



# Falk Prosthetics & Orthotics QUARTERLY

A Publication of Falk Prosthetics & Orthotics, Inc.

No. 34

## AFO – Orthosis for Many Reasons

The ankle-foot orthosis (AFO) ranks among the leading rehabilitation aids in the U.S. The majority of America's four million stroke survivors wear some form of AFO to overcome drop foot and other biomechanical complications. Add the additional millions of children and adults challenged by cerebral palsy; multiple sclerosis; head trauma; polio; Charcot disease; ALS; fractures, injury and disease processes of the lower limb; and other central nervous system disorders, and you have a vast population of people whose quality of life can be improved by an appropriately prescribed, designed and fabricated AFO.

### Orthotics Today

We now have a wealth of design and materials combinations at our disposal, each offering its own attributes for different rehabilitation objectives. With the technology and body of knowledge expanding at a rapid pace, it is the particular role of the board-certified orthotist to keep abreast of proven new developments.

That's a critical point. In our current difficult economy, it is sometimes tempting to choose non-traditional alternative providers for certain health services, foregoing qualifications and experience for a lower price. However, as in most things, "You get what you pay for" generally rings true in our field as well.

### Applications

AFOs are employed to control and correct biomechanical and/or neurological dysfunction, facilitate or restrict joint motion, maintain proper alignment of the lower limb, protect vulnerable structures, alleviate pain, and relieve weight-bearing.

Overcoming drop foot is the most common and probably most familiar application. The orthosis supports the ankle at a 90 degree angle, and dorsiflexion assist may be incorporated to help the foot assume proper position for heel strike. Thus compensated, patients walk more efficiently, more safely and with less fatigue.

In some instances, the objective is to protect body structures from further insult or injury, such



Courtesy Bioflex Inc.



Pediatric articulating AFOs

Courtesy Fillauer Inc.

as a chronically inflamed Achilles tendon. Other times, the goal may be to immobilize the ankle, such as in the presence of degenerative joint disease when the patient is either unable or unwilling to undergo arthrodesis surgery. Still another AFO objective is relief of axial loading by shifting some of the weight-bearing stresses to the orthosis.

Many variables enter into AFO construction: Materials, trimlines and intimacy of fit are key design determinants.

*(Continued on page 4)*



### Welcome, Duy Nguyen, LO, CO

Falk Prosthetics & Orthotics is pleased to introduce Duy Nguyen, who recently joined our staff. He will be working closely with Jeffrey Price, LPO, CPO in our Jupiter location. Duy is an American Board-certified and Florida-licensed orthotist and has almost completed his prosthetic residency as well.

Duy earned his bachelor's degree in orthotics & prosthetics at St. Petersburg College. He has a special interest in technical advances within the prosthetic industry and applying that knowledge to achieve the best possible outcomes for both upper- and lower- limb prosthetic patients. His knowledge and expertise will be a valuable asset to our staff as we continue to provide outstanding personalized care and prompt service to our patients both in and out of the hospital.

Falk Prosthetics & Orthotics is a full-service prosthetic and orthotic company serving Palm Beach County with offices in Delray Beach, Royal Palm Beach and Jupiter. We work closely with our patients, referring physicians and physical therapists to maximize the functional outcome of each patient.

We hope you find this publication informative and welcome your questions, comments and suggestions.



Duy Nguyen



Courtesy Otto Bock Health Care



# Orthotic Solutions for MS, ALS Patients

**M**ultiple sclerosis (MS) and amyotrophic lateral sclerosis (ALS) are related neuromuscular diseases that afflict patients with progressive muscle weakness in the lower extremities, accompanied by coordination and balance challenges. While the progression of the two disorders is distinctly different, both produce mobility challenges that can be ameliorated with focused orthotic support.

MS affects an estimated 2.5 million people worldwide. Diagnosis usually occurs between ages 20 and 50, more often in women. In MS, the body's own immune cells attack the nervous system causing inflammation, which damages the myelin protective sheath surrounding nerve cells. This process disrupts brain communication to the body, resulting in muscle deterioration. Other MS symptoms include memory and cognitive problems, extreme fatigue, numbness and tremors.

ALS is a progressive disorder that attacks nerve cells in the brain and spinal cord controlling voluntary muscle movement. As these neurons waste away, they can no longer transmit signals to actuate the muscles they normally control. ALS typically strikes between ages 40 and 60, more often in men. Besides weakness in the legs and arms, initial symptoms include twitching and speech, swallowing and writing difficulty. As the disease progresses, chest muscles atrophy as well, ultimately resulting in respiratory failure.

