

Development and implementation of a bibliotherapy intervention to improve attitudes towards device use for orthoses and prosthesis users aged 3-12

Caitlin Bowman Martwinski, MSPO, Children's Healthcare of Atlanta Orthotics and Prosthetics Department

ABSTRACT

Introduction: Lower-limb prostheses and orthoses have been proven to improve gait, function, and quality of life, and discourage or prevent deformities in children, yet noncompliance rates are as high as 81% in the pediatric population.¹ Analysis of literature on O&P device noncompliance shows peer attitudes, perceived social support, and the child's own view of the brace to be barriers to compliance.² Bibliotherapy, or the use of books as a tool for patient education, has been shown to be effective at improving self- and peer-perceptions of disability and treatment compliance in other pediatric healthcare settings, but has not been studied in O&P.^{3,4} Furthermore, few children's books on lower extremity orthotics are available.

Objectives: This research aims to quantify psychological perceptions of pediatric O&P device users' social support and attitudes toward device use. This research also aims to quantify how bibliotherapy can positively influence attitudes about the child's O&P device.

Study Design: Subjects were blocked into a study group based on appointment type (initial evaluation, delivery/fitting, follow-up, or control) and device type (orthosis versus prosthesis).

Methods: Ethics approval for this study was obtained from the Children's Healthcare of Atlanta Institutional Review Board (IRB00009860). Forty children age 3–12 years who utilize a lower-limb orthosis (n=20) or prosthesis (n=20) and were fluent in English volunteered for the study. Following informed consent, subjects were given a demographic survey, the Multidimensional Scale of Perceived Social Support (MSPSS) and the Device-specific attitude Likert scale (DSAS) to fill out prior to their O&P appointment.⁵ The prosthetic group was given the book *I Have a Doll Just Like You*, and the orthotics group was given the book *Anthony's Amazing AFOs!*⁶ to read during their appointment. The control group was not given any book materials to read. All groups received traditional patient education from their treating orthotist/prosthetist. At the conclusion of their appointment, all subjects completed an exit survey consisting of the MSPSS and DSAS. Changes in scores were analyzed using a paired-t test. Open-ended questions were analyzed for themes.

Results: 37 full data sets were analyzed for statistical significance (21 males / 16 females). Mean age was 7.5 years, with a range of 3.08±12 years. Participants by device type included supra-malleolar orthoses (two), ankle-foot orthoses (14), knee-ankle-foot orthoses (two), Symes/trans tibial prostheses (nine), knee-disarticulation/transfemoral prostheses (seven), and rotationplasty prostheses (three). No significant difference was found in pre- versus post-MSPSS

scores for the bibliotherapy group ($p=0.18$) nor the control group ($p=0.12$). Pre- to post-DSAS scores improved significantly for the bibliotherapy group ($p=0.038$). Further analysis of bibliotherapy timing showed a significant increase in DSAS scores for subjects who received bibliotherapy at follow-up appointments ($p=0.024$). Open-ended device-satisfaction question themes included concerns about physical fit or cosmesis of device (18.9%), feeling stared at (8.1%), and wearing the device to school (5.2%). Overall, 64.2% of subjects reported they “strongly agree” that they felt more empowered to wear their devices in public after receiving bibliotherapy. Analysis of open-ended question feedback about bibliotherapy included representation of a character that used a device just like the subject (32.1%), characters in the book being supportive (25%), the moral of the story (18.5%), and the main character advocating for themselves (10.7%) were helpful to subjects.

Discussion: Our results support the hypothesis that after receiving bibliotherapy, attitudes toward the device would improve while perceived social support would remain the same. This is consistent with the development of theory of mind.

Conclusions: Bibliotherapy is a simple and accessible education tool that healthcare professionals can use to encourage confidence and improve psychological outcomes for pediatric patients in O&P. Bibliotherapy appears to be most effective at follow-up, but further data on the timing, dosing, and training effects of bibliotherapy is needed. Subjective differences in book preference across participants support that increasing the variety of resources available for patients increases engagement across different patient demographics.

INTRODUCTION

Pediatric lower-extremity orthoses and prostheses have been shown to prevent or reduce deformities, promote beneficial anatomical alignments, improve gait biomechanics, and improve quality of life. Despite these benefits, rates of noncompliance to lower extremity device use in pediatric O&P populations are as high as 81%.¹ Further research findings describe that non-white patients have increased barriers to following up on an initial referral to an orthotist/prosthetist, contributing to higher rates of noncompliance in these populations.⁷ Noncompliance with a lower extremity orthosis or prosthesis can lead to serious consequences ranging from the need for more devices or a higher level of intervention, increased overall treatment time, and even unsuccessful correction, progression, or regression of a deformity that could result in the need for surgery.

Common patient-reported barriers to orthotic/prosthetic device compliance include bullying, the patient's perception of the device, parental attitudes^{2,8,9} concerning the orthosis/prosthesis, and perceived social support.^{1,2,8-10} These barriers are not without merit; one study found up to 80% of children using an orthopedic device report experiencing bullying behavior at school.⁸ Children with disabilities across cultures encounter negative attitudes, bullying, and lack of peer support at a higher rate than their non-disabled peers¹. Children as young as three years old have been documented having a bias or preference for able-bodied children over disabled children the same age.^{10,11} While these results can be disheartening, research also shows children between ages 3-8 years old are more open minded than older children at becoming friends with a child portrayed with mobility equipment.¹¹

Psychosocial barriers to O&P device treatment compliance can be targeted through bibliotherapy, or the use of books for patient, family, and peer education. Bibliotherapy has been shown to be a cost effective¹² method to address children's views, attitudes, and behaviors towards disability, as well as improve relationships between healthcare providers and pediatric patients.^{3,13} Bibliotherapy has also been used in healthcare settings to address mental health needs.¹⁴ Children's books have been famously described by Bishop (1990) as "mirrors and windows into a child's world" where books both mirror individual identity and demonstrate how peers may live differently¹⁵. Children of younger age have a hard time understanding disability on a conceptual level. When given books containing visual depiction of disability,¹⁶ descriptive vocabulary surrounding disability,¹⁷ and opportunity for the reader to share the emotion of a character in an emotional scenario,¹⁸ children are able to increase cognitive empathy towards disability.¹⁷

Cognitive empathy can be described as the ability to "think about what it would be like to walk in someone else's shoes" and is used to track development of theory of mind. Theory of mind is the ability to understand how another feels and how this predicts that person's attitudes and ultimately influences behaviors towards disability.¹⁷ Further research shows that children's books provide a crucial way to positively influence both internal and peer attitudes towards disability,^{4,19,19} as well as provide an accessible tool for modeling and encouraging positive and

accepting relationships among peers²⁰. Positively influencing peer and personal attitudes towards lower extremity orthoses and prostheses through bibliotherapy can then reduce the impact of psychosocial barriers on patient compliance.

