A Functional Comparison of a Carbon Fiber AFO and Two Modular KAFO Conditions Using Outcome Measures

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INTRODUCTION
An increasing population requiring orthotic treatment is the group of patients who have suffered traumatic brain injuries (TBI) and spinal cord injuries (SCI). This increase is pronounced in the Veteran’s Health Administration system, as prevalent conditions of participants in operations Enduring Freedom, Iraqi Freedom, and New Dawn requiring care are TBI and SCI. This population presents a challenge to orthotists as these patients can have a broad spectrum of clinical presentations. There is a unique subset of these individuals who are young and otherwise healthy, wish to maintain highly-active lifestyles, and are able to rapidly progress through rehabilitation and reintegration.

There are several orthotic interventions used to meet the requirements of these patients who present with lower extremity weakness. One such intervention is the modular, carbon-fiber knee-ankle-foot orthosis (KAFO). That is, a KAFO that can also be separated to function as an ankle-foot orthosis (AFO) or knee orthosis (KO). There is limited research to support the effectiveness of these devices, however, and questions persist in the orthotic community as to what patient populations would actually benefit from the use of these devices.

The purpose of this study is to determine the clinical efficacy of a modular, carbon fiber KAFO, and its KO option, compared to a high-activity AFO using clinically-implementable outcome measures. The study documents the device usage of a young TBI patient through his rehabilitation process.

METHOD
Outcome measures utilized in the testing were the timed up & go (TUG), 10-meter walk test (10mWT), and 2-minute walk test (2MWT) with rate of perceived exertion (RPE). The patient completed 2 trials of the TUG at a comfortable walking speed with the lower time being recorded. The patient completed 3 trials of the 10mWT at a comfortable pace and 1 trial as fast as possible. The average comfortable pace and fastest pace were recorded. The subject completed 1 trial of the 2MWT with total distance being recorded. RPE was taken immediately following the 2MWT. This protocol was repeated for each condition.

The patient completed the testing protocol at initial evaluation with no orthosis (NO) to establish a reference. The patient was then fit with a custom Trulife Combo KAFO as part of his transitional rehabilitation program. During fabrication of this orthosis he was fit with a pre-fabricated Streifeneder PeroSupport.tec AFO. Later in his rehabilitation process he began wearing only the KO portion of the combo KAFO with boots. The patient was given a one-week accommodation period to each orthosis and then completed testing. Clinical information on the patient including LE MMT scores were recorded from PT notes in his chart.

RESULTS
The results from outcome measures are shown in figure 1. Significant findings are as follows: For the 10mWT the KAFO showed the highest normal speed and fastest possible speed. The AFO was higher than NB and KO for fastest speed. 2mWT distance was greatest in KAFO compared to NB and KO. All orthosis conditions required less effort than did NB. The patient showed improvement in some LE MMT scores from intake to discharge.

<table>
<thead>
<tr>
<th>OM</th>
<th>NB</th>
<th>AFO</th>
<th>KAFO</th>
<th>KO</th>
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<tbody>
<tr>
<td>10mWT</td>
<td>1.17 m/s</td>
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<td>1.35 m/s</td>
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<tr>
<td>Fast</td>
<td>1.53 m/s</td>
<td>1.88 m/s</td>
<td>2.09 m/s</td>
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<td>8.66 sec</td>
<td>7.90 sec</td>
<td>6.65 sec</td>
<td>7.41 sec</td>
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<td>2MWT</td>
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<td>450 ft</td>
<td>490 ft</td>
<td>430 ft</td>
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<tr>
<td>RPE</td>
<td>7</td>
<td>3</td>
<td>2</td>
<td>2</td>
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</tbody>
</table>

Figure 1. Outcome measure results per orthosis

DISCUSSION
The modular KAFO showed the highest functional result across all measures. The AFO condition also showed potential for increased functional capacity compared to the KO condition. The KO, however increased perceived function similarly to the KAFO and AFO. It should also be noted that the KO condition is the current intervention most utilized by the patient in his daily life. The patient subjectively noted that turns were easiest with the KO condition, which may contribute to his preference for that option.

CONCLUSION
The modular, carbon fiber KAFO was the most effective orthotic intervention for this patient. The independent KO portion was also effectively used by this active patient progressing through rehabilitation.

CLINICAL APPLICATIONS
The modular KAFO shows potential to be an effective intervention for active patients with foot-drop and genu recurvatum. The KO portion may be a viable option of that orthosis for these patients to increase function and decrease exertion in some situations.

REFERENCES