CONCEPTUAL DESIGN FRAMEWORK OF 'INCLUSIVE ADAPTIVE CLOTHING' FOR PEOPLE WITH SPINAL CORD INJURY

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Abstract

The study proposed a holistic design framework to address the physical and psychological clothing needs of youth with Spinal Cord Injury. People with spinal cord injury not only experience the challenges of physical limitations and medical complications, but along with this, they also have to face complex psychological state due to sudden dependence on others for their basic everyday activities. The concept of adaptive clothing is entrenched in the ideas of rehabilitation and attempts to enhance the quality of life for people with disabilities. Despite numerous functional interventions, the reach of adaptive clothing in the market is still in question. The new design framework proposes the concept of 'Inclusive Adaptive Clothing' to break the taboo around adaptive clothing and to meet the manufacturing requirements. The objective of this paper is to identify abstractions with a bottom-up approach starting by examining existing models and developing the conceptual design framework. The design framework integrated the World Health Organization Quality of Life, SCIM model of independence and the functional, expressive and aesthetic (FEA) model of consumer needs, to determine the relationship between psychological state and level of physical independence to then evaluate an individual's clothing needs. In the physical dimension category, the attributes of daily living activities related to clothing have been defined in relation to the degree of physical independence. The subjective evaluation attributes, which are embedded in social, cultural and environmental aspect have been established to analyse the psychological state. The model is sensitive enough to define the required clothing attributes to meet the consumer needs of people with spinal cord injury and enhance its viability in manufacturing.

Introduction

The concept of consumerism changed the overall scenario of manufacturing and consumption of every product. The brands nowadays are not only focussing on the product design and quality, they are also concerned about overall user experience of the product or service. In the past few years, society has adopted egalitarianism approach for the development and evolution of products.

The overall shift in products is yet to be achieved as it is a complex issue to address various factors that influence the overall clothing experience of the consumers for people with and without disability. The conceptual framework is the necessity to address the complex problems of contemporary times. For a better understanding of the complex social phenomena, a multidisciplinary approach is required (Jabareen, 2009).

In this respect, the development of inclusive adaptive clothing for people with a spinal cord injury needs to be approached in the theoretical construct so that the developed model can give a better understanding about the requirements and demands in a given situation. The World Health Organization (WHO) defines spinal cord injury as an injury to the spinal column or spinal cord which result in paralysis, that is, inability to move or feel.

Traumatic spinal cord injury is categorized into two sub-divisions, based on the extent of paralysis:

- tetraplegia: paralysis of all four limbs,
- paraplegia: paralysis of the lower half of the body.

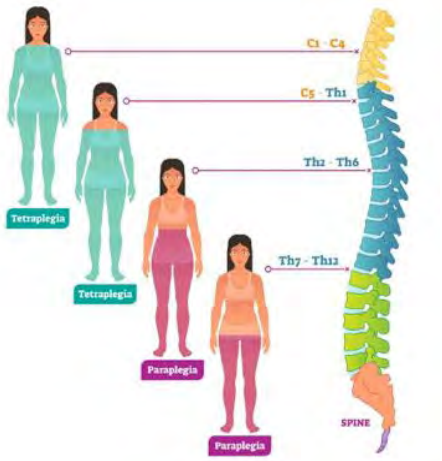

Figure 1. Extend of paralysis based on the injury to the spinal cord.
Source: Proper Physiotherapy.

The sudden anatomical changes which can result in the exclusion of many people from full participation in society often results in clinical depression (WHO, 2013). People with a disability face substantial challenges in finding clothing that could meet their requirements of fit, comfort, aesthetics, functionality, affordability and so on. (Suri, 2016; Sarcone, 2017).

Due to numerous variations of physical dependency, anatomical requirements, psychological state and consumers' clothing needs, identifying a framework within which clothing requirements might be addressed with an inclusive design approach is a complex but necessary process. Hence the purpose of the study is to propose the conceptual design framework for inclusive adaptive clothing to identify the needs and clothing attributes while keeping physical and psychological state in view.

Methodology

To determine the attributes of inclusive adaptive clothing, the universally accepted models were studied, adopted and combined to develop the conceptual design framework of inclusive adaptive clothing. Hence functional independence measure (FIM), WHO Quality of Life (WHOQOL) and the functional, expressive and aesthetic (FEA) model of consumer needs were analysed and combined.

