Evaluation of the Pressure Relief Ankle Foot Orthosis in Individuals with Hemiparesis Using Three Dimensional Gait Analysis

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INTRODUCTION

A normal gait cycle is characterized by a smooth advancement of the extremity from initial contact (heel strike) on one side to the subsequent (initial contact) on the same side. Four fundamental prerequisites are necessary for safe and energy efficient walking (Gage 1991). First, the stance limb must be stable and supportive in both the single and double support periods. Second, there must be adequate swing phase clearance to preclude a toe catch phenomenon during elevated limb advancement. Third, the foot must be properly pre-positioned to accept weight just prior to initial contact with the ground. Fourth, there must be adequate control and movement of the foot, knee and hip to enable efficient step length for functional ambulation to be realized. If any of these 4 prerequisites are severely compromised, the potential for optimal gait becomes adversely affected.

METHOD

Patients meeting the inclusion criteria listed below were provided a detailed explanation of the study and afforded the opportunity to ask any questions of the investigator. A total of eight subjects were chosen for this study. All had unilateral involvement (left or right sided), and were able to ambulate functionally with or without a single assistive device (cane/crutch). At the initial visit, subjects were examined and fit with an appropriate PRAFO® Orthosis given their relative weight, height and ambulating potential. Standard instructions were provided on fitting criteria, use, and care of the PRAFO® Orthosis. The subjects were then instructed to use the PRAFO® Orthosis daily over the period of one week (minimum) or longer.

RESULTS

3 of the subjects were able to achieve normal dorsiflexion in the mid swing phase. The mean ankle dorsiflexion in mid swing for these subjects showed a significant excessive equinus, which was corrected with the PRAFO® Orthosis into a normal range of motion. The difference between the barefoot and PRAFO® Orthosis walk was significantly different (p=0.029). As would be expected, there was a significant drop in the peak plantar flexion in swing from −25 +/- 8 degrees to −8 +/- 3 degrees (p<0.006) with an associated significant (p<0.006) decrease in the sagittal plane range of motion of the ankle. With the PRAFO® Orthosis, there was a heel contact pattern noted with an associated dorsiflexion moment in first rocker. Power generation in terminal stance, was reduced with the PRAFO® Orthosis in comparison to barefoot walking. Also, of note there was a significant improvement in knee function with the PRAFO® Orthosis with an increase in knee flexion at toe off from 33 to 43 degrees (p<0.037) and an increase in sagittal plane knee motion from 60 to 65 degrees (p<0.001) (Figure 4). These subjects also showed a significant (p<0.024) improvement in their step length from 57 +/-7 to 63 +/-8 cm when using the PRAFO® Orthosis. There was a trend towards increased walking velocity with the PRAFO® Orthosis as compared to barefoot; however, this was not statistically significant. The purpose of this study was to evaluate the effect of the PRAFO® Orthosis on the motion of the ankle joint during gait. The kinematic data in those patients showing a drop foot in swing confirm that the PRAFO® Orthosis is capable of supporting the foot in swing and thus eliminating the excessive equinus in the swing phase. This has the benefit of improving clearance in swing with the associated risk of falling.

DISCUSSION

The improved ankle positioning achieved has a functional benefit in terms of the prerequisites of normal gait with improved stability associated with a heel contact pattern and normal first rocker (Perry 1992) during loading response.

CONCLUSION

The results show that the PRAFO® Orthosis provides sufficient support of the ankle in swing to prevent excessive equinus and allow for more normal pre-positioning of the foot for initial contact. The increased peak knee flexion in swing seen in these subjects ultimately suggests improved function with respect to clearance in swing.

CLINICAL APPLICATIONS

To provide predictable joint position and movement patterns for the rehabilitating patient. Used secondarily, as an offloading and positioning AFO.

REFERENCES