Plastic Ankle-Foot Orthoses:

Indications and Functions

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Prescription of plastic ankle-foot orthoses at the Institute of Rehabilitation Medicine, New York University Medical Center (IRM-NYUMC), has over approximately the past 12 years been based on the identification of a pathomechanical condition affecting the ankle-foot complex for the purpose of matching that condition with a biomechanical device (plastic ankle-foot orthosis). Over the years, this basic system has been improved to include modifying factors such as spasticity and sensory status (Table I).

Table II represents an elaboration of the system in describing, in addition to indications, the biomechanical actions of each ankle-foot orthosis as well as contraindications. Each of the AFO's described is shown in Figures 1 through 5.

Tables I and II have been used successfully in the training of physicians, orthotists, therapists, and other health-related personnel. We hope that the readers of the Newsletter find these tables useful in their respective clinics to clarify indications and contraindications for the various AFO's.

Table I

Pathomechanical Condition	Biomechanical Device	Degree of Spasticity	Sensory Deficit
Weakness or absence of dorsiflexors	Posterior Leaf-Spring	None to mild	Reduced without medio-lateral instability
Weakness or absence of dorsiflexors and plantar-flexors	Spiral	Mild to moderate	Reduced with valgus instability
Equinovarus with rotation of foot	Hemi-spiral	Moderate	Mild to moderate
Equinovarus without rotation of foot	Hemi-posterior Leaf-Spring	Moderate	Mild to moderate
Other: 1. Pain 2. Sensory deficit 3. Structural	Solid ankle	Severe	Severe

Criteria are based upon musculoskeletal and neurological determinations rather than etiology. Included are:

1. Deformity
2. Joint mobility
3. Contractures
4. Motor Power
5. Spasticity
6. Presence or absence of edema
7. Sensory abnormalities, particularly proprioceptive

Ankle-Foot Orthosis	Posterior Leaf-Spring	Hemi Posterior Leaf-Spring	Spiral	Hemi Spiral	Posterior Solid Ankle
Biomechanical Action	Prevents foot slap at heel strike. Assist toe clearance in swing phase.	Prevents foot slap at heel strike. Assist toe clearance in swing phase with control of inversion.	Prevents foot slap at heel strike. Assist toe clearance in swing phase and push-off in stance phase with control of inversion and eversion. Provides extension moment at knee to assist stability.	Prevents foot slap at heel strike. Assist toe clearance in swing phase with control of inversion. Induces external torque on foot at heel strike.	Immobilize ankle in swing and stance phase.
Indications	Motor weakness of ankle dorsiflexors.	Motor weakness of ankle dorsiflexors and everters w/mild to moderate lateral instability and tendency toward varus (without foot internal rotation component).	Motor weakness of ankle dorsiflexors and/or plantar flexors with moderate medial-lateral instability. Mild motor weakness of knee extensors.	Motor weakness of ankle dorsiflexors and evertors with moderate to severe lateral instability and/or strong tendency toward equinovarus; internal rotation of foot; moderate spasticity.	Structural collapse of foot-ankle; pain due to movement of ankle; severe spasticity with sustained clonus; severe sensory deficit.
Contraindications 1. Motor Power	Moderate to severe weakness of ankle plantar flexors. Inadequate knee strength Inadequate hip strength	Moderate to severe weakness of ankle plantar flexors. Inadequate knee strength Inadequate hip strength	Pronounced imbalance of forces acting on ankle-foot complex. Inadequate hip strength	Inadequate hip strength	Inadequate hip strength
2. Spasticity	Moderate to severe spasticity	Moderate to severe spasticity	Moderate to severe spasticity	Severe spasticity with sustained clonus	
3. Joint Stability	Medio-lateral ankle instability with marked varus/valgus.	Valgus	Severe medio-lateral ankle instability	Valgus	
4. Joint Mobility	Ankle dorsiflexion limited to $<90°$ Fixed deformity	Ankle dorsiflexion limited to $<90°$ Fixed deformity	Ankle dorsiflexion limited to $<90°$ Fixed deformity	Ankle dorsiflexion limited to $<90°$ Fixed deformity	Significant functional movement of ankle during gait.
5. Volume Changes			Fluctuating edema	Fluctuating edema	Fluctuating edema

Figure 1. Posterior Leaf Spring Ankle Foot Orthosis.

