



Everyday use of lower limb orthotics and quality of life in subjects with neuromuscular disease

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Abstract

The time worn in different types of lower limb orthosis in subjects with neuromuscular gait disorders is observed over a 3 month period. Results show a significant difference in average time worn on work days compared to weekends with the DAFOs, AFOs and combined modular designs. Average time worn in KAFOs does not differ between week and weekends.

The rating of quality of life and satisfaction with the assistive device helps to understand influencing factors regarding the time worn. Handling, activities as well as ease of use, comfort and effectiveness are key factors that should be considered in the orthotic design to have a positive impact on the time worn.

Keywords orthoses, time worn, neuromuscular gait disorder

Introduction

Ankle-foot orthoses (AFOs) and dynamic ankle-foot-orthoses (DAFOs) are the most commonly used in underlying neurological disorders [1, 2]. The primary aims are to stabilize and adjust the foot as the base and to correct, or at least avoid further deterioration. Depending on the level of motor impairment, measured by the Gross Motor Function Classification System (GMFCS) [Fout! Verwijzingsbron niet gevonden.], a higher degree of stabilization may be required with knee ankle-foot orthoses (KAFOs).

In general, relatively little is known about factors influencing time worn in prescribed orthoses for the lower extremities, examples for monitoring time worn can be found in studies addressed to scoliosis therapy [4]. It is believed that the effect of orthosis therapy depends significantly on the time worn [5] and that this parameter is significantly over or underrated compared to reality when only reported by parents [6].

The following study was designed to investigate the time worn of orthotics in everyday life. Additionally patient satisfaction and quality of life was determined. Related factors like gait impairment and different orthotic concepts were considered.

Methods

45 patients with neuromuscular gait disorders using lower limb orthotics and the ability to walk at least 30 m with or without walking aids were included. At the first appointment (T1) users underwent a physical examination testing for range of motion, strength, deformities and spasticity. Temperature sensors (orthotimer®, rollerwerk medical engineering & consulting, Balingen, Germany) were implemented in all independently used parts of the orthotic concept. Values between 29 - 38.5 °C were rated as 'use-time'. After 90 days (T2) sensors were read and quality of life was determined via CP CHILD [7] and DISABKIDS [8]. Satisfaction with orthotics was rated via QUEST [9].

Results

Output of temperature sensors illustrate that AFOs have been used the longest time per day. Patients walking with orthotics with removable shank adaptations had the highest values in speed and cadence. Patients who used only DAFOs had higher ratings considering quality of life, whereas patients with removable adaptations were most satisfied.

Table 1. Time Worn (TW) differentiating week days v. weekends

type of orthoses	TW _{week} mean h/d	TW _{weekend} mean h/d	Diff. mean TW
DAFO	6,74	4,39	2,35 *
AFO	6,95	4,67	2,28 *
KAFO	3,60	3,31	0,29

The time worn differs significantly between weekends and week days in orthoses at DAFO and AFO level. KAFO show a lower mean compared to the other levels and a time worn which is not influenced by the day of the week (Table 1).

Table 2. Quest: satisfaction with the 3 most important aspects answered with "quite satisfied" or "very satisfied" in %

Aspekts	DAFO n=5 in%	AFO n=21 in%	KAFO n=2 in%	mAFO n=11 in%
ease of use	80	86	100	91
comfort	40	81	100	82
effectiveness	60	81	100	91

Out of the 12 Quest items 'ease of use', 'comfort' and 'effectiveness' were rated as the most important aspects. The satisfaction with these is shown for the different levels of orthotic devices as well as the group of modular AFOs (Table 2).

Conclusion and discussion

Long term monitoring provides insights in individual daily habits, daily demands and environmental factors. This insight helps determining and designing orthotic concepts, and highlights that not necessarily the smallest concepts were the most accepted or beneficial ones. The lower and constant time worn during the week in KAFO compared to AFO and DAFO is in accordance to the GMFCS level. From the user reports KAFOs are mainly used for therapy and training for a limited time every day.

Using temperature sensors to evaluate the time worn does not provide information about the activities performed with the devices. Follow up studies could include activity monitoring to determine between wearing and actively using the assistive device.

Weight and dimension as well as complexity, like in the modular concepts, are accepted by the users as long as they experience the device as effective. Additional to biomechanical principles it is crucial to recognize the requirements given by the individual everyday life. Considering these in an individual orthotic concept, may encourage a longer wearing time.

References

- [1] Mello Figueiredo, E., et al., *Pediatric Physical Therapy*, 20(3):207–223, 2008.
- [2] Healy, A., et al., *PloS one*, 13:e0192094, 2018.
- [3] Palisano, R., et al., *Developmental medicine and child neurology*, 39:214–223, April 1997.
- [4] Andreas Helfenstein, A., et al. *Spine*, 31:339–344, February 2006.
- [5] Tardieu, C., et al., *Developmental medicine and child neurology*, 30:3–10, February 1988.
- [6] Josina C Maas, J. C., et al., *Disability and rehabilitation*, 40:398–403, February 2018.
- [7] Narayanan, U.G., et al., *Dev Med Child Neurol*, 2006. 48(10): p. 804-12.
- [8] Ravens-Sieberer, U., et al., *Psychosoc Med*, 2007 Jul 12;4: Doc08.
- [9] Demers, L. *Assist Technol*, 1996. 8(1): p. 3-13.