CE

Lower Extremity Orthoses in Children With Spastic Quadriplegic Cerebral Palsy

Implications for Nurses, Parents, and Caregivers

Kathleen Cervasio

Understanding trends in the prevalence of children with cerebral palsy is vital to evaluating and estimating supportive services for children, families, and caregivers. The majority of children with cerebral palsy require lower extremity orthoses to stabilize their muscles. The pediatric nurse needs a special body of knowledge to accurately assess, apply, manage, teach, and evaluate the use of lower extremity orthoses typically prescribed for this vulnerable population. Inherent in caring for these children is the need to teach the child, the family, and significant others the proper application and care of the orthoses used in hospital and community settings. Nursing literature review does not provide a basis for evidence in designing and teaching orthopaedic care for children with orthoses. A protocol for orthoses management has been developed to assist caregivers to accurately care for children with lower extremity orthotic devices.

Introduction

Advances in medical care are improving the survival rates of children with cerebral palsy. Spasticity is the most common impairment found in children with cerebral palsy (Himmelmann, Beckung, Hagberg, & Uvebrant, 2007). Approximately 85% of children with cerebral palsy require the use of orthoses to assist in reducing muscle tone and avoid orthopaedic complications when the child begins to stand (Himmelmann et al., 2007). The proper application of orthotics (braces) and a review of complications associated with orthoses use are typically skills nurses are not exposed to in schools of nursing and rarely in hospital practice. The pediatric nurse manages complex orthopaedic pediatric cases in the home, the hospital, and school settings. The nursing literature does not describe the role of the professional nurse in the management of these patients in any environment. The focus of this article is on the nursing management of lower extremity orthoses in a child with spastic quadriplegic cerebral palsy. The evidence basis for orthoses care was designed after literature review from orthotists, physicians, and physical therapy professional literature.

Cerebral Palsy

One of the most common chronic childhood disabilities is cerebral palsy (Berker & Yalcin, 2008). The prevalence for cerebral palsy in the United States is 2.4 per 1,000 children, an increase over previously reported data (Hirtz, Thurman, Gwinn-Hardy, Mohammad, Chaudhuri, & Zalusky, 2007). Cerebral palsy is primarily a disorder of movement and posture originating in the central nervous system with an incidence of 2.5 per 1,000 live births with spastic quadriplegia being the common type of cerebral palsy (Blair & Watson, 2006). This nonprogressive neurological disorder is defined as a variation in movement, coordination, posture, and gait resulting from brain injury around birth (Blair & Watson, 2006). Numerous associated comorbidities are usually present with cerebral palsy requiring various interventions. Neurological findings can consist of the following:

- Muscle weakness
- Abnormal muscle tone
- Balance problems
- Loss of selective control
- Pathological reflexes
- Loss of sensation

This lifelong developmental disability will require that the child and significant others will need to learn various interventions to assist the child to function to the best of their ability. Various treatments are focused around the control of spasticity and the promotion of movement (Tilton, 2009).

Spasticity

The most common form of muscle overactivity caused by cerebral palsy is spasticity. *Spasticity* is defined as "a motor disorder characterized by a velocity-dependent increase in tonic stretch muscles with exaggerated tendon jerks resulting in spasms, dystonia and other associated phenomenon" (Berker & Yalcin, 2008, p. 1210). Spasticity has a significant effect on the function, comfort, and body

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The authors have disclosed that they have no financial interests to any commercial company related to this educational activity.

DOI: 10.1097/NOR.0b013e31821b6c18

image of a child with cerebral palsy. Tone in spasticity is subjectively measured utilizing the Ashworth Scale that rates tone from 1 (no hypertonia) to 4 (rigid or extension present) (Mutlu, Livanellogiu, & Gunei, 2008). The goals of spasticity treatment are to

- maximize function,
- prevent subluxation,
- prevent contractures,
- ease discomfort,
- ease care,
- improve body image,
- maintain mobility, and
- maintain range of motion.

The care of a child with a neuromuscular disorder requires an interdisciplinary approach. The importance of physical therapy and a regular regimen of muscle stretching in a child with cerebral palsy may prevent complications such as the beginnings of contractures. The array of interventions to decrease tone continues to rely on the standard of orthoses (Berker & Yalcin, 2008).