While MS and ALS have many common features, they are different in one important respect: Though multiple sclerosis is chronic and

incurable, life expectancy can be normal or near-normal. With assistive devices, many MS patients continue to walk and function at work with minimal disability for 20 or more years. By comparison, the ALS path of progression is continual and straight; life expectancy is typically three-to-five years, although 25 percent of patients live longer than five years after diagnosis.

Because lower-extremity muscle weakness manifesting in drop foot is common to ALS and MS patients, orthotic support is frequently prescribed in both instances to stabilize the foot and provide a safer and more efficient gait.

In drop foot the leg muscles are unable to achieve reliable forefoot ground clearance; tripping and falling are common. Patients may try to compensate with an exaggerated high-stepping gait pattern, which is both awkward and tiring. An orthotic device, generally some form of ankle-foot orthosis (AFO), provides a much superior solution.

## Treatment Options



Posterior leaf spring AFO.

**Posterior leaf spring AFO**—In general, our approach with any orthosis is to provide the lightest and least-complex device that will get the job done. In the early stages of MS and ALS, that objective is generally best delivered by a custom-molded posterior leaf spring AFO, a simple L-shaped brace that provides necessary support primarily behind the ankle and under the foot and adds a degree of dorsiflexion assist. Width and thickness are customized to reflect the strength and weight of the patient. With its thin profile and light weight, this AFO enjoys a high level of patient acceptance.

**Articulated AFO**—This design, featuring medial and lateral hinge joints closely aligned with the anatomical ankle joint and trimlines encompassing the sides of the leg as well as the back, provides added support for patients demonstrating drop foot along with medial and/or lateral instability. The articulated AFO can also help control knee hyperextension resulting from quadriceps weakness.



Articulated AFO  
Courtesy Fillauer Inc.

The disadvantage of this design is that it is more bulky and difficult to conceal, an important consideration for some patients.

**Solid-Ankle AFO**—This rigid construction promotes stability in all planes by preventing both dorsiflexion and plantar flexion. It is an appropriate choice when ankle motion must be controlled, as in the presence of ankle or knee instability or when ankle spasticity requires counter-resistance.



Solid-ankle AFO  
Courtesy Fillauer Inc.

Addition of an anterior panel creates a floor reaction during weight-bearing to apply an effective knee extension moment, providing added safety for patients with advanced muscle weakness. With its bulk and rigidity, the solid-ankle design is the least-tolerated AFO among this patient population.



Courtesy Horton Technology Inc.

**KAFO**—When controlling the entire leg is required, a knee-ankle-foot orthosis can be applied. This long leg brace effectively prevents knee hyperextension by maintaining close contact both below and above the knee. A knee locking mechanism can be included as needed for added stability.

**FES Systems**—In recent years, a non-traditional approach to controlling drop foot and limited knee hyperextension has emerged, which can benefit early stage MS and ALS patients. Functional electrical stimulation devices such as the WalkAide and the Bioness L300 direct electrical current to the peroneal nerve to trigger ankle dorsiflexor contraction timed to the gait cycle. FES devices are not widely approved for insurance reimbursement at this time.

Orthotic prescription for MS and ALS patients begins with an individualized gait assessment followed by careful measurements and/or casting for creating the most intimate, effective orthosis possible. While we realize both diseases are progressive in nature and likely will require heavier and more technically rigorous orthoses down the road, we also understand that “bracing for the future” will only hasten the need for those more advanced devices. Therefore, we generally design AFOs to reflect existing and near-future conditions and anticipated needs.

Over time, MS and ALS patients tend to receive several braces of varying degrees of support and control, giving them a choice based on their planned activities and how they feel on a given day. MS patients in particular have good days and bad days, making the availability of different levels of orthotic support a true advantage.

For additional information about orthotic management for MS and ALS patients and the different types of AFOs, we invite you to call our office.

## Note to Our Readers

Mention of specific products in our newsletter neither constitutes endorsement nor implies that we will recommend selection of those particular products for use with any particular patient or application. We offer this information to enhance professional and individual understanding of the orthotic and prosthetic disciplines and the experience and capabilities of our practice.

We gratefully acknowledge the assistance of the following resources used in compiling this issue:

- Bioflex Inc. • Fillauer Inc. • Horton Technology Inc.
- Innovative Neurotronics • Orthomerica Products Inc.
- Össur • Otto Bock Health Care • Ultraflex



FES unit for drop foot  
Courtesy Innovative Neurotronics

# Fighting MS Every Step of the Way

60-year-old Jerry has been living with symptoms of multiple sclerosis for more than 20 years. Despite his diagnosis, he has managed to remain reasonably active, self-employed and involved in the community, thanks to excellent on-going medical care and orthotic support.