While the effectiveness of bibliotherapy has been well researched in the field of early childhood education, limited research and limited books are available for the O&P pediatric population.²¹ Furthermore, within O&P, bibliotherapy has not been evaluated as an intervention to increase a patient's own perception and attitudes towards their lower extremity orthosis or prosthesis. This study aims to develop an appropriate children's book to be used for bibliotherapy for lower extremity pediatric orthoses users. This study also aims to quantify if bibliotherapy is an effective form of patient education for pediatric orthosis and prosthesis users to improve internal attitudes towards device use and increasing perceived social support of device use.

It is hypothesized that bibliotherapy intervention will increase internal attitudes towards device/device wear, but that perceived social support will not change following one-shot bibliotherapy intervention.

METHODS

Literature Review

A comprehensive literature review of existing research on bibliotherapy and available children's books pertaining to orthoses and prostheses was performed across two databases (Google Scholar and PubMed). Search terms strategy included ("Prostheses and Implants"[Mesh] OR "Orthotic Devices"[Mesh] OR prosthetic* OR orthotic* OR lower extremity braces OR braces) AND ("Bibliotherapy"[Mesh] OR "bibliotherapy" OR "bibliotherapies" OR "childrens book" OR "childrens book" OR "children's books" OR "children's book" OR "reading therapy" OR "children's literature"). No results perfectly matching the Boolean phrasing were found on either GS or PM. For this reason, the search was broadened on both GS and PM. Studies describing pediatric P&O compliance barriers (n=5), studies describing bibliotherapy in other health professions (n=2), and studies including disability, theory of mind, and/or children's books (n=8) were included. Exclusion criteria included studies about adults (published before 1995), studies written exclusively for classroom libraries and/or teachers, expert opinion articles, studies that focused on solely developmental or intellectual disability, and studies about children's books without mention of disability.

Selection of Prosthetics Intervention

A review of current picture books about orthotics and prosthetics was conducted. Books commercially available in the United States on Amazon, Barnes and Noble, and on the Amputee Coalition's "Resources to Help Children Understand Limb Loss and Limb Difference"²² were reviewed. Potential books for bibliotherapy were reviewed for content.

Inclusion criteria for book use included picture books in English; books that demonstrated use of a lower extremity orthosis or prosthesis in both a medical and non-medical (community setting); books that included vocabulary to describe an orthosis/prosthesis and why someone may use one; demonstration of peer acceptance of the character using an orthosis/prosthesis; and a plot which demonstrates a caring relationship between the orthotist/prosthetist in the book and the child. Exclusion criteria for the books included chapter books; books printed in a language other than English; books that contained negative self-talk or negative thoughts towards the orthosis/prosthesis; books set only in a medical setting; and books about only upper extremity or spinal devices without mention of lower extremity devices. Preference was given to books that were written by a medical professional with education/experience working with children in orthotics and prosthetics, and to books which included diverse characters to target patient populations at higher risk for non-compliance with O&P device use.

The book “I Have a Doll Just Like You” by Julie Ann Zitterkopf Larson MD, MPH met these criteria and was identified for use in the study for the prosthetic cohort. However, book selection about orthoses was limited. Two potential books for the study were identified, but neither orthotic book met all desired criteria for bibliotherapy; one book was entirely set in a medical setting; neither book demonstrated a conflict and resolution with peer acceptance; and neither book had diversity of character appearance. For these reasons, a book about orthoses was developed to be used for the study.⁶

