Effect of an Ankle Foot Orthosis Intervention for Children With Non-Central Nervous System Cancers: A Pilot Study

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Purpose: Children with cancer are at risk for physical performance limitations. This pilot study investigated the feasibility and initial efficacy of an ankle foot orthosis (AFO) in children with non–central nervous system cancer with peripheral weakness. Methods: Participants included children aged 5 to 11 years diagnosed with cancer. Children wore AFOs for 1 cycle of chemotherapy. Pre- and postintervention adverse events, adherence, gait, strength, range of motion, activity, and fatigue were measured. Results: Six of 7 children completed the study with no adverse events reported. Positive trends were observed in step length (46.23-49.25 cm), dorsiflexion strength (19.25-24.50 lb), ankle dorsiflexion range of motion (0.5-8°), and activity (7850-9857 epochs). Negative trends observed included cadence and fatigue ratings. No change was observed in the 6-minute walk or parent-reported fatigue. Conclusions: An AFO intervention is feasible in children with cancer. Initial efficacy results warrant further study.

INTRODUCTION AND PURPOSE

Today, greater than 80% of children diagnosed with cancer will survive for 5 or more years.1 With cure rates rising, the focus of pediatric oncology is not only on cure but also on improving the quality of life of children during treatment and through all stages of survivorship. Cancer treatment may involve chemotherapy, biologic therapy, radiation, and/or surgical intervention, which eliminate cancerous cells in the body. However, these treatments can also damage the healthy cells of the body resulting in acute and late effects. Physical performance impairments and physical activity limitations are among the documented acute and late effects of childhood cancer.2-5 These impairments begin early in treatment and can contribute to activity and participation limitations that persist in survivorship and into adulthood.

Physical activity demands the neuromuscular and musculoskeletal system to perform at a high level. Unfortunately, cancer treatment can cause impairments in all systems. Chemotherapy-induced peripheral neuropathy is a side effect that can occur in the treatment of multiple pediatric cancers.6-10 The neurotoxic chemotherapy drug, vincristine, is used in the treatment of many childhood cancers including acute lymphocytic leukemia (ALL), as well as some common solid tumors, such as the Wilms tumor and rhabdomyosarcoma. Vincristine exposure has been shown to be associated with both motor and sensory neuropathy that can affect the physical...
performance of a child with cancer. It is proposed that vincristine damages the microtubules resulting in both axonal damage and demyelination. The related sequelae include decreased motor skill level, muscle weakness, balance impairments, and dorsiflexion range of motion (ROM) deficits. Multiple reports have described decreased passive and active dorsiflexion ROM during chemotherapy and years after treatment end in children with ALL treated with vincristine. Research on the effects of loss of ankle ROM and peripheral muscle weakness, such as gait pattern changes, in children with cancer treated with vincristine is now emerging. Our research team recently found that gait velocity and step length were reduced in 62 children and adolescents treated for non-central nervous system (CNS) cancer when compared with an age- and sex-matched control group. In this study, the distance a child could cover in the 6-minute walk test (6MWT) correlated with their active ankle dorsiflexion ROM and step length.

Physical therapy research has focused on documenting the presence of impairments; and now researchers are beginning to explore interventions to address these impairments in the pediatric oncology population. General strength and endurance training in patients with ALL resulted in positive outcomes in overall function. More specifically, ankle dorsiflexion stretching and lower extremity strengthening during treatment increased knee extension strength and ankle ROM; however, it did not lead to a significant change in functional ambulation. Pilot studies also reported physical therapy intervention as feasible with good parent satisfaction during the initial treatment phases for pediatric ALL. The need for intervention research in the pediatric oncology population is apparent and presents the opportunity for this study to further knowledge in the field. Since no other studies on the effectiveness of an ankle foot orthosis (AFO) in this population have been completed, a pilot study was needed to establish feasibility and provide data on which to base a larger trial. The purpose of this pilot study was to explore the feasibility and potential for effectiveness of an ankle foot orthotic intervention for children with cancer and peripheral muscle weakness.

