DESIGN OF AN UXILIARY FURNITURE FOR PATIENTS IN REHABILITATION STAGE

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ABSTRACT

Human spin is a complicate and sensitive body part. Every spine is as unique as a fingerprint. Every person has his own unique 'spine print', and that print changes as the person's posture changes. Injuries in the spine can cause serious problems in a person's daily life. Sometimes the conservative treatment that is often applied is not enough, so surgical intervention is necessary. A serious kind of spine surgery is spinal fusion which is a surgical procedure used to correct problems with small bones in the spine (vertebrae). It is essentially a "welding" process. After this stage, the patient is undergoing rehabilitation, a stage that varies from person to person. The rehabilitation stage is temporary and it is very critical for patient's recovery. During this phase the patient have to follow doctor guidelines in a very restrict program. In current research, auxiliary furniture is designed, aimed to improving the quality of people life in rehabilitation stage after a serious surgery of spinal fusion.

Key words: furniture design, universal design, patients, spinal fusion, rehabilitation stage.

INTRODUCTION

The main purpose of industrial design since the end of the 19th century, when it began to appear until today, is the design of furniture and other industrial products that aim to improve the everyday life of the people who use them. With the evolution of science, materials and technology, people's needs have grown dramatically. Furniture and other industrial products should be increasingly complex and sophisticated to cover a larger group of human needs (Clarkson *et al*, 2013). Many times these needs are not covered from a classic industrial design process but we have to adopt more efficient methods like Universal Design. According to Roger Coleman the following questions have to be answered in a new design "Who is going to use my design?" "What do they need from my design?" "How do I take any medical needs into account? (Coleman *et al*, 1994)

The evolution of medical science is continuous, new methods of treatment are constantly being discovered, new wound treatment techniques are being implemented. A large number of wound treatment techniques result in surgical procedures (Outi L. et.al, 2017). The patient after a surgical procedure should follow a rehabilitation step following specific medical instructions. Indeed, in some post-operative rehabilitation stages such as Spinal fusion, the patient should follow a long rehabilitation phase that may take several months. During that time, the patient should be in upright position (Laureen D. et.al, 2017).

The purpose of this paper is to design wooden interior furniture that will be able to support and facilitate the patient in the rehabilitation phase after Spinal fusion surgery. For this purpose, a survey was carried out with the distribution of questionnaires in rehabilitation centers in Central Greece, as well as the method of personal interviews from

people in the process of rehabilitation or who have already completed this stage. Subsequently, based on the data collected, they were utilized using tools for the design and development of furniture and other industrial products. The methods used as design tools are Brainstorming, Story Board, Mind mapping, concept design and cad modeling.

1. EXPERIMENTAL METHODS

In order to search the necessity of designing a furniture that supports the patient at the rehabilitation stage, a survey was carried out which was based on the questionnaires responded by patients undergoing rehabilitation after a surgical procedure and personal interviews of patients who completed the stage of rehabilitation. A market survey was also conducted to find similar furniture - aids that serve patients' needs. The answers given from the questionnaires, shows the need for designing a product - furniture that will serve the needs of the patients at home. Overall, the questionnaire contained 15 questions and responded to it by 73 people who are either ill themselves or have a patient in their family. Specifically, the question of how much such furniture would help the movement of the persons in their space, 38% of respondents answered “very much” while 40% responded ‘much’ (Fig. 1). Also, in the question 'From what material would you like to be the auxiliary furniture?' 72% replied from wood and 28% from other materials (Fig. 2).

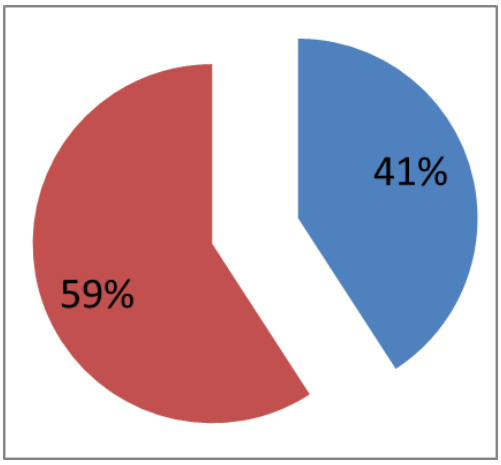


Figure 1: Persons who were in their immediate vicinity a person who could use the particular furniture.