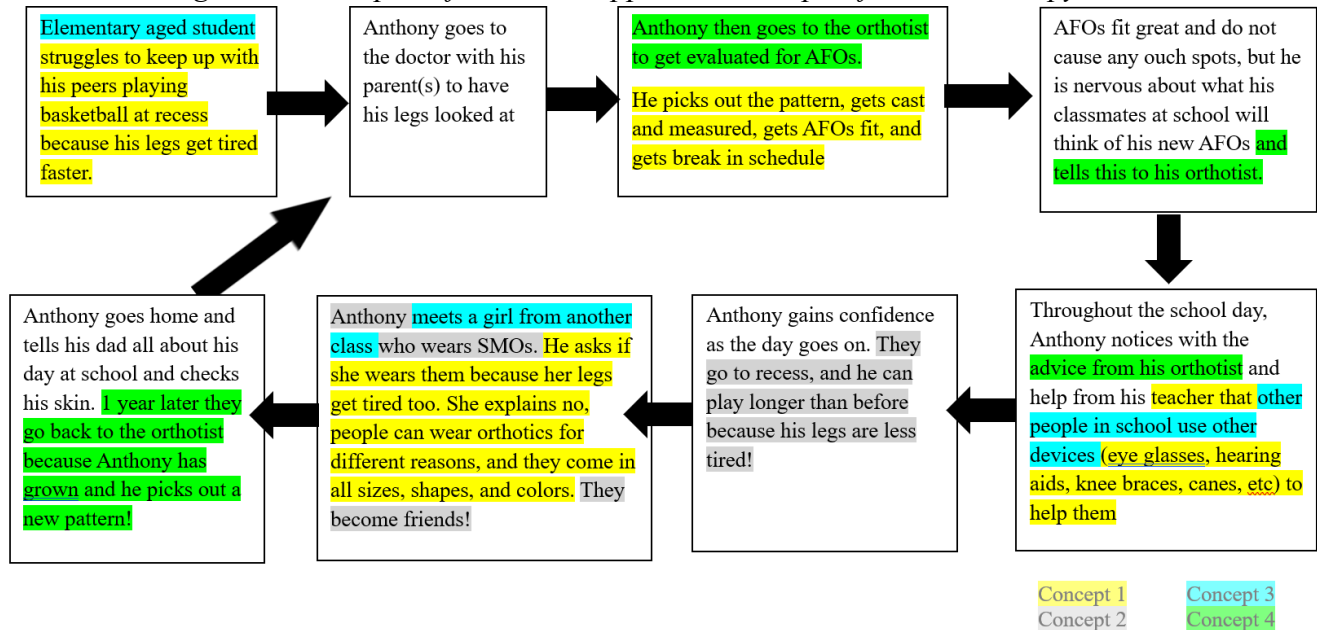
Development of Orthotics Intervention

A 32-page illustrated children’s book titled “Anthony’s Amazing AFOs!” was written with four main concepts to target several orthotic use compliance barriers (Table 1). The plot of the book, written by an orthotist, takes place in both medical and community settings, and follows the story of a young child go from struggling to play at recess to being fit with bilateral AFOs who eventually coming to terms with how both he and his peers at school will react to his new AFOs. Figure 1 shows the conceptual framework applied to the general plot of the book.

Table 1: Conceptual framework of children’s book intervention

Concept 1	Give able-bodied and disabled children vocabulary to describe orthoses and why a someone might wear them to increase empathetic behavior and increase theory of mind.
Concept 2	Show a child who wears a lower extremity orthosis a character they can resonate with in a medical and non-medical setting. Show peer acceptance of said character.
Concept 3	Represent children of color in the book using orthoses and other assistive technology .
Concept 4	Demonstrate a caring relationship between orthotist/prosthetist and patient.

Figure 1: Conceptual framework applied to book plot for bibliotherapy use



Book illustrations were completed in 2024 in collaboration with a BFA Art Education Candidate at Virginia Commonwealth University. The artist contributed their training and specialized knowledge of the use of illustrative medium as an education tool, while an orthotist advised the artist what the braces and tools used in a clinic look like. Copyright was obtained through the United States Government and publishing for research use was completed through a third party (Barnes and Noble Press). A nine subject pilot trial consisting of volunteers aged three to twelve years was conducted at the University of Pittsburgh (STUDY 23040108) to demonstrate efficacy of the book as a bibliotherapy tool. This pilot study yielded statistically significant ($p=0.04$) improvements in Chedoke Attitudes Towards Disability (CATCH) Scale scores when comparing pre- versus post- book reading CATCH scores with a paired t-test.

Bibliotherapy Study Design

Ethics approval for this study was obtained from the Children's Healthcare of Atlanta Institutional Review Board (IRB00009860). Consent from parents/legal guardians and assent to participate in the study was collected from all study volunteers. Inclusion criteria consisted of age range three to twelve years old, fluent in English, able to cognitively answer questions on a Likert Scale, and user of a lower extremity orthosis or prosthesis. Exclusion criteria included patients who were not fluent in English, children who were not yet in school, patients who utilized a spinal device (TLSO, scoliosis brace), and patients who primarily utilize an upper extremity device (WHO, upper extremity prosthesis).

A power analysis was conducted using a between-groups continuous (means) calculation based on differences needed to determine significance between the MSPSS scores and was used

to determine the minimum sample size required for the study. Assuming a medium effect size (Cohen's $d = 0.5$), an alpha level of 0.05, and a desired statistical power of 0.95, the analysis indicated that a total of 16 participants (8 per group) would be needed for a two tailed paired t -test. To account for potential attrition, we aimed to recruit 40 participants in total. From December 2024 to August 2025, 40 children age three to twelve years old who utilize a lower-limb orthosis ($n=20$) or prosthesis ($n=20$) and were fluent in English receiving O&P treatment at a children's hospital volunteered for the study.

Following informed consent, subjects were given a demographic survey, the Multidimensional Scale of Perceived Social Support (MSPSS) and the Device-specific attitude Likert scale (DSAS) to fill out prior to their O&P appointment. Demographic information collected included age, sex at birth, diagnosis, type of orthosis/prosthesis using, length of device use, school grade, and modality (in person, online, hybrid) and type of school attending (public, private, or homeschool). The MSPSS is a validated 12 question Likert-Style questionnaire used to screen for friend, family, and important other support and is scored low to high (high being desirable). The Device-specific attitude Likert scale (DSAS) consisted of a series of twelve questions adapted from the OPUS in working more appropriate for pediatric users (Table 2). Patients were able to select from a seven-point Likert scale ranging from "very strongly agree" to "very strongly disagree". Strongly agree scores were scored a 7; negative statements were reverse scored appropriately, with higher scored showing a more positive attitude towards the user's device.

Table 2: Questions on the device-specific attitude Likert scale (DSAS)

Item 1	I feel my orthotist/prosthetist encourages me to wear my orthosis/prosthesis.
Item 2	I wear my orthosis/prosthesis when my orthotist/prosthetist says I am supposed to wear them.
Item 3	I worry kids at school are going to make fun of my orthosis/prosthesis.
Item 4	I do not like to wear my orthosis/prosthesis in public.
Item 5	I have no issues wearing my orthosis/prosthesis to school.
Item 6	Kids my age are supportive of me wearing my orthosis/prosthesis to school.
Item 7	Sometimes I do not wear my orthosis/prosthesis because I do not want to be bullied.
Item 8	I worry a lot about what others think of my orthosis/prosthesis.
Item 9	My orthosis/prosthesis make me stand out in a bad way.
Item 10	My teacher is supportive of me wearing my orthosis/prosthesis in the classroom.
Item 11	My family is supportive of me wearing my orthosis/prosthesis.
Item 12	My friends like my orthosis/prosthesis.