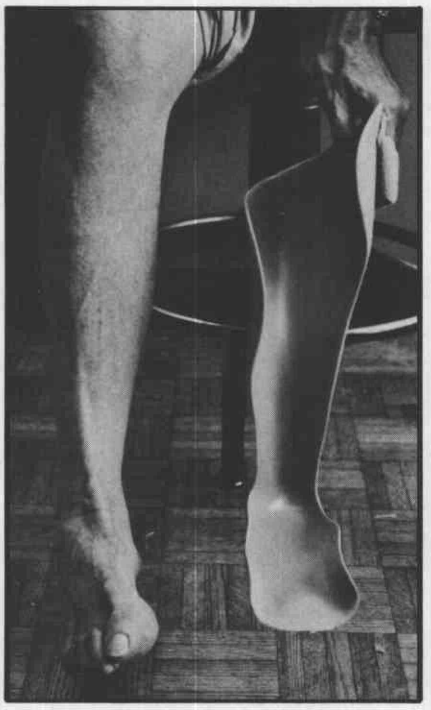

Figure 2. Hemi Posterior Leaf Spring Ankle Foot Orthosis.

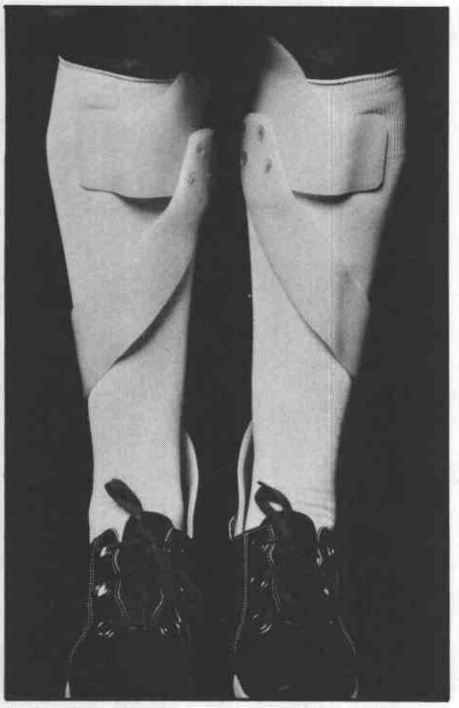

Figure 3. Spinal Ankle Foot Orthosis.

Figure 4. Hemi Spiral Ankle Foot Orthosis.

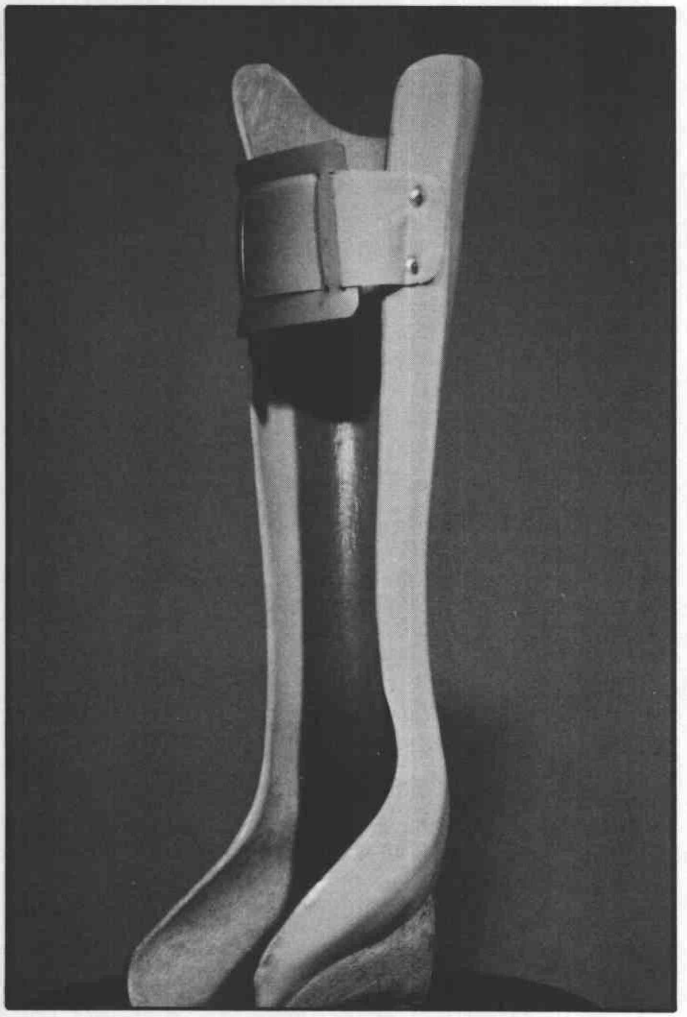

Figure 5. Posterior Solid Ankle Foot Orthosis.