Functional Independence Measure

The FIM was developed to evaluate functional ability in daily activities, as represented mainly by the burden of care arising from a disability (Functional Recovery Outcome Measures Work Group , 2008) The FIM instrument is based on 18 tasks, designed to assess the person's level of physical independence. The FIM assess based on two scores, that is, motor and cognitive score (Figure 2) (Ferrucci et al., 2007).

The scale reflects the time, energy, effort, and equipment that are used to achieve the task (Functional Recovery Outcome Measures Work Group , 2008). Multiple studies support the reliability and validity of FIM scales in the older population. The attributes required to meet the physical clothing needs are directly related to clothing experience of the users. Hence attributes related to the ability to dress the lower body are adopted for conceptual design framework for inclusive adaptive clothing.

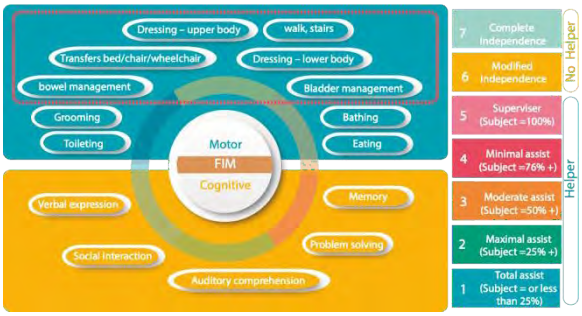

Figure 2. Model of Functional Independence Measure. For the purpose of this study, only the attributes framed in red area are studied on mentioned scale.

WHO Quality of Life

World Health Organization defines Quality of Life (QOL) as an individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns (WHO, 1997). WHO QOL is a validated tool to measure QOL as perceived by a person with a spinal cord injury (Jang, 2004), hence it was selected to evaluate the psychological aspect of people with spinal cord injury.

The four domains, that is, the psychological state, level of independence, social relations, and environment are adopted for the conceptual design framework.

The physical health and the spiritual beliefs do not have a prominent direct or indirect influence on the attitude towards clothing hence they will not be considered for the study.

Figure 3. WHO QoL Model. For the purpose of study only the attributes framed in black dotted area are adopted.

FEA Consumer Needs Model

The Functional, Expressive, Aesthetic (FEA) Model is a user-centred model intended to identify the clothing needs of the end consumer (Lamb and Kallal 1992). The strength of the FEA Model is its inherent flexibility to be combined with other design process models and theories (Orzada and Kallal, 2019). The concentric circle consumer needs FEA Model, developed by Lamb and Kallal (1992), is formed by three separate circular layers as shown in Figure 4.

The Target Consumer is the centre of the model, and various attributes of consumers have been studied for better understanding like demographics, psychographics, physical characteristics, activities, and preferences.

The second circular layer of the model represents the culture ring as “culture acts as a mediator or filter between the intended users of apparel and their requirements or desires in their apparel items” (Lamb and Kallal, 1992).

The third circular layer cites the name and provides sub-attributes of each of the FEA elements.

The arrows demonstrate the interrelationship between the functional, expressive and aesthetic elements (Lamb and Kallal, 1992). Expressive considerations are defined as the values, roles, status and self-esteem of the wearer. Aesthetic considerations are art elements and design principles (Lamb and Kallal, 1992).

Figure 4. FEA consumer need model integrated with principal of universal design.

To make the framework more effective and inclusive, six out of seven principles of universal design are integrated with functionality of the FEA model, that is:

- Principle 1: Equitable Use.
- Principle 2: Flexibility in Use.
- Principle 3: Simple and Intuitive Use.
- Principle 4: Perceptible Information.
- Principle 5: Tolerance for Error.
- Principle 6: Low Physical Effort.

The seventh principle, Size and Space for Approach and Use, would not be considered as it has least relevance in the case of clothing.