The research team developed an AFO intervention study in response to the need to address ankle impairments and ankle function with a focus on gait. The 3 common types of AFOs include a solid AFO, hinged AFO, and posterior leaf spring or dorsiflexion assist AFO. The solid AFO holds the ankle in a neutral position controlling the ankle in the sagittal plane, hindfoot in the frontal plane, and forefoot in the transverse plane throughout gait. The hinged AFO holds the hindfoot in the frontal plane and the forefoot in the transverse plane and allows closed-chain dorsiflexion. The posterior leaf spring or dorsiflexion assist AFO assists ankle dorsiflexion during swing phase and resists plantar flexion, without controlling the hindfoot or forefoot. The solid AFO design was chosen for the intervention as most appropriate to address ankle ROM, gait change, and foot control. Our clinical experience indicates that when children with non-CNS cancer wear hinged AFOs a common outcome is poor range restoration and foot posture preservation. Therefore, a solid AFO was proposed as preferable. Research on children with cerebral palsy and individuals with incomplete spinal cord injuries supports this choice. In a review of AFO efficacy in children with cerebral palsy, Neto and colleagues recommended greater control of ankle ROM using solid AFOs versus hinged AFOs. In addition, persons with incomplete spinal cord injuries demonstrated greater step length in a solid AFO compared with a hinged AFO. The unique total contact solid AFO design consists of 2 layers of copolymer plastic secured to the limb in a traditional manner with Velcro strap closures at the instep, distal third of the shank, and proximal shank. The inner boot is made from a thinner plastic material that allows easy donning and doffing. The inner boot of the AFO is fabricated to envelop the foot and ankle and provide total contact to maximize triplanar motions during the stance phase of gait. The malleoli are padded to improve comfort and compliance. The sole purpose of the outer boot is to provide a more rigid structure, preventing material stresses on the inner boot.

The function of this total contact solid AFO is to enforce a heel-toe gait pattern. It limits dorsiflexion ROM normally recruited as the patient transitions from mid stance to late stance, effectively holding the knee in extension and maximizing muscle length for a longer duration of time. In addition, it increases step length, increases knee extension and dorsiflexion at initial contact. This increased repetitive tensioning on the gastrocnemius during the gait cycle will theoretically over time increase the muscle’s length. The heel-toe gait pattern theoretically enforces tibialis anterior use despite weakness due to neuropathy, yet bracing does come with the risk of decreasing muscle use and therefore creating weakness. Gait efficiency is improved by reducing foot/ankle mal-alignment and compensation patterns that limits tibialis anterior activity. The aims of this pilot study were to examine the feasibility of an AFO intervention in children with peripheral muscle weakness undergoing treatment for non-CNS cancer and to evaluate the effect of the intervention on gait characteristics, ankle impairments, and physical activity level. It was hypothesized that children with non-CNS cancer would tolerate wearing the AFOs for a cycle of chemotherapy and display improvements in gait pattern, ankle function, and physical activity.

**METHODS**

**Study Design**

A quasi-experimental, repeated-measures, 1-group design was used to evaluate the feasibility and efficacy of the AFOs in children with peripheral weakness due to cancer treatment. A convenience sample was recruited from the oncology outpatient clinic in a major children's...
hospital. The Institutional Review Board at the site approved the study. Inclusion criteria included children (aged 5-18 years) who (1) spoke English; (2) were receiving chemotherapy that included vincristine for treatment of ALL, the Wilms tumor, or rhabdomyosarcoma; (3) were experiencing muscle weakness with a manual muscle grade of 4 or lower in dorsiflexors and great toe extensors with a physical therapist recommendation for solid AFOs, and a medical prescription for AFOs; (4) were able to give assent according to institutional guidelines; and (5) had parental consent to participate. The study excluded children if they had (1) an antecedent neurological impairments; (2) history of lower extremity surgeries; and/or (3) an intensive care stay of greater than 48 hours within 2 weeks of recruitment.

**Intervention**

Study participants received the AFO intervention for 1 cycle of chemotherapy, approximately 4 weeks (range: 29-45 days) in duration. This time period was selected to allowed chemotherapy agents to be on the same schedule at baseline and postintervention. A certified orthotist casted the custom solid AFO on the date of the preintervention testing and fit the AFO within 5 days time. Families were taught how to assess for skin irritation and were directed to contact the orthotist if the AFO caused skin irritation or discomfort. A physical therapist trained each participant in a heel-toe gait pattern in a 45- to 60-minute session with the solid AFO emphasizing step length and speed. Training also included floor to stand transitions and stair negotiation using the AFOs. Participants were instructed to wear the AFO 23 of 24 hours per days after a 5-day ramp up period to optimize gait change during the daytime and contracture management throughout all hours of the day.