**Down to Cases**

In “soldiering on” Jerry reflects the dogged determination of many people with MS not to give in to their disease, a trait both admirable and at the same time potentially harmful. By minimizing the effects of the disease and his need for biomechanical support in his own mind, he sometimes chooses to wear older, less-supportive orthoses, thereby accepting a less-effective gait and risking a fall.

Over the years Jerry has received a progression of orthotic devices to accommodate his disability, beginning with a minimally controlling posterior leaf spring AFO to address his drop foot condition. After five years, his weakness had progressed to the point of requiring a more substantial articulating AFO, but like many MS patients unwilling to accept the visible indications of their disease, he refused to wear it for many months.

When he finally came to accept the more prominent AFO, Jerry was already demonstrating significant knee hyperextension, reminiscent of a polio patient, for which his orthotist created a custom-molded knee-ankle-foot orthosis to provide added safety and support.

Yet to this day, Jerry continues to wear his articulated AFO, avoiding the KAFO whenever possible, because he feels it is too confining and is unwilling to accept that his weakness and loss of muscular control are progressing to the point of requiring a long leg brace.

Though his condition has obviously placed significant limitations on how he gets around and his stamina, Jerry is determined to live his life as normally as possible.

He continues to pursue his love of travel, but now must be transported to and from airport terminal gates by wheelchair and has to forego some of the sights due to his reduced mobility and inability to climb more than a few stairs. On the other hand, he has learned to

compensate thanks to the rental availability of newer mobility aids such as the Segway Personal Transporter.

So while life is not altogether ideal for this MS patient, he is getting along nicely and expects to continue his active lifestyle for many years to come. His orthotic team is dedicated to helping him every step of the way.



Courtesy Fillauer Inc.



Knee-ankle-foot orthosis  
Courtesy Ultraflex





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# When You Need an AFO Expert...

*(Continued from page 1)*

## Materials

No factor has had greater impact on the progression of AFO design than the adaptation of sheet plastics to orthosis fabrication. Custom-fabricated plastic AFOs are considerably lighter in weight, more comfortable to wear, can easily be worn with different shoes, are more cosmetically pleasing, and most importantly, provide the substantial benefits of total contact.



*Courtesy Orthomerica Products Inc.*

In recent years, plastic laminate buildups incorporating fiberglass and graphite resins have been employed to strengthen solid-ankle AFOs to achieve triplanar

ankle immobilization. Previously, controlling ankle rotation with an AFO was difficult at best.

## Designs

To attempt a comprehensive discussion of all possible AFO types would necessitate a much larger newsletter. Several of these designs are discussed in the MS/ALS management article on page 2.

Tone-reducing AFOs comprise an interesting subset of AFO design based on considerable evidence that hypertonicity can be influenced by cutaneous stimulation and joint position. One version, the dynamic AFO (DAFO), is a thin, highly flexible orthosis featuring a custom-contoured soleplate that provides total contact support and stabilization of the dynamic arches of the foot. The DAFO is widely used in the pediatric population in conjunction with active postural control and balance-oriented therapy programs.



*Pediatric DAFOs*

## The AFO Expert

Rehabilitation professionals who prescribe AFOs to their patients do not need to try to keep up with the latest designs and fabrication

techniques but rather to recognize that there is one type of practitioner who, generally speaking, knows more about AFOs than anyone else, including how to:

- perform a comprehensive patient orthotic evaluation...
- identify the most appropriate design for a given problem...
- accurately cast and modify a lower limb model...
- select the most advantageous materials...
- fabricate, then refine, the finished orthosis, and...
- measure outcome and modify the AFO as necessary to produce optimal results.

In the certified orthotist, rehabilitation decision-makers have at their disposal an AFO expert who can help them achieve optimal outcomes for their patients. Call us for details.



*Laminated  
 Solid-ankle AFO  
 Courtesy Fillauer Inc.*

## Off-the-Shelf or Custom?

The continuing rise of health care costs in America is exerting ever-increasing pressure on orthotic practitioners to forego the well-established therapeutic and functional advantages of custom fabrication for the immediate cost savings of prefabricated alternatives.

Some applications do lend themselves to off-the-shelf AFOs, particularly those whose use will be short-term or a stepping stone to another orthosis. By far the greater number, however, should be custom-made from an anatomic model. Here's why:

To carry out their role optimally, most AFOs rely on a total-contact fit and proper pressure distribution across the entire covered area. Total contact, which also helps guard against skin breakdown, does not occur with prefabricated products. Moreover, even when prefab models come in several sizes, achieving a "proper" fit is difficult.

Prefabricated AFOs and other pre-fab orthoses may have their place, but for the majority of applications custom is better and, by doing the job right the first time, is likely the better choice in the long run.