Results and Discussion

This study outlines the new conceptual design framework to determine the essential attributes need to consider to develop inclusive adaptive clothing for people with a spinal cord injury. People with disabilities tend to select ready-to-wear clothing over specialised pattern garments because they tend to reduce general stigma associated with a disability (Lee and Jin, 2019). The new conceptual design framework for inclusive adaptive clothing is the integration of FIM, the WHO QoL, and the FEA consumer needs model. As the inclusive, adaptive clothing framework focuses on the holistic approach to enhance the user's experience, it is crucial to consider all the three elements, that is, (1) the physical state: physical limitation due to disability; (2) the psychological state: mental state due to everyday challenges; and (3) the clothing needs of the user: understanding the aesthetic, functional and expressiveness (trends) needs of users.

As the model illustrates (Figure 5 below), if the product is developed by only focussing on the clothing needs and physical state of the user then it will result in to mass produced adaptive clothing which is not widely accepted by user because of social stigma (Lee and Jin, 2019). Whereas if designers consider the physical and the psychological state of the users then that will provide customised clothing to the small section of people with disabilities which will be unaffordable by many. In the current situation, ready-to-wear is chosen by the majority of people with disability which is designed to consider the clothing needs and psychological state of the general user but it does not address the physical limitation of users with a disability and hence results in poor user experience. In comparison, all the three combined models give a more holistic outcome; it addresses the clothing needs of larger population and develops inclusive clothing for people with disability and people without disability.

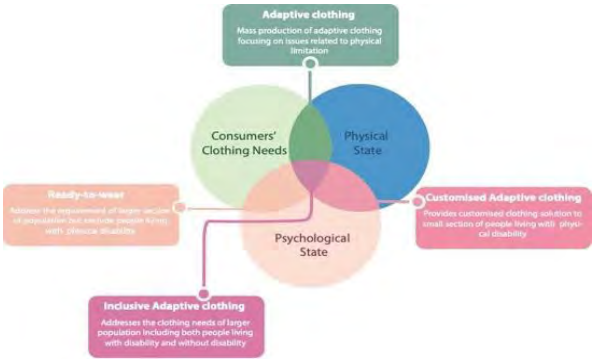

Figure 5. Three key attributes of inclusive adaptive clothing.

In this proposed framework, the physical state Figure 6 is accessed by evaluating the degree of independence to perform clothing-related daily activities. The degree of independence helps to understand the requirement of functional features in inclusive adaptive clothing. It is important to consider that requirements of paraplegic will be differ from requirement of quadriplegic. In paraplegia user have paralysis in the lower body and have full control in upper body, hence there are limited challenges comparatively to limited or no movement/control in upper body along with lower body in case of quadriplegic.

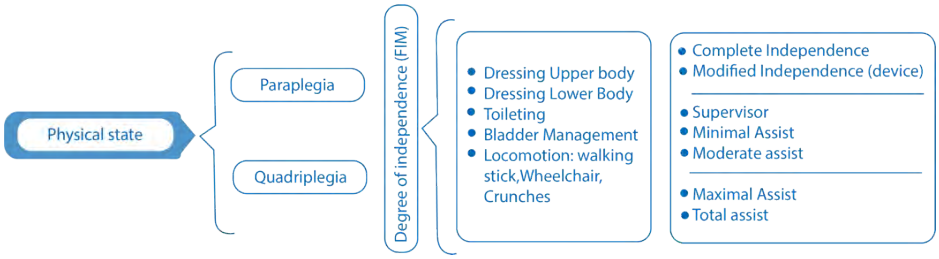

Figure 6. Physical attributes of 'Inclusive Adaptive Clothing' framework.

Understanding the psychological state is equally important especially in case of traumatic spinal cord injury as physical differences impacts people with physical disabilities psychologically results in development of distinct characteristics than able-bodied people (Chang et al., 2009). Since body image and appearance are essential elements of face-to-face interactions, clothing can alleviate or aggravate the situation. The psychological state assessment is based on the state of rehabilitation/ years of injury as the time has an impact to develop the patient's perception towards their self-concept and body image. Their psychological state got impacted by their environment and social relation. To understand the acceptance rate of inclusive adaptive clothing, it is crucial to analyse the psychological state of the user as shown below in Figure 7.

