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Step By Step

Matching patients to an off-the-shelf orthosis.

by Don Buethorn, CPO

Pairing patients with an ankle-foot orthosis (AFO) takes years of practice to perfect the process and apply the correct solution.

Clinicians have numerous options for custom-made and off-the-shelf orthoses. However, non-custom AFOs, when used properly, can be just as successful and even more effective as their custom counterparts. The key is recognizing the appropriate patient presentation and integrating an off-the-shelf orthosis.

People who require a lower extremity orthosis have diverse needs, and a six-step bracing protocol can help match patients with braces. More non-custom bracing solutions are moving from shelves and onto the feet of mobility-challenged patients. Practitioners may be turning to these braces for patients who need the external support of an AFO for several reasons, such as: price, since they cost less; quality, which allows refinements and consistency; and supportive marketing, where print and online materials with visuals allow you to educate patients about the new brace.

Braced for Support

Braces provide external stability, which can be necessary for a variety of reasons. Braces can help patients who lack neuromuscular or skeletal integrity. These deficiencies can limit a patient's ability to stabilize affected parts in positions of function.

In some cases, braces support patients who experience diminished voluntary control. For example, take a Fredric's ataxia patient who experiences unsteady control and sensory awareness of foot and ankle positions. The patient walks with a steppage gait and wider support base, causing him to frequently lose his balance. Stairs quickly become the enemy. In this situation, a flexible and intimate foot support, combined with mild support across the ankle in the sagittal and frontal planes, gives the patient improved security in community ambulation.

In other instances, braces are used to replace absent voluntary control. An example is a patient with a peroneal nerve injury who lacks active dorsi-flexion. She vaults on the sound side and has pronounced foot slap at the beginning of stance phase. For such a patient, a flexible AFO that resists plantarflexion can effectively maintain dorsiflexion during the swing phase. It also assures proper heel contact at the beginning of the stance phase. During heel strike, a flexible AFO bends to reduce the knee flexion moment usually associated with a rigid AFO.

A patient with spina bifida who experiences absent muscle control, which reduces active plantarflexion, can also benefit from AFO support. This type of patient walks with excessive knee and hip flexion, and compensating lordosis. An AFO that blocks dorsiflexion during midstance reduces kinetic chain compensation and allows a gait with reduced energy expenditure.

Patients may also require AFO support to resist or block excessive unbalanced, uncontrolled muscle activity (spasticity). A patient with spastic hemiplegic gait fits this description. A patient bears weight only on the metatarsal heads of the foot, and he walks with compensating ipsilateral knee and hip flexion. He also vaults on the sound side to help with affected side clearance during the swing phase.

This type of patient struggles to maintain adequate dorsiflexion range on the affected side. In this case, an AFO that securely seats the foot, supports the forefoot and blocks the plantarflexion. It will allow dorsi-flexion, help generate heel strike, improve hip and knee extension at heel strike, and encourage ankle dorsiflexion and knee flexion during the latter half of the stance phase. These actions should help maintain dorsiflexion range.

Applying Six Steps

A team-based approach to managing patients involves a concept of brace planning and implementation to allow each member of the clinic team, as well as the patient and family, to provide input toward a successful outcome.

This protocol allows you to consider an off-the-shelf design after you develop a clear definition of the patient's need for external support. Once stability need is defined, it's easier to evaluate the advantages of an off-the-shelf system to achieve the best functional outcome. Within these six steps, a rehab team can consider if there's an off-the-shelf AFO that meets the specifications developed during the assessment phase.

Here is the six-step protocol I follow in brace clinics:

Step 1: Assess a patient's needs for external stability.

Step 2: Choose an appropriate level of external stability.

Step 3: Use any options to create a better match to address a patient's specific needs.

Step 4: Measure or cast the area and order the brace (level of support) with any optimizing features.

Step 5: Fit, adjust and habituate with the device.

Step 6: Assess the outcome.

To illustrate these steps and identify if an off-the-shelf AFO is the appropriate solution, consider the situation for Barbara. Barbara is a 55-year-old post-cerebrovascular accident patient who presents with left hemiplegia. She walks with a walker or quad cane.