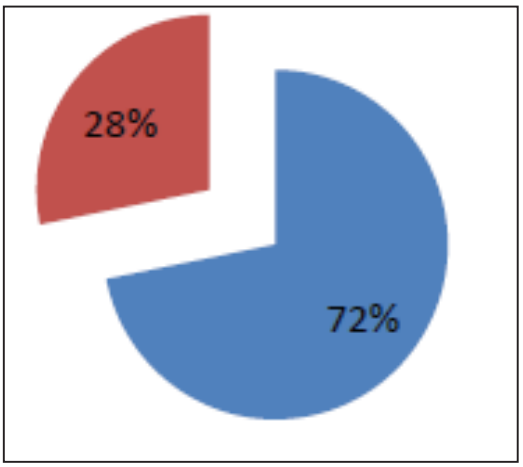


Figure 2: Users prefer a wooden furniture.

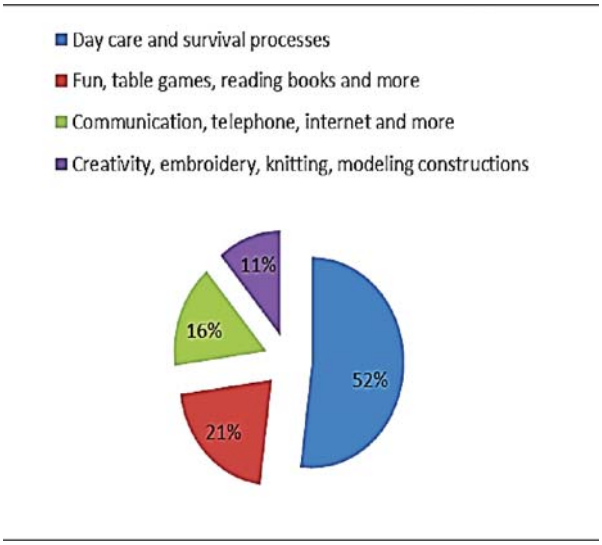


Figure 3: Daily activities that are lacking or that are difficult for people in recovery.

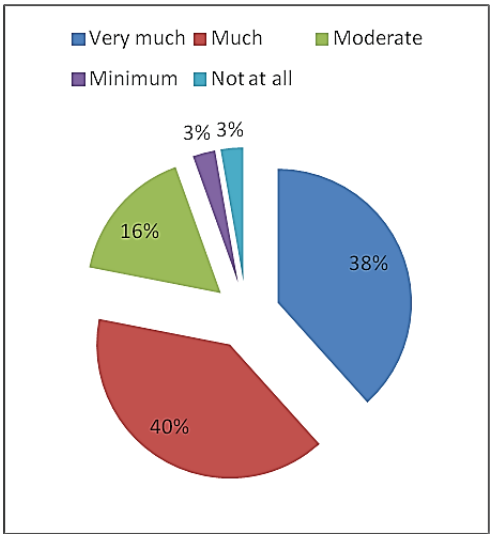


Figure 4: How much help would offer such furniture to people with temporary difficulty in movement?

Most respondents (52%) believe that daily activities that are lacking or that are difficult for people in rehabilitation stage are the daily care and survival processes. Then they are considered to be lacking entertainment (21%) (TV, board games, reading books, etc.). The next activity that is considered to be lacking or becoming difficult is communication (16%) (phone, internet etc) and the last activity they are lacking is creativity (11%) (embroidery, knitting, modeling constructions etc.) (Fig.3). In Fig. 4 are presented the answers about how useful it would be a furniture like this, so 28 (38%) respondents answered "very much", 29 (40%) people answered "very much", a smaller percentage of respondents (16%) answered the help it could offer would be "modest" while only two of them (3%) responded minimally, and 2 others (3%) said that such furniture would not provide any assistance to people with difficulty in moving.

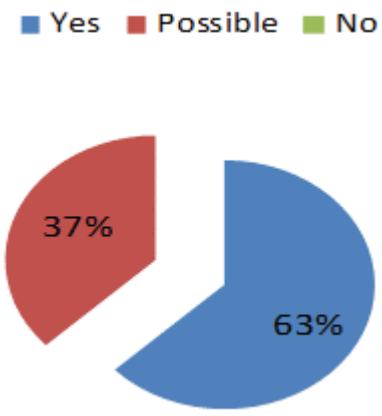


Figure 5: Is important furniture dimensions to be adapted?

Regarding to how necessary it would be, the dimensions of this auxiliary furniture to be adapted to the user, most of the respondents 63% (46 people) responded positively and a fairly large number 37% (27 people) replied that this possibility would be "possible" necessary. It is worth noticing that none of the respondents answered negatively to the possibility of adapting the dimensions of this auxiliary furniture to the individual user (Fig. 5).