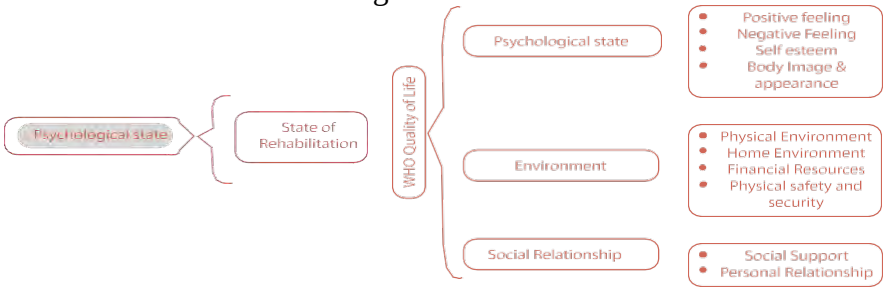

Figure 7. Psychological state attributes of 'Inclusive Adaptive Clothing' framework.

The model also accepts that the gender aspect is important to consider along with users' age to understand their clothing needs. Wingate et al. (1986) stated that “females viewed the salient functional clothing features more positively than did the males.” Kidd (2006) detected that young woman with special needs considered personal attractiveness and self-confidence for their clothing fit. In comparison, older women with disabilities wanted a comfort aspect for their clothing, such as a “soft fabric”, and clothing that was easy to don and doff as a functional aspect. To address consumers' needs it is important to analyse and meet the aesthetic and expressive clothing desires of the users along with the functionality requirements. The integration of the principle of universal design enhances the efficiency of the framework and makes it efficacious.

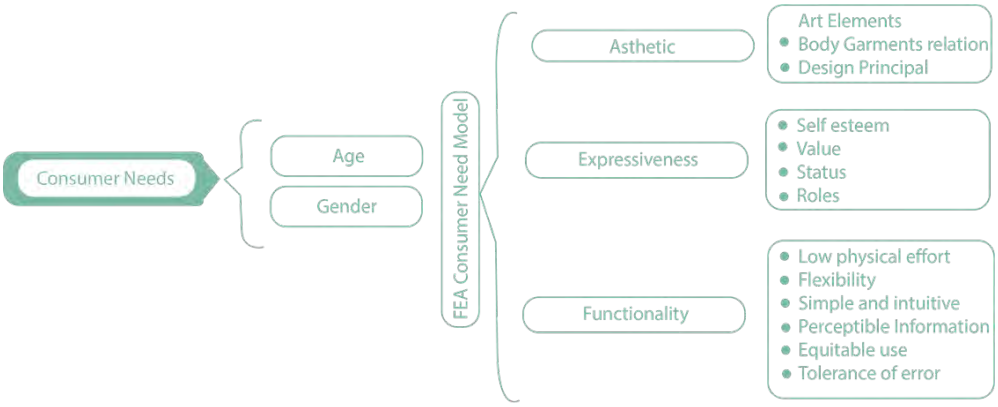

Figure 8. Consumers clothing needs attributes of ‘Inclusive Adaptive Clothing’ framework

To meet the requirements of users that will evolve after collection and analysis of data using the conceptual design framework of inclusive adaptive clothing, it is also crucial that the resulting product should be production feasible without making major changes to sewing machines so that it can be mass produced for both the people with and without disabilities at affordable price.

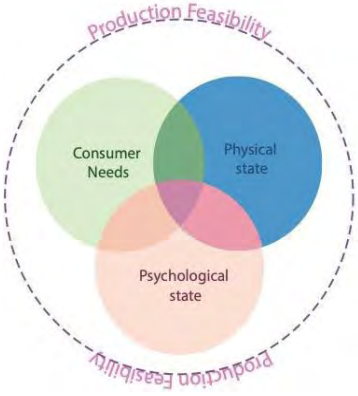

Figure 9. Conceptual design framework for ‘Inclusive Adaptive Clothing’ framework

Conclusion

The fashion industry is increasingly focussed on launching adaptive clothing for consumers as it saves time, and it is also gaining popularity and acceptance. As per Vogue's projection, the global market for adaptive clothing is expected to be valued at nearly $400 billion by 2026. This study provides the conceptual design framework to provide clear strategies for inclusive adaptive clothing to enhance the user experience for people with traumatic spinal cord injury. This new framework has a holistic approach to address the psychological needs, physical state and consumer clothing needs of the traditional as well as non-traditional users. This model could be used to further collect the data and develop inclusive adaptive clothing.

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