Subjects were blocked into a study group based on appointment type (initial evaluation, delivery/fitting, follow-up, or control) and device type (orthosis versus prosthesis). The prosthetic group was given the book *I Have a Doll Just Like You*, and the orthotics group was given the book *Anthony's Amazing AFOs*.⁴ to read during their appointment. The control group

was not given any book materials to read. All groups received traditional patient education consisting of verbal and written wear and care instructions from their treating orthotist/prosthetist. These tools are standardized across the Children's hospital O&P department, and clinical staff receive standardized annual training on patient education. At the conclusion of their appointment, all subjects completed an exit survey consisting of the MSPSS and DSAS. Changes in scores were analyzed using a paired-t test. Open-ended questions were analyzed for themes.

Statistical Analysis

The hypothesis that perceived social support would change was tested comparing before and after MSPSS scores using a two-tailed paired t-test ($\alpha=0.05$.) The hypothesis that attitudes towards the orthotic/prosthetic device would improve was tested by analyzing results of the DSAS scale using a two-tailed paired t-test ($\alpha=0.05$). Open ended feedback was analyzed for themes.

RESULTS

Subject Demographics

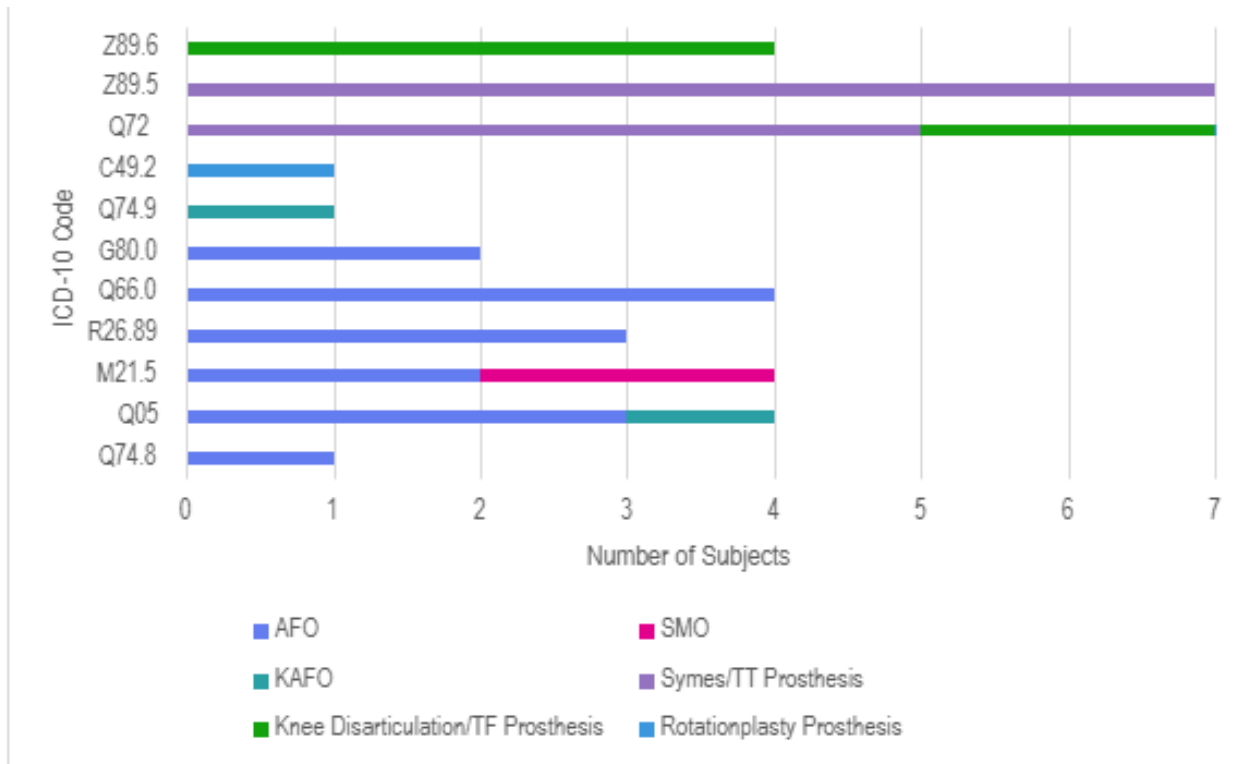
37 full data sets were analyzed for statistical significance (21 males / 16 females). Mean age was 7.5 years, with a range of 3.08 ± 12 years. All subjects were fluent in English, and three subjects reported speaking another language at home (Spanish). School grades of participants ranged from pre-kindergarten/preschool (seven), Kindergarten (seven), first grade (four), second grade (four), third grade (two), fourth grade (seven), fifth grade (two), sixth grade (two), to seventh grade (one). School modalities of subjects consisted of public school in person (73%), private school in person (10.8%), homeschooled with family members (8.1%), public school virtually (2.7%), and homeschooled with non-family members (Co-OP) (2.7%). One subject was not yet in formal schooling.

Participants by device type included supra-malleolar orthoses (two), ankle-foot orthoses (fourteen), knee-ankle-foot orthoses (two), Symes/transtibial prostheses (nine), knee-disarticulation/transfemoral prostheses (six), rotationplasty prostheses (three), and foot-on-foot prosthesis (one). Participants by primary diagnosis code (ICD-10) included Spina Bifida (four), clubfoot (four), Cerebral Palsy (four), pes planovalgus (three), toe walking (three), congenital limb deformity (one), below knee congenital limb difference (four), below knee acquired limb difference (six), above knee congenital limb difference (two), and above knee acquired limb difference (five) (Table 3). Subject primary diagnoses blocked by device type are described in Figure 2.

