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# Relevance Method to Structure of Orthosis

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## Abstract

There are many problems when treatment is needed. Such diseases occur in young and old people. The orthosis and their development have lot of problems. One way to solve this problem is to define and apply standard rules and procedures throughout the development process. We show in this work is to develop a methodology to structure the orthosis design process. A case study was used to validate the proposed methodology. It was applied to the development of an orthosis to treat a camptocormia – bent spine syndrome. This disorder is characterized by the anteroflexion of the trunk and especially affects elderly people and young non-health people with difference disease.

KEY WORDS: orthopedic devices, development of orthosis, structure of orthosis

## Introduction

The design of orthopedic devices, or orthoses, may include particular requirements and design specifications, mainly related to the patients' varying characteristics, such as morphological changes or treatment evolution. The reason is that the orthosis is in permanent direct contact with the patient's body and consequently should be adaptable and comfortable. There are no strict rules and stages that should be respected during the development process [1,2]. Consequently, orthosis development depends adapted to the user needs [3,4]. One of the current challenges in the field of orthoses is to develop a device to treat

camptocormia [5, 6]. Also known as bent spine syndrome, this pathology is characterized by the anteroflexion of the trunk in populations. Camptocormia precludes the patients from having a normal daily life since the curved posture causes contraction of the diaphragm (fatigue problems) [5], reduces walking gait, results in a lack of social visual contact, etc. The purpose of this study was to develop a design methodology devoted specifically, to the orthosis and its application during the development of a brace to treat camptocormia.

## Materials and Methods

We have used new breakdown of the design process [7,8] as a base (task clarification, conceptual design, embodiment design, and detailed design), it was possible to develop a new design methodology for the development of the orthosis. The first stage of the proposed methodology corresponds to task clarification, which may include the definition of the orthosis stakeholder,

the orthosis typology, and the orthosis life situations. Orthosis development should play mean roal is biomedical area. There are two main actors with respect to the medical domain, the doctor and the orthoprothesist. The doctor is responsible for the diagnosis and the medical design specifications of the orthosis. The proposed methodology is composed of six stages: mechanism research; concept, displacement, and dimensional constraints; comfort adaptations; blocking definition; orthosis definition; and orthosis design qualification. These stage [7], have been revised and supplemented. These stage [7], have been revised and supplemented. the methodology proposed considers a superposition of stages for a more dynamic design process.

## Results

The methodology was then applied to the development of a brace to treat a postural pathology named camptocormia. Also known as bent spine syndrome, it is characterized by the progressive anteroflexion of the trunk during walking and in the standing position [8-16]. Contrary to other postural disorders, camptocormia is reversible, which means that the postural flexion is not permanent and same time patients are able to redress their posture [12-16]. But etiologies of camptocormia are not completely understood [12-16]. Yet, as the camptocormia is a multicasual postural disease, these causalities should were considered during the orthosis design process [12-16]. The specifications is very good, if witch correspond to the starting point of the methodology. Even if presently the etiologies of camptocormia are not completely understood by the medical community, and still exists several questions without answers, the treatment combining physiotherapy sessions with a brace has presented satisfying results [12-16]. Yet, as the camptocormia is a multicasual postural disease, these



causalities were considered during the orthosis design process. From the stakeholders' definition, the design team in accordance with the medical domain establishes the orthosis specification. These specifications correspond to the starting point of the methodology. The following stage, blocking definition, defines the mechanism blocking system which locks the orthosis in the prescribed treatment position (trunk redressed). As at the anterior stage, the technical solution depends on the possibilities available to the enterprise. In this case, in accordance with the enterprise's blocking system database, the choice rests with an obstacle blocking system. The next stage, orthosis definition, is based on the architectural design stage, which means assembling all the components of the orthosis. This stage is developed in strict contact with the user's domain since, depending on the geometry of the supports (a custom-made orthosis), the positioning of the mechanism may change. During this stage, numerical and experimental analyses are performed in order to evaluate the mechanical behavior of the orthosis. The last stage, orthosis design qualification, corresponds to an evaluation of the orthosis by the user (user's domain). As previously described, during this stage, several questions were put to the user in order to evaluate the different components of the orthosis, for example, the supports, the mechanism, the blocking system, comfort, and ergonomics. The results of these inquiries not only enabled the designer first to make any necessary improvements but also to personalize the orthosis according to the patient's needs.

## Conclusions

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The development of medical devices is a demanding task, especially with respect to orthoses because of the way in which they are classified. In some cases, this results in deficient products that do not meet the patient's needs. The primary aim of the present work was to develop an orthosis design methodology based on dividing up life situations and integrating the design constraints in different knowledge domains. This methodology was then applied to the development of a new orthosis, a brace to treat camptocormia. Although several concepts emerged, in this study, only a representative group of specifications were considered, and for this reason, only one concept has been presented. The selected concept meets the main device specifications in terms of straightening the patient's posture. This straightening was possible through the link chain proposed during the conceptual design stages and allows a vertical displacement of the chest.

Concerning comfort, two aspects were considered. The first was the use of a neoprene layer between the rigid part of the supports and the body, and the second was the fact that with the proposed concept it is possible to tighten the supports to the body and consequently adjust the orthosis to the patient's morphology. The blocking system of the proposed concept was specially taken into account in terms of ergonomics. Since the developed orthosis will be manipulated by elderly people and in some cases by patients with Parkinson's disease, the fact that their fine motor skills are often reduced must be considered.

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