**Measurement**

Participants were measured at baseline before wearing the AFOs and post-AFO intervention. Post-AFO intervention study measurements were completed after 1 cycle of chemotherapy. The measurements were taken at a similar time point within the chemotherapy cycle as the baseline measurement (± 3 days) to control for symptoms related to chemotherapy.

Feasibility. Safety was measured through the assessment of skin irritation and breakdown throughout intervention by participant/family report and tracked visits to orthotist for revision. Adherence to AFO wear was measured throughout the intervention period using a thermal sensor compliance monitor (Cricket device, Boston Brace, Avon, Massachusetts) that is integrated into the anterior strap of the AFO. The device measured when, and for how long, the AFO was worn. It contains a temperature sensor that monitors wear adherence. The Cricket was removed from the AFO postintervention and data were downloaded from the “reader” to a study database. The monitor has been successfully used to assess adherence in children using thoracic-lumbar-sacral orthoses with established validity.27,28

Gait. The GAITRite Gait Analysis System was used to measure spatial and temporal gait characteristics. The GAITRite system is an electronic walkway that contains sensor pads connected to a computer data acquisition system. As the person walks on the walkway, the sensors and computer system record a number of variables including velocity, step length, stride length, cadence, base of support, and pressure patterns of the foot. This system has been shown to be a valid measure of gait characteristics in adults and children, with good test-retest reliability in children for velocity and cadence (ICC range: 0.73-0.93) and acceptable amounts of clinically relevant error for all gait variables except toe in/out and heel to heel base of support.29,30 The temporal and spatial gait parameters using this system in a normative sample of children have been published.31 Measurements of participants were completed prior to the AFO intervention (baseline) barefoot. After the AFO intervention, participants were measured both barefoot and while wearing orthotics.

**Ankle Range of Motion and Strength.** To study the effects of the intervention on the ankle, measurements included ankle dorsiflexion ROM and dorsiflexion strength. Both active and passive ROMs were obtained with subject positioned in prone with the knee extended and the foot over the edge of the mat table. The knee extended position has been found to correlate best with available ROM of the ankle during heel strike phase of gait. When a standardized approach is used by trained clinicians, the interrater reliability has been reported to be high (0.88).32 Strength was measured using hand-held dynamometry and manual muscle testing. Ankle dorsiflexion strength affects the gait pattern and overall function in children. Dynamometry of ankle dorsiflexion is a reliable and valid tool for the measurement of strength in children with ALL.33 Reference data are available for ankle dynamometry in children aged 4 to 16 years.33 Manual muscle testing of great toe extension was performed, as the dynamometer was too large to isolate only the great toe in children. The 2 strength measurements were chosen as these muscles demonstrated weakness in the study by Gilchrist and Tanner6 of patients with non-CNS cancer and are indicative of a length-dependent peripheral neuropathy. These muscles also create forces that are important in gait allowing initial contact at heel strike with neutral foot alignment.

**Physical Performance Measurements.** Physical performance measures included actigraphy and the 6MWT. The Mini Motionlogger actigraph (Ambulatory Monitoring, Inc, Ardsley, New York) is a wristwatch-like device that is a reliable and valid measurement of frequency and intensity of movement. Analysis of actigraph records reveals that movement is relatively high during wakefulness and decreases to near-zero values during sleep. Activity is measured in epochs (activity spikes) in 1 minute intervals. Mean daytime activity counts are an indication of the average activity level during waking hours.34 In this study...
the actigraph was programmed in the low proportional integrating measure mode. This mode is an estimate of movement intensity most useful with daytime activity levels.\textsuperscript{35} The actigraph was placed on the participant’s nondominant wrist and worn continuously for at least 4 days, which allowed for 3 full 24-hour periods at baseline and after completion of the AFOs. The mean number of activity counts was calculated for the 3-day period.

In addition, the researchers also chose the 6MWT to measure physical performance. It has been used as a functional measure of ambulation capability and for the estimation of maximal functional capacity and endurance of the cardiorespiratory system. Guidelines from the American Thoracic Society for the administration of the 6MWT were followed.\textsuperscript{36} The 6MWT has been used to assess performance in children who are severely ill with advanced cardiac or pulmonary disease, as well as children receiving cancer treatment.\textsuperscript{37-39} Height-specific reference standards are published for the 6MWT using a sample of 1445 children who were healthy aged 7 to 16 years.\textsuperscript{40} The measurement was performed at baseline with participants barefoot and then repeated post-AFO intervention with participants wearing the AFOs. The postintervention 6MWT was completed with subjects wearing AFOs to explore the effect of the AFO on functional capacity.

