as noted, then the consult with the orthotist becomes a matter of custom designing that particular brace for that patient to best achieve some degree of ambulatory independence.

When discussing goals, it must be remembered that the lifestyle of the particular patient must be taken into consideration as well. Factors such as cosmesis for an individual who may want to wear shorts or skirts is a consideration. The weight of the device can be an extremely important factor, especially in patients who are active in sports, or in very weak and debilitated patients. The ease of application and removal of a brace must be tailored to the individual patient. It is important to consider the patient's manual dexterity as well as comprehension of brace application and removal. In many cases, home assistance is not only helpful but may be necessary. Other ambulatory aids may be of assistance to the patient in utilizing the brace. Walkers or canes may greatly improve what may appear to be an inadequate brace or less than functional situation.

The fourth step in the brace prescription process is the actual writing of the prescription. Generally, in terms of insurance reimbursement for the brace shop, the description of the device is necessary along with the clinical diagnosis.

Notations from the consultation with the orthotist are utilized in actually prescribing the specific devices necessary in construction of the brace. The orthotist will then take these devices along with the patients extremity measurements to fabricate the customized brace.

The final step in the prescription process is the clinical evaluation of the dispensed brace. The brace should be inspected for pressure points where skin irritation may occur. Walking, climbing stairs, arising from a sitting position, and sitting from a standing position should be evaluated. The brace may create impingement about the knee with extremes of flexion or there may be certain releases or stops necessary about the knee to assist the patient in arising from a sitting position.

Notations related to daily living activities are particularly important when observing the patient. You should not only observe the patient in level gait, but also in the many activities that may comprise the day to day existence of the patient.

You should engage the patient in a discussion relative to their acceptance of the use of the device. If the patient appears disappointed or saddened by the appearance, weight or general visual impact of the device, certain considerations for modification may be necessary. An unhappy patient will leave the device in the closet and will not utilize it to its fullest potential.

Modifications or changes to other kinds of braces for specific needs may also be necessary. A very athletic patient may require a specific brace for running and jogging and a secondary device for more sedentary activities. A period of time should be given for break-in and adjustment of the brace. Continued evaluation by the orthotist as well as modification during the initial weeks of use are important to customize the brace to a particular patient and their special needs.

ILLUSTRATIVE CASES

The following illustrative cases demonstrate the use of foot and leg bracing in podiatric medicine. Different pathologies and goals are presented to highlight specific applications of foot and leg bracings.

Case 1

The patient is a seventy-eight year old caucasian female with tibialis posterior tendon dysfunction. She is a non-surgical candidate because of medical reasons.



Fig. 1 A. Anterior view of the affected right lower extremity.



Fig. 1 B. Posterior view demonstrating valgus positioning of tarsus with tibialis posterior dysfunction.



Fig. 1 C. Anterior view of patient in double upright brace with a medial T-strap secured to the lateral arm of brace.



Fig. 1 D. Posterior view of patient demonstrating the bracing system maintaining a varus attitude of the tarsus.

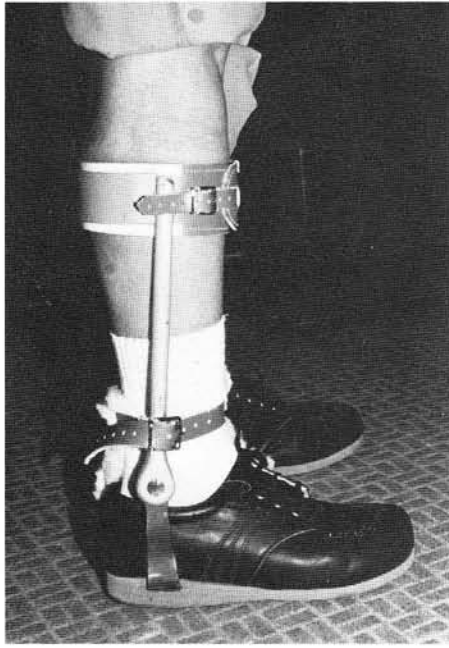


Fig. 1 E. Lateral profile of bracing system demonstrating securing of the T-strap to the lateral arm of double upright brace.

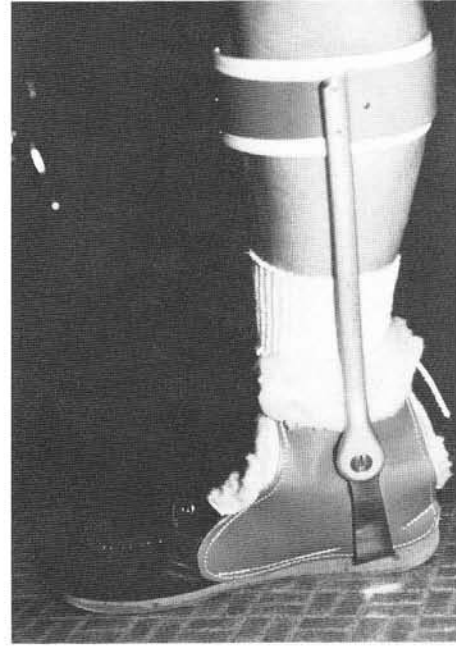


Fig. 1 F. Padded medial T-strap medial perspective securing midfoot into a varus attitude. Note the ankle hinge is a free hinge without spring or stop assist. This patient had adequate ankle dorsiflexory and plantarflexory range of motion and good joint function without pain or discomfort.

