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Editorial

Application of Superplastic Materials in Ankle Foot Orthosis

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EDITORIAL

Foot drop is one of the prevalent neuromuscular disorders which is due to defects in fibular nerve and paralysis of foot dorsi flexors. Inability to lifting the forefoot and instability of the ankle during the gate cycles are the common symptoms of foot drop. Foot drop patients cannot produce enough ankle moment in their ankles to elevate their forefoot during the gate cycles.

Cerebral palsy is an umbrella term for a group of disorders that affects a person's movement, and can be unilateral (Hemiplegia) or bilateral (Diplegia). 17 million people are affected by Cerebral palsy and almost one million patients in the United States exist with this kind of disorder. Designing ankle foot orthosis (AFO) helps the foot drop patents to have normal ankle behavior and walk normally.

An ankle foot orthosis consists of rigid thermoplastic casts, steel or aluminum upright and a hinge component which connects the foot brace to the calf brace. Generally, an AFO creates a support for leg to control the position and motion of the ankle. There are two main types of AFOs; Passive AFOs and active AFOs. In passive AFOs ankle, the joint is locked and there is not any motion in ankle joint during the gate cycle. Utilizing passive AFOs provides partial stability during walking; but because ankle angle is fixed at zero degree, using the passive ankle foot orthosis creates a rigid gate cycle. In active, the AFOs ankle joint is not locked and relative motion between the foot brace and calf brace provides more natural walking. In fact, active AFOs provide medial and lateral stability as well as the ability to produce dorsi and plantar flexion.

Researchers have been designing novel active ankle foot orthoses to help the foot drop patients walk more naturally [1-6]. In recent years, by studying the super elasticity of NiTi, researchers have designed active AFOs by utilizing components such as shape memory alloy hinge or shape memory alloy wires [7-8]. In one of the most recent designs, by applying super elastic NiTi spring, a new hinge has been designed and fabricated to produce more natural behavior during the gate cycles [9-11]. Compare to the conventional stainless-steel ankle foot orthosis, NiTi based ankle foot orthosis produces more range of motion, more ankle moment and more natural walking.

In conclusion, novel ankle foot orthosis can be designed to produce more range of motion and more ankle moment during the gate cycles. Comparison of ankle angle and ankle moment profiles for a healthy subject and an unhealthy subject during the gate cycles helps to quantify the severity of the foot drop. Less difference between the healthy and unhealthy subjects is a good sign for the functionality of the ankle foot orthosis.

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