Orthoses

Orthoses are braces that hold an extremity in a stable position. The goals of bracing are to increase function, prevent deformity, align the joint, decrease spasticity, facilitate motor control, and stabilize the trunk (Berker & Yalcin, 2008). There are many types of orthoses utilized to care for children with cerebral palsy who have gross motor deficits. Ankle foot orthoses (AFOs) are the most effective and the most common type of brace prescribed to treat children with cerebral palsy (Bjornson, Schmale, Adamczyk-Foster, & McLaughlin, 2006). The AFO ends below the knee of the child (see Figure 1). The other most commonly prescribed orthosis is the supra-malleolar orthosis. The supra-malleolar orthosis ends above the ankle of the child (see Figure 2). All orthoses require a prescription from a physician and are custom made by an orthotist. The use of orthoses is a long-term effort that provides supports and prevents injury to the child. Increasingly nurses will see orthoses in the community environment and require competency in caring for a child with this type of bracing. Critical to the care of a child wearing orthoses is teaching the family and significant others orthoses management. Safe nursing care of children with orthoses avoids complications and can enhance the quality of the child's life (Figures 3 and 4).

Orthoses Application

The application of orthoses in children with spastic quadriplegic cerebral palsy can be a challenging task. It is necessary to engage the child, parent, and caregivers to perform orthoses application by focusing on the positive results orthoses can have for the child and for them. The pediatric nurse teaches the child, parent, and caregivers the rationale for orthoses, procedures to assess the child and the orthoses, and the process of orthoses application, and emphasizes the positive outcomes that may occur when orthoses are managed and handled properly (Table 1). Allowing significant others to be directly involved in the care of the child with orthoses and returning demonstrations after instructions

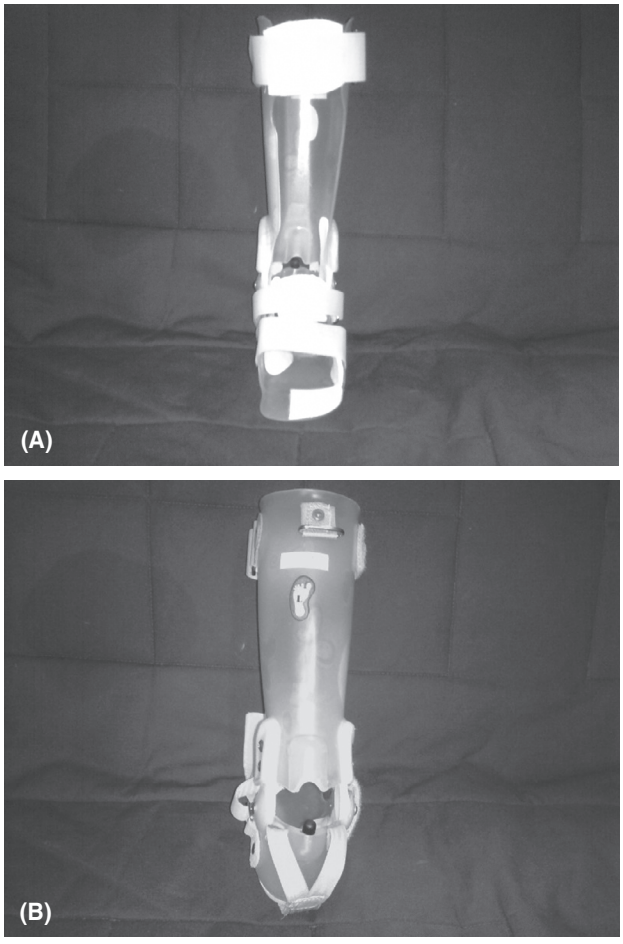

Figure 1. Ankle foot orthoses. (a) Front view. (b) Back view with hinge.

may lead to a sense of accomplishment. It is always helpful for the pediatric nurse to leave resources in both text and pictures so the child and the caregivers have references once the nurse has left. It is always the goal of the pediatric nurse to foster confidence and independence in the child and the caregivers of children wearing orthoses (Votroubek & Tobacco, 2010).