Table 3: Description of ICD-10 diagnosis code

ICD Code	Diagnosis Description
Q74.8	Partial Foot
Q05	Spina Bifida
M21.5	Pes planovalgus
R26.89	Toe walking
Q66.0	Clubfoot
G80.0	Cerebral Palsy
Q74.9	Congenital Leg Deformity
Q72.0	Congenital Reduction of Lower Extremity
C49.2	Osteosarcoma
Z89.5	Acquired absence of limb, below knee
Z89.6	Acquired absence of limb, above knee

Figure 2: Subjects by device type and primary diagnosis code (ICD-10)



Self-reported length of orthosis or prosthesis use included first time device user (four), device use of less than one year (one), device use for one to two years (four), device use for two to three years (four), device use three to five years (eight), and device use of five or more years (sixteen). Subjects were blocked by orthosis use (n=19) or prosthesis use (n=18) and by appointment type initial evaluation (n=9), delivery/definitive fitting (n=9), initial follow up (n=9), and control (n=10).

Multidimensional Scale of Perceived Social Support

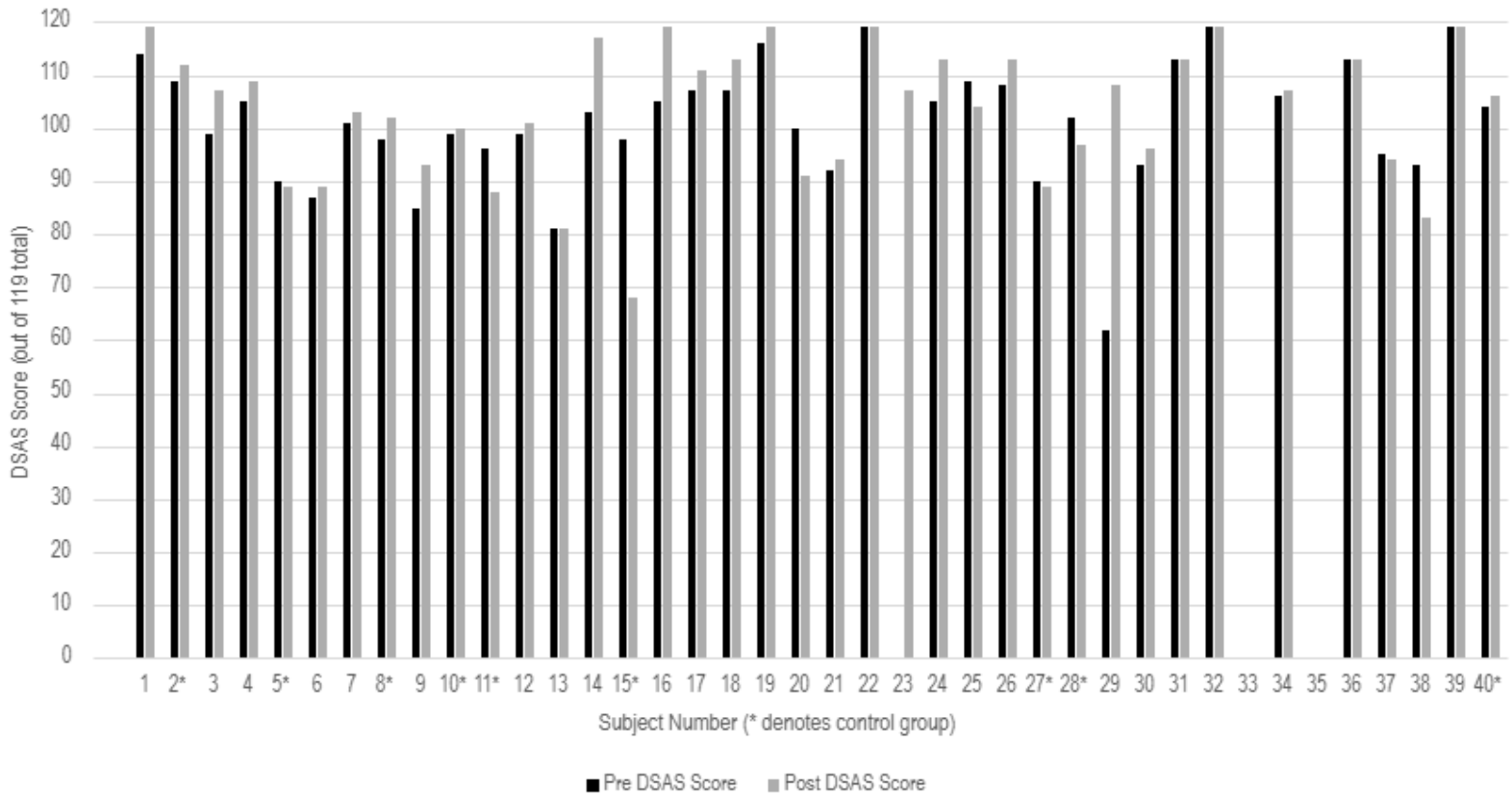
No significant difference was found in pre- versus post-MSPSS scores for the bibliotherapy groups ($p=0.18$) nor for the control group ($p=0.12$). Mean scores on MSPSS at initial survey were 6.45 out of 7 for the orthotics group and 6.57 out of 7 for the prosthetics group. Mean scores on MSPSS at the end of patient's appointment was an average of 6.57 out of 7 for the orthotics group and 6.75 out of 7 for the prosthetics group. While not statistically significant to the general population, within the study, both the orthotics group and prosthetics group mean MSPSS scores did improve slightly from initial survey to post-appointment survey (orthotics Δ mean score = +0.12, prosthetics Δ mean score = +0.18). Lowest scoring questions on the MSPSS overall were item seven ("I can count on my friends when things go wrong"), item nine ("I have friends with whom I can share my joys and sorrows"), and item 12 ("I can talk about my problems with my friends") with mean scores for the question of 5.90, 5.79, and 5.82 respectively.