Fatigue was measured using self-report scales during a clinic visit at baseline and after completion of the AFO intervention. The Childhood Fatigue Scale (CFS) is a 14-item questionnaire through which the child rates his or her experience in the past week with each fatigue-related problem using a 5-point Likert scale; total fatigue scores range from 0 to 56 with higher scores corresponding to greater amounts of experienced fatigue. The CFS was tested in 149 children and validity and reliability have been established.\textsuperscript{35} The Parents Fatigue Scale consists of 17 items that ask parents their perceptions of the amount of fatigue experienced by their child in the past week. The questions are rated on a 4-point Likert scale, and scores can range from 17 to 68. Reliability and validity of the parent scale was established in a population of 147 parents.\textsuperscript{35} The fatigue instruments take about 5 minutes to complete, have low burden, and have been used in multiple previous studies in children with cancer.\textsuperscript{36-40}

Data Analysis

Software used for data analysis was SPSS version 20.0. Descriptive statistics were used to portray patients’ demographic data, types of cancer, and time between measurements. Descriptive statistics were also used to summarize study feasibility including the percentage of patients and families who assented/consented, percentage time orthotics were worn as prescribed, percentage who wore the actigraph wristband for 3 days, percentage that completed study measurements, and the percentage that experienced skin breakdown. Because of the small sample size, nonparametric statistics were used to evaluate trends in subject outcomes. Measurements that had right and left components, such as step length, stride length, and ankle function, were averaged to create a single score for each measurement time point. The Wilcoxon signed-rank test with a 2-sided significance level was used to evaluate the trend in improvement in the dependent variables of gait measurements, fatigue, and physical performance. In this exploratory study, exact P values of significance are reported to indicate trends in study variables.

RESULTS

Feasibility

Seven patients were invited to the study with all the patients and families (100%) assenting/consenting to participation. One patient and family dropped out of the study explaining that the burden of measurements was too much with the intensity of current treatment. The remaining 6 participants (86%) completed all the study measurements. Two of the 6 subjects required minor adjustments for pressure areas post-AFO initial fitting, and none experienced any skin breakdown. The cricket measurement indicated that after the first “ramp up” week the mean hours per day of orthotic wearing was 12.31 (standard deviation [SD] = 13.01). Three of the 6 children did not wear their AFOs at night.

Participants

Six children, between the ages of 5 and 11 years, participated and completed study measurements. They included 4 girls and 2 boys with several diagnoses including ALL (B-cell and T-cell) and the Wilms tumor of the kidney. The mean number of days between the start of cancer treatment and the baseline measurement day was 140 days (range: 11-547 days, SD = 203.4). The mean number of days between the baseline and postintervention measurements was 36 (SD = 6.4). Participants had received a mean cumulative dose of vincristine of 18.7 mg/m\textsuperscript{2} (SD = 19.2) prior to wearing the AFO’s and had received a mean cumulative dose of vincristine of 22.2 mg/m\textsuperscript{2} (SD = 18.0) by the time the postintervention measurement occurred. Five of 6 subjects received full dose vincristine during the intervention period, and 1 received 50% of the normal doses secondary to neuropathy.

Efficacy Results

Comparisons of gait characteristics are described in Table 1, and step length is shown by participant in Table 2. Step length, stride length, and velocity demonstrated a slight trend toward improvement when comparing pre- to postintervention measures taken barefoot. Even postintervention, substantial positive trends were seen when comparing barefoot gait to gait with AFOs; the median step length increased from 49.25 cm to 59.16 cm (P = .028) and the median cadence decreased from 133.6 steps/min to 120.6 steps/min.
Table 1: Comparison of Gait Characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Preintervention/Barefoot</th>
<th>Postintervention/Barefoot</th>
<th>Z Value</th>
<th>P</th>
<th>Postintervention/AFO on</th>
<th>Z Value</th>
<th>P</th>
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<tbody>
<tr>
<td>Step length (cm)</td>
<td>46.23</td>
<td>49.25</td>
<td>−1.572</td>
<td>.116</td>
<td>49.25</td>
<td>59.16</td>
<td>−2.201</td>
</tr>
<tr>
<td>Stride length (cm)</td>
<td>92.89</td>
<td>99.16</td>
<td>−1.572</td>
<td>.116</td>
<td>99.16</td>
<td>120.35</td>
<td>−2.207</td>
</tr>
<tr>
<td>Velocity (cm/s)</td>
<td>93.6</td>
<td>104.85</td>
<td>−1.363</td>
<td>.173</td>
<td>104.85</td>
<td>115.75</td>
<td>−1.153</td>
</tr>
<tr>
<td>Cadence</td>
<td>122.35</td>
<td>133.6</td>
<td>−0.943</td>
<td>.345</td>
<td>133.6</td>
<td>120.6</td>
<td>−2.201</td>
</tr>
<tr>
<td>Heel to heel base of support (cm)</td>
<td>11.00</td>
<td>8.63</td>
<td>−0.105</td>
<td>.917</td>
<td>8.63</td>
<td>10.67</td>
<td>−1.57</td>
</tr>
</tbody>
</table>