The orthoses should be inspected prior to each application for rough edges, ensure that the Velcro straps are intact, and check the hinges near the heels if present. Communication with the child and family during orthoses application is essential to involve them in the

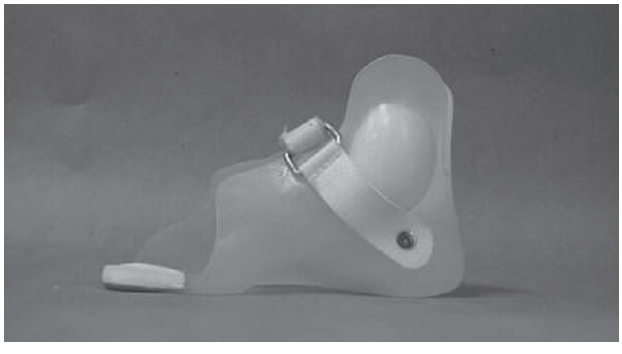

Figure 2. Supra-malleolar orthosis.

FIGURE 3. Orthoses. This is an example of a hinged ankle foot orthoses (AFO). Orthoses can be colorful and have prints to be more child-friendly and acceptable to wear.

process since the caregiver will be responsible once the nurse leaves. Prior to the application of the orthoses, assess the child's legs, feet, and toes carefully to ensure that the skin is intact. The child should be seated safely to properly apply the orthoses and be reassured that this will not cause pain. After the initial skin assessment, cotton knee socks should be applied that are wrinkle free to protect the skin because the orthoses are made of rigid

FIGURE 4. Applying orthoses. Caregiver applied AFO to a child and puts on fitted sneakers in an upright position to assure proper application and fit of the orthoses.

TABLE 1. HOME CARE NURSE TEACHING TOOL—THE CHILD WITH ORTHOSES

At the completion of instructions, the child and the caregivers should be able to:

- Describe the purpose
- Store the orthoses safely
- State the purpose of the skin assessment
- Demonstrate proper application
- Report any redness, swelling, or pain
- Use the orthoses safely
- Tell when a new pair of orthoses is needed
- Perform procedures for new orthoses
- Clean the orthoses
- Describe skin care
- Know when to call the orthotist or the physician
- Wear the orthoses as prescribed
- Use safety measures at all times

Signature nurse_____
Signature patient_____
Signature caregiver_____
Date_____

plastic materials (Shipley & Shipley, 2010). The child's heels should be inserted first all the way to the back of the orthoses and then secure the first Velcro strap across the front of the foot. Once the heel is in place, fasten the second Velcro strap below the knee and then the last Velcro strap that secures the toes. The knee sock can be folded

TABLE 2. BASIC CARE AND COMFORT NCLEX QUESTION FOR ORTHOSES

1. Ankle foot orthoses (AFOs) are used to decrease spasticity in a child with cerebral palsy are worn 8 hours a day, removed once for daily bathing, and cause little interference with activity. The nursing care of a child with orthoses includes:
   a. increased calories to accommodate increase work of the muscles.
   b. increased observation of child safety during the day.
   c. assessment of the oral temperature daily.
   d. assessment of the skin.

Answer: d.

Rationale: Skin assessment is one of the vital nursing assessments in a child wearing orthoses.

2. Nursing interventions for a 10-year-old child with cerebral palsy wearing orthoses during a home care visit includes:
   a. provision of comfort, nutrition, and range of motion exercises.
   b. provision of skin care, play activities, and educational information for the braces.
   c. assessment of the orthoses, positioning the child, and passive range of motion.
   d. assessment of the gait, ambulate the child as tolerated, increase oral fluids.

Answer: b.

Rationale: The skin assessment is a priority in the care of a child wearing orthoses. The nurse should engage the child in appropriate play activities to engage the child in the care. A 10-year-old child has some understanding of the use and care of orthoses.

over the top of the brace to provide more comfort (Shipley & Shipley, 2010). If the child wears bilateral orthoses, then the orthoses for the other side should always be applied since both are worn together for balance and safety. Children usually wear the orthoses through the day after a gradual increase in wearing time of the orthoses has occurred and there are no concerns such as red skin marks (Votroubek & Tobacco, 2010). Orthoses are typically worn under clothes and require shoes that are one size larger than the child's foot without the orthoses and may need to be wider (Shipley & Shipley, 2010). If the shoe is too tight, the orthoses will cause skin redness. Although lower extremity orthoses are lightweight, it is wise to buy lightweight shoes also, so the child can walk or position easily and not tire quickly. Caregivers should be instructed to check the skin under the braces for pressure if the child is crying, or the weather is very hot or cold since the plastic adjusts to the temperature in the environment. Orthoses should always be worn with shoes to avoid orthoses breakage and cracks from stress (Table 2).