Of the 37 full data sets analyzed, six subjects had pre-appointment perceived social support (MSPSS) mean scores of less than 6, indicating a moderate to low level of perceived support. All six subjects with moderate mean scores were prosthesis users. Five of the six lower scorers were male. Two of the lower scorers indicated they were homeschooled, three attend public school in person, and one subject attended private school in person. Low perceived social support scorers were in second grade (one), fourth grade (three), and sixth grade (two). Amputation type of lower perceived social support scorers included acquired AK amputation (three, device use 3-5+ years), acquired Symes amputation (one, device use for 5+ years), foot on foot prosthesis (one, first time device user), and rotationplasty (one, device use for 1-2 years). While not statistically significant, four of these subjects saw a decrease in mean MSPSS score following their appointment (two in control group, two receiving bibliotherapy at dynamic alignment) and two of these subjects saw an increase in mean MSPSS score (both received bibliotherapy at dynamic alignment). Interestingly, low MSPSS scores were not correlated with low DSAS scores.

Device-Specific Attitudes Likert Scale

Pre- to post-DSAS scores improved significantly for the bibliotherapy group ($p=0.038$). Pre- to post-DSAS scores did not improve significantly for the control group ($p=0.285$). DSAS scores by subject number are reported in Figure 3. Further analysis of bibliotherapy timing showed a significant increase in DSAS scores for subjects who received bibliotherapy at follow-up appointments ($p=0.024$).

Figure 3 : Device specific attitudes pre- and post- scores by subject number



Mean DSAS scores by device type included SMO (93.82 pre, 112.25 post), AFO (105 pre, 103.5 post), KAFO (109.5 pre, 119 post), below knee prosthesis (97.57 pre, 104.57 post), above knee prosthesis (99 pre, 98.5 post), and rotationplasty prosthesis (108.5 pre, 109.5 post). Mean DSAS scores by primary ICD-10 diagnosis code included pes planovalgus (100 pre, 98.67 post), clubfoot (96.75 pre, 90.25 post), spina bifida (109.5 pre, 109.5 post), toe walking (95.33 pre, 104 post), cerebral palsy (99.5 pre, 99.25 post), congenital limb difference below knee (104.6 pre, 107 post), acquired limb loss below knee (107.5 pre, 108.5 post), congenital limb difference above knee (87.5 pre, 110.5 post), acquired limb loss above knee (99 pre, 98.5 post), and rotationplasty (108.5 pre, 109.5 post).

Lower pre- and post- DSAS scores are noted amongst nine subjects (Table 4). Three of these subjects were orthosis users, the rest were prosthesis users. School modality of low DSAS scorers included public school in person (seven) and private school in person (two). Grades of these participants included preschool (two), first grade (one), third grade (one), fourth grade (three), fifth grade (one), and sixth grade (one).

Table 4 : Characteristics of low DSAS scorers

Study Subject number	Device used	Cohort	Intervention group	School grade	School modality	Pre-appointment DSAS Score	Post-appointment DSAS Score
03	Symes prosthesis	prosthetic	Delivery/dynamic alignment	3 rd	Public in person	99	107
06	AFO	orthotic	Initial follow up	4 th	Public in person	87	89
09	AFO	orthotic	Initial follow up	5 th	Public in person	85	93
12	AFO	orthotic	Delivery	Preschool	Public in person	99	101
21	Knee disarticulation prosthesis	prosthetic	Initial follow up	1 st	Public in person	92	94
27	Partial foot AFO	prosthetic	Control	preschool	Private in person	90	89
29	Foot on foot prosthesis	prosthetic	Delivery/dynamic alignment	4 th	Private in person	62	108
37	Bilateral above knee prosthesis	prosthetic	Delivery/dynamic alignment	4 th	Public in person	95	94
38	Symes prosthesis	prosthetic	Delivery/dynamic alignment	6 th	Public in person	93	83

Scores on DSAS item three (“I worry kids at school are going to make fun of my orthosis/prosthesis”), item four (“I do not like to wear my orthosis/prosthesis in public”), and item nine (“My orthosis/prosthesis make me stand out in a bad way”) were on average lower than other items scored in both pre- and post-appointment surveys. For all subjects, item three mean score was 5.11 pre, 5.51 post, item four mean score was 5.54 pre and 5.81 post, and item nine mean score 5.13 pre and 5.05 post. Interestingly, while item 3 and 4 mean scores slightly improved in both the control and bibliotherapy groups, item 9 mean scores decreased by from 6.0 to 4.8 in control group and increased from 4.81 to 5.10 in the bibliotherapy group.

Bibliotherapy Group Themes

Subjects in the bibliotherapy group indicated that the most influential part of the book was the story (42.8%), the pictures (32.1%), the main character (21.4%) and the cover (10.7%). Open-ended device-satisfaction question themes included concerns about physical fit or cosmesis of device (18.9%), feeling stared at (8.1%), and wearing the device to school (5.2%). Overall, 64.2% of subjects receiving bibliotherapy reported they “strongly agree” that they felt more empowered to wear their devices in public after receiving bibliotherapy. Analysis of open-ended question feedback about bibliotherapy included representation of a character that used a device just like the subject (32.1%), characters in the book being supportive (25%), the moral of the

story (18.5%), and the main character advocating for themselves (10.7%) were helpful to subjects.

DISCUSSION

Our findings support the hypothesis that bibliotherapy increases internal positive attitudes towards O&P device use. Furthermore, our findings suggest that bibliotherapy is most effective at initial follow up after device delivery. At Children's Healthcare of Atlanta, the initial follow up appointment commonly takes place one month after device delivery to check in and assess how a patient is doing. After the patient has had a month to use their orthosis or prosthesis, they typically have had the opportunity to use said device in public settings such as at school and their community. Addressing concerns and questions that may arise during this time through bibliotherapy appears to encourage patients, whereas control group members who only received traditional patient education at initial follow up did not have the same results. Offering bibliotherapy to patients at follow-up may be a beneficial strategy to encourage patients during their treatment period, especially patients who show signs of or report difficulty of device wear at school.