Abbreviation: AFO, ankle foot orthosis.

Table 2: Study Measurements Pre- and Post-AFO Intervention

<table>
<thead>
<tr>
<th>Subject</th>
<th>Pre-AFO Barefoot</th>
<th>Post-AFO Barefoot</th>
<th>Post-AFO AFO on</th>
<th>Step Length (cm)</th>
<th>Passive Ankle ROM (Degrees)</th>
<th>Ankle Dorsiflexion Strength (lb)</th>
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</thead>
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<tr>
<td>1</td>
<td>43.21</td>
<td>47.64</td>
<td>59.47</td>
<td>8.00</td>
<td>16.00</td>
<td>15.00</td>
</tr>
<tr>
<td>2</td>
<td>41.69</td>
<td>50.87</td>
<td>58.86</td>
<td>0.00</td>
<td>18.50</td>
<td>22.00</td>
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<tr>
<td>3</td>
<td>48.45</td>
<td>46.54</td>
<td>56.20</td>
<td>1.00</td>
<td>8.50</td>
<td>16.50</td>
</tr>
<tr>
<td>4</td>
<td>57.60</td>
<td>61.51</td>
<td>69.99</td>
<td>−2.50</td>
<td>2.50</td>
<td>27.00</td>
</tr>
<tr>
<td>5</td>
<td>48.02</td>
<td>44.29</td>
<td>54.22</td>
<td>−1.00</td>
<td>4.00</td>
<td>5.50</td>
</tr>
<tr>
<td>6</td>
<td>44.44</td>
<td>54.38</td>
<td>60.36</td>
<td>3.50</td>
<td>7.50</td>
<td>30.00</td>
</tr>
</tbody>
</table>

Abbreviation: AFO, ankle foot orthosis.

Ankle measurements also demonstrated positive trends pre- to postintervention with an increase in the median passive dorsiflexion ROM from 0.5 to 8° (P = .027) and an increase in the median ankle dorsiflexion strength from 19.25 lb to 24.5 lb (P = .046). Each individual’s results are shown in Table 2. Change in active dorsiflexion ROM trended slightly upward, and the manual muscle test of great toe extension showed a slight negative change.

Physical performance measures showed mixed results. Actigraphy measurement of movement increased slightly from 7850 epochs to 9857 epochs (P = .116). No significant change in distance walked was found, however, when comparing the 6MWT before and after intervention. The child fatigue scale score decreased from 27 to 15 points (P = .078), however no real change in the parent fatigue scale score was seen.

Discussion

The aim of this pilot study was to explore the feasibility and efficacy of an AFO for children with peripheral muscle weakness due to cancer treatment side effects. When considering the implications of this study, the main limitation of a small sample size needs to be taken into account.

Children undergoing cancer treatment are burdened by stress to their body and mind, and any additional therapeutic intervention needs to be both feasible and efficacious. In our study, our participants were able to tolerate the AFOs without adverse skin reactions with some needing slight revisions postinitial fit, although 1 participant found that the study measures were too great a burden to complete. A wearing schedule of 23 of 24 hours was recommended; however, the mean wear time was 12.31 hours with a 13-hour SD.