Existing with the issues of gross motor movement is the sensory alterations that the child experiences (Naslund, Jeniskey, Sundelin, von Wendt, & Hirschfeld, 2005). An example of sensory disintegration is that the child may experience pain to light touch by a professional or caregiver. The sensory integration issues, if present, must be part of the plan to apply the lower extremity orthoses (Shamsoddini, Shamsoddini, & Hollisaz, 2009). Cooperation from the child when applying orthoses may need to be augmented with the use of a soft voice, soft touch, kind words, message, stretching, favorite toys, or music to decrease the child's fear and ensure that orthoses are applied safely (Nilsson, Kokinsky, Nilsson, Sidenvall, & Enskar, 2009).

Skin Assessments

Skin assessment and skin care are critical elements for the nurse to assess and teach the parents and significant others so the child with orthoses has no complications.

Any discomfort or swelling the child experiences requires the orthoses to be reassessed to ensure that it is not the cause of the problem. When the orthoses are new a regimen of 30 minutes on, check the skin, reapply the AFOs, and increase the time worn by 30 min throughout the day until the child can wear the AFOs all day without issues (Hsu, Michael, & Fisk, 2008). Pressure marks from straps should disappear on the skin once the orthoses are removed from the child's feet within 15–20 min (Jones, Morgan, & Shelton, 2007). If redness is prolonged, do not reapply the braces and call the orthotist to adjust the braces. Growth patterns in young children need to be monitored closely when wearing orthoses so braces do not damage the child's feet. The presence of skin redness, complaints of orthoses tightness, or the child's toes extending over the toe plate of the orthoses may indicate that it is time to new orthoses. Young children typically require new orthoses every 6–12 months while growing to ensure the right fit ("*Children with,*" 1998). Every new pair of orthoses will require a new pair of lightweight shoes to correctly fit over the new orthoses.

It is generally recommended not to use lotions or oily substances on the feet of a child who wears orthoses because skin softening may lead to skin breakdown. The skin must always be kept clean and dry. Clothing around the legs should be loose and properly fitted to the child. Orthoses tend to make the feet sweat so changing cotton socks more than once a day may be necessary. Any pain, swelling, or open skin areas should be immediately reported to a physician or orthotist and the orthoses should not be reapplied until properly evaluated (Morris & Dias, 2007).

Orthoses Care

Orthoses should be inspected daily to ensure that there are no cracks, loose screws, or broken Velcro straps. Most orthoses should be hand cleansed with soap and water if soiled and thoroughly dried before the next wearing (Morris & Dias, 2007).

Foot odor can develop from the orthoses so they can be left out to air or disinfected with rubbing alcohol, but always follow the recommendation of the company and orthotist making the orthoses. Careful observation to lower orthoses with hinges can prevent rust and silicone spray can keep hinges operating properly. Never place orthoses in a washing machine or a dryer. Proper storage of orthoses, when not in use, ensures that they will not be damaged. Never store the orthoses near a radiator or leave them in the sun because the heat can warp the shape of the orthoses or can cause burns if applied to a child's feet.

Summary

Nursing practice must be supported with evidence to safely and accurately care for pediatric patients with orthoses. Protocols are used in a variety of ways to guide clinical practice while promoting quality care. Increasingly, nursing needs to collaborate with other disciplines to share common knowledge bases in clinical care. The interventions of pediatric nurses with children with cerebral palsy wearing orthoses, their parents, and their caregivers provide valuable knowledge and skills to support the physical and psychosocial needs of the child and the caregivers.

Application-type questions have been provided to utilize with nursing students and pediatric nurses to review orthoses use in children with spastic quadriplegic cerebral palsy.

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