Our results support the findings demonstrated by Maftai et. al., Bianquin et. al. and Bishop that providing children language and books to understand a disability, allows the disability to become normalized. The normalization of disability and its affiliated physical components (such as O&P devices, assistive devices, and other orthopedic/mobility equipment) in turn influences the device user's theory of mind surrounding their own disability, as reported by Mendonça et. Al. Our results echo the sentiment that children's books truly are "windows and mirrors" to how children view the world; improvements in DSAS score data in this study affirms that bibliotherapy can be used as a "window" into the lives of children who utilize an orthosis or prosthesis' perceptions and attitudes towards their own device use. These insights can lead to more meaningful health counseling from the treating orthotist/prosthetist. Furthermore, within the DSAS, several patients reported improved attitudes towards their orthotist/prosthetist in addition to their device, which is consistent with findings of bibliotherapy used in other pediatric healthcare settings^{3,13}

It is important to be able to influence the attitudes of patients towards their own devices and research on de-stigmatization of O&P device use in the greater community is necessary. Further understanding of key strategies, such as using bibliotherapy in classrooms of pediatric O&P device users is necessary to influence peer attitudes/perceptions towards the device, increase peer acceptance, and decrease bullying behaviors.

One limitation of the study is that data collection occurred in one appointment. Longitudinal data analyzing the training effect following bibliotherapy was not collected. Further research is needed to better understand training effects of bibliotherapy. Additionally, future research may want to consider a wider variety of devices such as spinal orthoses, pectus braces,

upper extremity orthoses, or upper extremity prostheses as they were not included in the study. Further research exploring whether bibliotherapy could benefit these patients, and understand their perceptions of device use, is needed.

A weakness of using the MSPSS in this study design is that there is no normative data to compare an orthosis or prosthesis user's results with an age matched pair from the general population. The MSPSS was developed solely to show changes in perceived social support within an individual. Our results show that certain patient populations within our data set such as acquired above knee amputation, appear to have lower perceived social support than other groups of orthoses and prosthesis users in the sample group. This contradicts the findings by Quarry (2016), who suggests that compared to normative data, children with acquired limb loss or congenital limb difference had higher self-esteem but had lower emotional regulation skills than age-matched able-bodied peers.²³ It is useful to note that this data was collected in a summer camp setting where children were surrounded by other children with a limb loss/limb difference, whereas our data set was taken in a medical office setting. Additional research data would be helpful to compare these findings with not only other O&P device users, but also with normative data. Further research is needed to better understand which populations within pediatric O&P are at higher risk for lower perceived social support and mental health outcomes. Research identifying these risks would allow orthotist/prosthetists and other allied healthcare providers to better identify who may need additional support to be successful with device use.

Another area of research warranting further exploration centers around building an understanding when a pediatric patient may be naturally pre-disposed to a higher risk of struggling with device wear in public. Data in our study shows that children in preschool, 4th, 5th, and 6th grade had lower DSAS scores than other grades in school. These grades are commonly attributed with a transition in school. This is consistent with Theory of Mind, as children are more likely to understand and realize differences between themselves and peers around these ages. If a child understands that they are different, and if that difference is perceived to be not accepted by peers, this could lead to more self-consciousness with device wear and lower perceived social support and negative body image. A broader understanding of these negative consequences would allow the healthcare community to respond appropriately and support these children with age-appropriate patient education and behavioral and mental health resources. Studies show younger children perceive differences the same as old children, but older children are less likely than younger children to accept differences/disability in their peers¹¹.

By applying Theory of Mind and being more acutely aware of how their device may differentiate them from their peers, it makes sense that our data trended to have higher DSAS scores. Children who were more medically reliant on their devices to ambulate or have a higher functioning level of mobility had higher scores than children who presented with an ability to walk without a device. It was noted that those children who could ambulate without their device felt less positive towards the device in situations where the device was merely improving alignment or gait. On the contrary, children who required their device to be ambulatory felt more

positive toward their device. Acquired above knee amputees did have relatively lower DSAS scores compared to their congenital AK counterparts and their BK congenital and acquired peers. These differences may suggest that pathology and/or functional use may play a prognostic role when we consider device acceptance.

Further research on bibliotherapy amongst different cultures, languages, and regions in the United States and worldwide is needed. Our study only recruited children fluent in English receiving care in the southeastern United States. Subjective differences in book preference across participants support that increasing the variety of resources available for patients increases engagement across different patient demographics.

Since the inception of this project, additional books about orthoses and prostheses have been developed, namely two books written by Children's Healthcare of Atlanta O&P patients followed by advertisement of the study. When orthosis and prosthesis use is normalized in media and public life, social stigmas are confronted and what could be seen by a patient initially as alienating becomes an opportunity for creative self-expression and reflection.

CLINICAL RELEVANCE AND CONCLUSIONS

Based on the findings of this study, it can be concluded that bibliotherapy is an accessible, approachable, and affordable tool clinicians may utilize in pediatric orthotic and prosthetic clinics. Bibliotherapy is accessible to clinicians in the sense that it requires little additional clinician training to administer, yet has a notable impact on patient outcomes, especially when offered at follow up appointments. A simple solution may be to keep a copy of a children's book containing themes described earlier in this paper in the waiting room, patient room, or available for patients to borrow to take to school to read with their teacher and class. Further research, education, and training for orthotists and prosthetists to recognize when patients may need additional behavioral and mental health resources are also necessary.

AKNOWLEDGEMENTS

CBM would like to thank Rose Turner, University of Pittsburgh SHRS Librarian (HSLs) for her help with the literature search process. CBM would also like to thank Lindsay Bowman, BFA and the VCU Arts Department for character conceptualization support and illustrative contributions. CBM would like to thank Jennifer Galbraith, LCPO and Karl Barner, LCPO for their support with data collection, research mentorship, and assistance with IRB approval at Children's Healthcare of Atlanta. CBM would like to thank Dr. Goeran Fiedler, PhD for serving as the primary faculty mentor at the University of Pittsburgh during intervention tool development.

