

# SOFT DESIGN FOR AN REHABILITATION EXOSUIT: A PRELIMINARY APPROACH

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## Introduction

Nowadays, physical impairments are common, and they are caused by different reasons [1]. The normal aging process accentuated by increasing life expectancy, neurodegenerative diseases and finally daily living misfortunes such as accidents (falls, motor vehicle accidents, sport practices and others), all having a significant contribution for this reality.

The resultant mobility deficit has a high and long-term impact on social, economic and financial sphere of communities and health care systems worldwide [2]. Besides, the psychological effect of these life changes on patients may be stressful, painful and in some cases depressive [3].

As an attempt to mitigate the negative effects of these mental and physical conditions, some solutions were already developed. They include wanderers, wheeled vehicles and wheelchairs [4]. However, most devices do not have rehabilitation as primary goal.

Despite the early stages of development, exoskeletons and exosuits [5] already play an important role in a rehabilitation context, as seen in some solutions described on literature [6,7].

## Soft Design

The design, being one of the most valuable characteristics, has a direct impact (at different levels) on users' appreciation about the solution. This explains why every design decision must be made carefully.

It is crucial the design adopted can accommodate some natural movements of the user, such as flexion and extension, abduction and adduction and/or some rotations. In summary, it must allow the appropriate degrees of freedom (DOFs) [8].

Also, the aesthetic appearance is a very relevant consideration. The patient should feel comfortable and secure, and that he is using a simple and usable device with practical benefits in his life.

Being a wearable soft solution premises the use of soft, flexible and biomimetic materials, such as some biocompatible polymers [9,10]. This fact contributes for a global solution more adaptable to the user.

As an example of these concepts, figure 1 represents a very early scheme of what could be a soft wearable design for the elbow.

## Discussion and Conclusion

Although every important aspect of an exoskeleton or exosuit is well known and well described on literature, from distribution of weight to safety measures or power

production and consumption, it is important to keep the design development as a whole.

Having the patient point of view in mind, these devices should be perceived as natural body extensions, instead of strange and exogenous objects. This aspect may become more important than the overall helpfulness of the device, if baseline objectives are achieved through its usage.

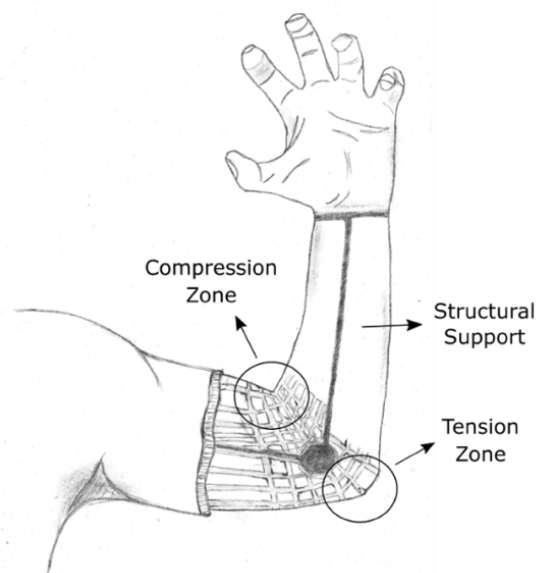


Figure 1: Scheme of an elbow exosuit.

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