At the same time, the market research showed that the most popular device used by

patients is the walker. The research carried out showed that auxiliary furniture should meet the following objectives: a) To offer any improvement to the new conditions of their everyday life b) To make pleasant and productive, for people with temporary difficulty in the movement, to stay in the home area c) To support the communication with their relatives additional functions despite the difficulty of moving outside the home d) to give those who use it the impression of temporary use rather than a permanent status e) to offer in a successful way the impression of minimizing the diversity of the people who make use of auxiliary furniture. (f) its construction is such that it is easy to move and detach its individual parts from the user himself.

1.1. BRAINSTORMING

Brain Storming is called the process where the constraints set are to be addressed and met by targeted solutions and proposals, a team of designers, through a process of creative search for new ideas, solving problems, meeting the constraints and leading to innovative solutions. The goal of a brain storming is to externalize different ideas from team members. The process begins by identifying the problem, as well as determining queries that will stimulate creative thinking. The main purpose of brain storming for the design of auxiliary furniture is to meet the needs of the users and the functions that it should cover. The needs to support in the home, but also to meet the basic necessity of the food, were the needs where the priority was given. Great importance should also be given on the ergonomics of furniture based on anthropometry (Yayici, 2016). Special attention was also given to safety factor safety so that furniture can safely support the user when moving in the house. Considerable care should also be given to the design of the auxiliary furniture, with the auxiliary surfaces that it will have to include for the installation of a mobile phone, laptop, tablet etc. Also, the materials should not have a heavy weight.

1.2. STORYBOARD

The aim of the Story Board is to help the designer understand the user's needs, the content and use of the product, the interactions between the users - products. Story Board is used throughout the design process, from the birth of the idea to its evaluation. Through this the emphasis was placed on the operation of the product and the intended behavior of the product. It also helped to pay attention to the technical functions of the product as well as to psychological / social / economic / cultural functions. Finally, the Story Board tried to answer questions like: Where? When? What? Why? With whom? For how long?

1.3. MIND MAP

This method is being used at the beginning of "Searching for the Idea". The designer begins by creating illustrations on how to develop opportunities for innovation development. A thematic core is defined in the center of the map (Bednar, 2009). Mapping our ideas shows the potential relationships that develop (or are about to being developed) from the opportunities or solutions that the designer discovers through the map. It is a map depicting specific relationships and hierarchies. Such a tool helps the designer to develop discussions to find the solution. The method helps to further detect and develop a concept. On the map to be developed in five stages: a) Definition of the Thematic Core and related sub-themes b) Mapping of the Thematic Core and related sub-themes c) Exploring the potential opportunities around the Thematic Core and related issues d) Improving the Thematic Core map according to the initial requirements e) Map analysis and

identification of final areas for further exploration.

1.4. CONCEPT DESIGN – CAD MODELING

The concept design refers to the initial design of ideas in sketches. Sketches should capture design suggestions that meet the user's needs as outlined in the previous steps. The idea that will be selected by the evaluation will be detailed below in CAD Modeling. After selecting the final idea follows the stage of 3d modeling where the pre-designed idea should be designed in every detail. The design software is AutoCAD 2018. During the detailed design process, the designer is able to identify any errors or omissions that were not detected earlier. It is likely that significant improvements will emerge, or even changes in the central concept, so that the furniture – product is constructively and structurally correct.

2. RESULTS AND DISCUSION

The research carried out showed that auxiliary furniture should meet the following objectives: a) To offer any improvement to the new conditions of their everyday life b) To make pleasant and productive, for people with temporary difficulty in the movement, to stay in the home area c) To support the communication with their relatives additional functions) despite the difficulty of moving outside the home d) to give those who use it the impression of temporary use rather than a permanent status e) to offer in a successful way the impression of minimizing the diversity of the people who make use of auxiliary furniture. (f) its construction is such that it is easy to move and detach its individual parts from the user himself. The main purpose of brain storming for the design of auxiliary furniture is to meet the needs of the users and the functions that it should cover. The need to support in the home, but also to meet the basic necessity of the food, was where the priority given. Great importance should also be given on the ergonomics of furniture based on anthropometry. Particular attention was also given to the issue of safety to the safety factor so that the furniture safely supports the user when moving within the home. Considerable care should also be given to the design of the auxiliary furniture, depending on the auxiliary surfaces that it will have to place for the installation of a mobile phone, laptop, tablet etc. Also, the materials should not have a heavy weight (Fig. 6).