Case 2

The patient is a seventy-nine year old white male with a history of CVA and right sided hemiparesis and weakness in the peroneals with spastic invertors.



Fig. 2 A. Anteroposterior view with general varus attitude of the foot.



Fig. 2 B. Lateral perspective of foot and leg demonstrating severe inversion attitude during stance phase of gait.



Fig. 2 C. Anterior clinical perspective of double upright brace with valgus T-strap fixed to shoe. Note the use of a quad cane to assist in stability of gait.



Fig. 2 D. Posterior perspective of brace demonstrating valgus T-strap secured to medial arm of double upright brace system.



Fig. 2 E. Note plantar grade attitude of the foot in weightbearing position.

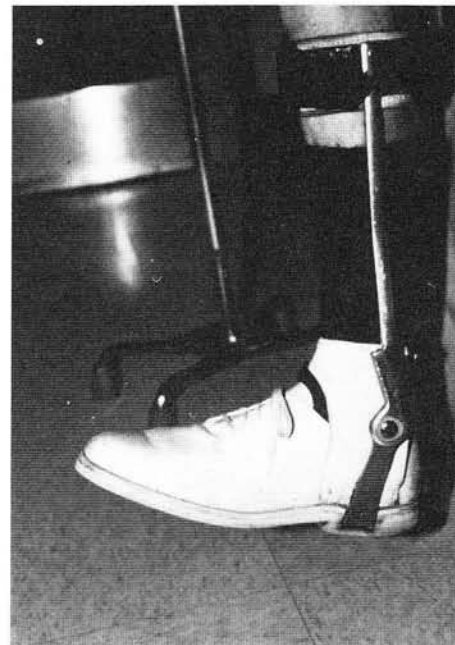


Fig. 2 F. Note dorsiflexed attitude of foot with spring assist of Klenzank ankle incorporated in the double upright brace to assist weak dorsiflexors.

Case 3

The patient is a twenty-four year old black male with a history of talipes equinovarus in childhood. The patient had a triple arthrodesis, two years prior with satisfactory result, yet experiences degenerative arthritis of the ankle with a significant degree of pain and discomfort. Also, severe limb length discrepancy is present.



Fig. 3 A. Anterior posterior clinical presentation. Notice the limb atrophy and compensation through knee flexion due to the significant limb length discrepancy.



Fig. 3 B. Posterior clinical perspective.



Fig. 3 C. Anterior posterior view of patient in patellar tendon weightbearing brace with free ankle. The brace has been utilized to relieve body weight pressures onto the ankle through acceptance of weightbearing through the patellar tendon. Note compensation for limb length discrepancy as well.



Fig. 3 D. Lateral perspective of foot within bracing system.



Fig. 3 E. Proximal cup portion of patellar tendon weightbearing brace demonstrating plasti-zote liner to gently assume pressure into the proximal leg.



Fig. 3 F. Bracing system. Note the articulating proximal area for ease of application for the patellar tendon contact portion of the brace. Also note the free ankle incorporated into the device without hinge or stop apparatus due to the adequate muscle function about the ankle. Also, a molded foot orthosis is utilized to assist in forefoot to rearfoot alignment.

Case 4

Six-year old black female with developmental delay syndrome as well as spastic diplegia and bilateral flexible pes valgus.



Fig. 4 A. Note severe pes valgus of right lower extremity.



Fig. 4 B. Posterior perspective of extremity.



Fig. 4 C. Clinical presentation of foot within molded AFO with free ankle and posterior stop to assist with ankle dorsiflexion due to weak anterior muscle group.



Fig. 4 D. Note varus angulation of foot within bracing system. Molding and fabrication of the brace was carried out with the foot held in a more satisfactory alignment with contouring of the foot plate portion of the AFO to help fore-foot to rearfoot alignments.



Fig. 4 E. Posterior perspective of brace. Note posterior stop and velcro system of straps to secure brace to the leg.



Fig. 4 F. Free unlimited dorsiflexion of the ankle hinge.



Fig. 4 G. Limitation of plantarflexion range of motion at the ankle demonstrating dorsiflexory assist for swing phase of gait. Note contour of foot portion of orthosis to help maintain foot alignment through the stance phase of gait.

CONCLUSION

If the logical progression as outlined in this paper is followed in the brace prescription process, the ultimate goal in prescribing the brace should be realized. Making the orthotist part of your team in patient evaluation and care is a critical factor. Becoming familiar with local orthotists and utilizing them as an information resource is also extremely beneficial. It may even be prudent to simply have the patient visit the orthotist and review the types of bracings that may be available so that the patient may become more comfortable with the impending use of such devices.

The use of foot and leg bracing is a critical portion of the podiatric physician treatment regime. Familiarization with the bracing systems available as well as their applications is critical in understanding this resource for your patients. It is hoped that this introduction will invite you to become more familiar with these systems and utilize them for your patient.

RISK MANAGEMENT CONCERNS

A knowledge of bracing and its potential contribution to the treatment plan of the patient is necessary.

Identify patients who are non-surgical candidates due to other medical problems. These patients may gain satisfaction from bracing alone.

BIBLIOGRAPHY

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