REFERENCES

1. Marcotte D, Ferri E, Xue X, et al. Barriers and facilitators to lower extremity orthotic compliance in the pediatric population: A scoping review of the literature. *Prosthet Orthot Int.* 2023;47(2).
https://journals.lww.com/poijournal/fulltext/2023/04000/barriers_and_facilitators_to_lower_extremity.6.aspx
2. Gornitzky AL, England P, Kiani SN, Yellin JL, Flynn JM. Why Don't Adolescents Wear Their Brace? A Prospective Study Investigating Psychosocial Characteristics That Predict Scoliosis Brace Wear. *Journal of Pediatric Orthopaedics.* 2023;43(1):51-60.
doi:10.1097/BPO.0000000000002272
3. Babarro Velez I, Lacalle Prieto J. Literature as a therapeutic instrument in the health-disease process in childhood. *Enfermería Global.* 2018;17(2):585-616.
doi:10.6018/eglobal.17.2.299201
4. Ellis G. Social Model Thinking about Disability through Picturebooks. *CLELEjournal.* 2019;Vol. 7(2):61-78.
5. Zimet GD, Dahlem NW, Zimet SG, Farley GK. The Multidimensional Scale of Perceived Social Support. *J Pers Assess.* 1988;52(1):30-41. doi:10.1207/s15327752jpa5201_2
6. Bowman Martwinski C, Bowman L, Goeran F. Development of a Children's Book Intervention to Increase Pediatric Orthotic Device Compliance and Improve Peer Attitudes towards Disability for 3-12 Year Olds. In: *American Orthotic & Prosthetic Association (AOPA) National Assembly.* O&P Edge ; 2024.
7. Rambo A, Rhodes L, Lomax J, et al. Factors that Influence Acquisition of Lower Extremity Braces in the Pediatric Orthopaedic Population. *Journal of Pediatric Orthopaedics.* 2022;42(1):40-46. doi:10.1097/BPO.0000000000001998
8. Carrillo LA, Sabatini CS, Brar RK, et al. The Prevalence of Bullying Among Pediatric Orthopaedic Patients. *Journal of Pediatric Orthopaedics.* 2021;41(8):463-466.
doi:10.1097/BPO.0000000000001911
9. Rahimi S, Kiaghadi A, Fallahian N. Effective factors on brace compliance in idiopathic scoliosis: a literature review. *Disabil Rehabil Assist Technol.* 2020;15(8):917-923.
doi:10.1080/17483107.2019.1629117
10. Babik I, Gardner ES. Factors Affecting the Perception of Disability: A Developmental Perspective. *Front Psychol.* 2021;12. doi:10.3389/fpsyg.2021.702166

11. Huckstadt LK, Shutts K. How Young Children Evaluate People With and Without Disabilities. *Journal of Social Issues*. 2014;70(1):99-114. doi:10.1111/josi.12049
12. Nystrand C, Feldman I, Enebrink P, Sampaio F. Cost-effectiveness analysis of parenting interventions for the prevention of behaviour problems in children. *PLoS One*. 2019;14(12):e0225503. doi:10.1371/journal.pone.0225503
13. Hart J. Bibliotherapy: Improving Patient's Health Through Reading. *Alternative and Complementary Therapies*. 2021;27(6):298-300. doi:10.1089/act.2021.29351.pro
14. Yontz-Orlando J. Bibliotherapy for Mental Health. *International Research in Higher Education*. 2017;2(2):67. doi:10.5430/irhe.v2n2p67
15. Bishop RS. Mirrors, Windows, and Sliding Glass Doors. *Perspectives: A Review Journal of the Cooperative Services for Children's Literature*. 1990;6(3):ix-xi. Accessed November 28, 2025. <https://www.scribd.com/document/506033060/Mirrors-Windows-and-Sliding-Glass-Doors>
16. Mendonça P, Savoie A, Émond AM. Theory of Mind, Aesthetic Judgment and Child Development Issues: A Narrative Review / Théorie de l'esprit, jugement esthétique et enjeux du développement de l'enfant : un compte rendu narratif. *The Canadian Review of Art Education / Revue canadienne d'éducation artistique*. 2019;46(2):33-53. doi:10.26443/crae.v46i2.69
17. Maftai A. Children's Self-Esteem and Attitudes toward Disability, Perceived Competence and Morality: The Indirect Effect of Cognitive Empathy. *Children*. 2022;9(11):1705. doi:10.3390/children9111705
18. Bensalah L, Caillies S, Anduze M. Links Among Cognitive Empathy, Theory of Mind, and Affective Perspective Taking by Young Children. *J Genet Psychol*. 2016;177(1):17-31. doi:10.1080/00221325.2015.1106438
19. Hayden HE, Prince AM. Disrupting ableism: Strengths-based representations of disability in children's picture books. *Journal of Early Childhood Literacy*. 2023;23(2):236-261. doi:10.1177/1468798420981751
20. Bianquin N, Sacchi F. More than Just Pictures: Using Picture Books to Broaden Young Learners' Disability Understanding. In: *Proceedings of the International and Interdisciplinary Conference IMMAGINI? Brixen, Italy, 27–28 November 2017*. MDPI; 2017:890. doi:10.3390/proceedings1090890
21. Meyer A, Genareo V. "Does Your Arm Hurt?" A Content Analysis of Upper Limb Differences in Children's Books. *Michigan Reading Journal*. 2021;53(3). Accessed November 28, 2025. : <https://scholarworks.gvsu.edu/mrj/vol53/iss3/8>

22. Amputee Coalition. Resources to Help Children Understand Limb Loss and Limb Difference. November 2021. Accessed November 28, 2025. <https://amputee-coalition.org/understand-limb-loss-and-limb-difference/>
23. Quarry C. Self Esteem and Emotional Functioning in Children With Congenital and Acquired Limb Loss. *Alliant International University ProQuest Dissertations & Theses*. Published online 2016. doi:10137882

BIBLIOGRAPHY

1. Zitterkopf Larson, Julie Ann MD and Kerr, Jacqueline. *"I Have A Doll Just Like You!"* CreateSpace Independent Publishing Platform. Paperback. 2017.
2. Bowman Martwinski, Caitlin and Bowman, Lindsay. *"Anthony's Amazing AFOs!"* Barnes and Noble Press. Paperback. 2023.