This variability can be better understood by considering multiple factors. Some children are able to wear the AFOs when sleeping, and others may not tolerate the weight or feel discomfort in their sleeping position. In working with families, we did stress the importance of sleep and did not encourage wear if the AFO interfered with sleep. In our study, 3 of 6 children did not wear them at night. Other children have fear of the social effect of wearing AFOs and may avoid wear when in a social situation. The wear time is important when considering effects on ankle ROM. In a randomized clinical trial of children with spastic diplegia, researchers compared a group of day-wear of a solid ankle AFO with group that wore the AFO both day and night. Both groups demonstrated increased passive ROM, and no significant difference was found between groups. Considering we found an increase in the median of 7.5° in our study group after 1 month, ROM benefits may occur with day wear only. However, this needs to be further investigated in a larger trial. Theoretically, the gastrocnemius would be actively stretched more when walking in a solid AFO during day wear than in a static stretch at 90° during night wear. The biarticular anatomy of the muscle and the biomechanics of the knee and
ankle during initial contact and terminal stance phase of gait cause a stretch at each joint. This theory also would concur with the longer step length that has been reported when wearing a solid AFO compared with barefoot in children with ankle weakness. In a small study by Arazpour et al, researchers compared the step length of barefoot gait with gait with a hinged AFO and a solid AFO during treadmill training in patients with incomplete spinal cord injuries. They found subjects demonstrated the greatest step length when wearing the solid AFOs. Our participants demonstrated a significant increase in step length similar to that found. Their results also demonstrated the lowest cadence in the solid AFO group. Our findings in children with cancer are similar.

We were unable to locate similar studies evaluating orthotic interventions in children with cancer to which we might compare our findings. Comparisons of a hinged AFO and solid AFO in children with cerebral palsy reveal better contracture management with solid AFOs, but a more functional gait pattern with hinged AFOs. The etiology and progression of ankle weakness and gait deficits differ greatly between a child with a CNS deficit such as cerebral palsy and a peripheral nerve deficit such as chemotherapy-related peripheral neuropathy in a child with cancer so these results are not directly comparable.

The children in our study experienced an increase in ankle dorsiflexion strength during the intervention when a concern might be that bracing could decrease the need for ankle dorsiflexion activation and thus lead to weakness. Although a direct causal relationship between bracing and increased strength cannot be assumed, this finding needs to be assessed in a larger group. The children in our study were at different points in their chemotherapy regimen so effect of the timing of their neurotoxic agents on strength cannot be analyzed. In our sample, participants had not only received vincristine before the AFOs were used, but also received a mean cumulative dose of 3.5 mg/m2 (approximately 2 doses) while receiving the AFO intervention. Although chemotherapy known to be neurotoxic was administered during the intervention, the children showed a trend toward reduced ankle impairments with the AFO intervention. Anecdotally, children undergoing neurotoxic cancer treatment in our clinical experience show compensations in their gait pattern when they have ankle weakness. For example, a child may compensate with flat foot initial contact and early heel rise when dorsiflexion becomes weak. If this compensation pattern continues throughout chemotherapy, the child could have dorsiflexion weakness from drug-induced peripheral neuropathy and from disuse compensation in gait. When this same child uses a solid AFO to ambulate, the compensation might be corrected, and a child could theoretically use the dorsiflexion strength they have and possibly become stronger as the nerve and muscle allow. This could explain our results of increased dorsiflexion strength during AFO intervention and chemotherapy.

Although the physical performance measures of activity and the 6MWT evidenced little change, a longer time period between measurements may be needed before the benefits of the AFO are reflected in physical performance. The fatigue measure used in our study also demonstrated a slight improvement throughout the intervention period that merits further exploration in a larger study. The trend toward a decrease in fatigue reported by children demonstrated the largest change in this time period; however, it is difficult to say whether this is related to the children’s adjustment to diagnosis, the chemotherapy treatment cycle, or the intervention. This finding was consistent with an earlier study in which fatigue measured with the CFS decreased in children during the first 3 cycles of chemotherapy.

Since research has demonstrated that survivors of pediatric cancer have physical performance limitations into adulthood, interventions are necessary. Recently, Ness et al found that long-term survivors of ALL with reduced active ankle dorsiflexion were more likely to demonstrate decreased walking efficiency measured by the 6MWT. This finding emphasizes the need to address both ankle ROM and walking efficiency both during and after treatment. This pilot study reveals a feasible intervention aimed at addressing these impairments. Further research is needed in a larger sample measuring similar outcomes, as well as investigating relationships between the severity of chemotherapy-induced peripheral neuropathy, AFO design, wear time, activity level, cancer diagnosis, and age.

CONCLUSION
An ankle foot orthotic intervention is a feasible option to use in children with non-CNS cancer. This intervention has potential to improve physical performance of children with cancer across the trajectory of treatment and survivorship.

REFERENCES
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