On her left side, Barbara is moderately supinated and plantar-flexed during the swing phase, and she has trouble consistently clearing her toe. She initially contacts the floor under her lateral forefoot and contacts the heel early in the stance phase. Also, she usually leaves her ankle plantar-flexed during the stance phase, which is expressed as knee hyperextension.

During Barbara's assessment, the rehab team notes that her foot position can be manually corrected to a balanced position with moderate effort. Her ankle can be dorsiflexed manually to 7 degrees, although there's a clonus response to the muscle stretch.

Barbara isn't confident and secure during ambulation, and she doesn't have the necessary level of neuromuscular control for reliable foot and ankle positions or function. However, she does have the appropriate range of motion to allow these positions to be accessed.

At this point in the assessment, we've reached the stage of brace selection. When designing stability

for a leg, start at the ground with the foot, move proximally to the ankle, then to the knee and finally to the hips (if appropriate). In Barbara's case, her foot supination can be corrected with some effort. She requires a brace that encloses a significant portion of the hindfoot. The lateral instep and malleolar area needs to be contained, and the medial forefoot also needs an intimate fit.

Moving on to her ankle stability needs, the rehab team notes her moderate high tone plantarflexion, which needs to be controlled. This control should come from a fairly strong resistance or a plantarflexion block. She also needs access to a few degrees of dorsiflexion movement during the stance phase between forefoot contact and heel rise. Following her ankle assessment, we address Barbara's knee stability. She presents with hyperextension, which is a compensation for excessive plantarflexion and not a result of weak or absent quadriceps or plantarflexors. As a result, she doesn't need direct external stability at the knee. Effective control of the excessive plantarflexion at the ankle should suffice.

With these assessments, the brace design begins to take shape. The appropriate AFO design needs an integral containment of the foot or a separate molded foot component that nests in the outer frame.

The posterior upright of the AFO can be flexible with strong resistance to her plantarflexion and easy flexing to allow dorsiflexion. Or, her AFO can use a hinged design with a plantarflexion stop, with assisted dorsiflexion. There are several ways to optimize this brace to meet Barbara's needs. Thinner plastic is appropriate, as it reflects her small stature and gentle ambulation. Also, optimizing the brace's trim lines can facilitate independent donning and orient the straps for easier right-hand manipulation.

And finally, Barbara's granddaughter chooses pink straps with a heart decoration to adorn her new braces. At this point, we can see if there's an off-the-shelf AFO that matches her needs.

Looking over her list of needs, we see that Barbara can be corrected to a foot and ankle position that's reflected in most off-the-shelf AFOs. And her position of function for the planned brace isn't a limitation to an off-the-shelf solution. But, Barbara's need for a carefully contoured foot containment eliminates choosing an off-the-shelf AFO. All the elements of Barbara's plan make some difference, but the fit and control of her supinated foot position is essential for a successful outcome. Because Barbara's brace requires custom fabrication, she needs to be cast or scanned to create a 3-D model for the orthotic lab.

Even though Barbara's AFO has to be custom-made, she'll probably need some work at the initial fitting stage to fine-tune the brace's fit and function.

Habituating to an Orthosis

In order to properly habituate to a new brace, patients need to build wearing time and practice using the stability. Many people underestimate how a patient's skill effects proper brace use. For example, judging function in a new brace before the patient has developed skill can be misleading.

The initial fitting is used primarily to determine if the patient can begin to build brace-wear time. Two to 3 weeks of consistent brace-wear and practice provides a fairly good picture of the design and a plan's success. However, minor adjustments for comfort and fit issues aren't uncommon.

Functional shortcomings that go unseen during the initial fitting can also surface as the patient increases the demands he's putting on a new brace.

Following a standard assessment process can allow a decision to be made concerning the use of off-the-shelf or custom AFOs. Identifying the patient's needs is critical to an accurate brace design and plan. A six-step process allows you to make an educated decision on the effective integration of off-the-shelf orthoses.

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