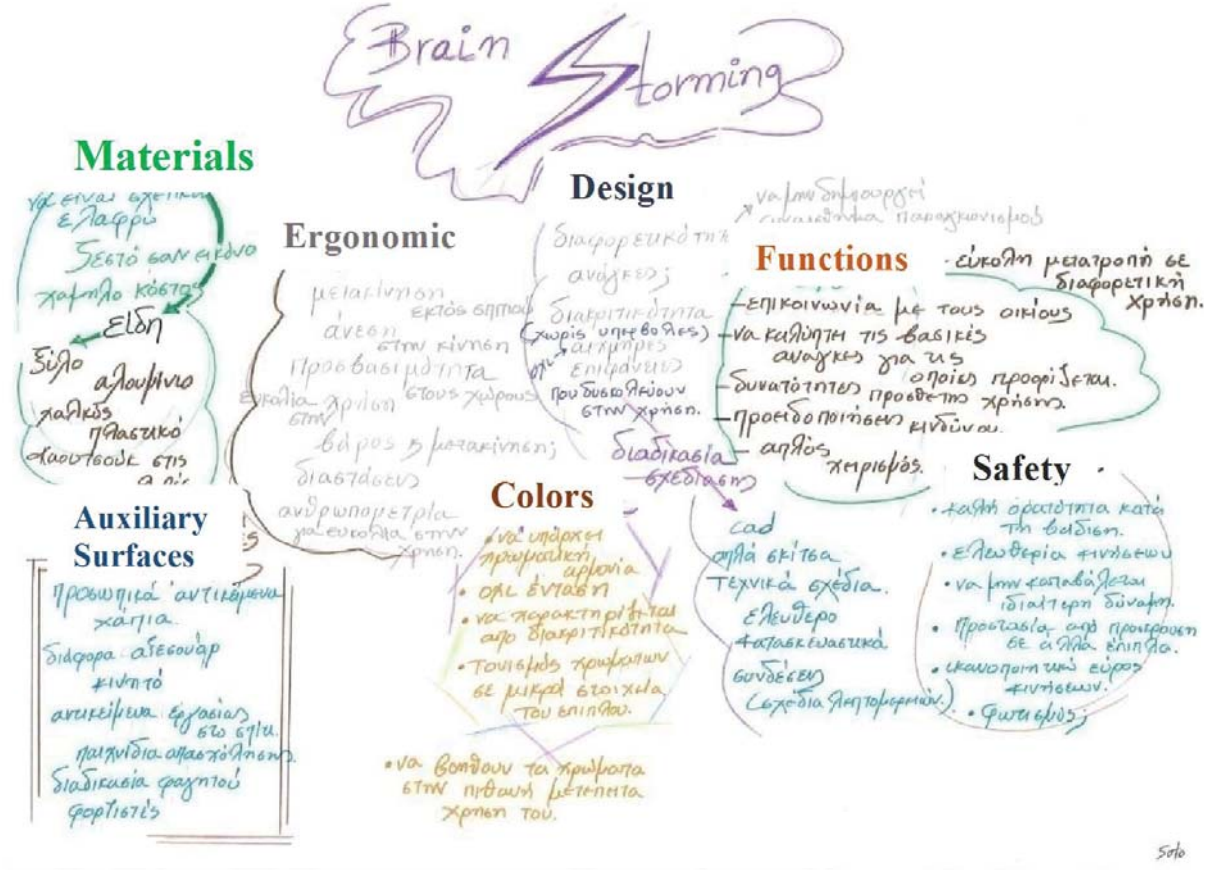


Figure 6: Brain Storming

The final mind and map storyboard are presented in Fig. 7 and Fig. 8.

Figure 7: Mind Map

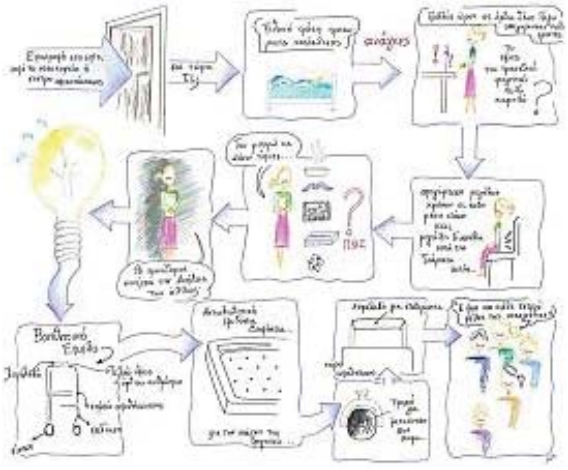


Figure 8: Storyboard

2.1. FINAL CONCEPT DESIGN

Covering the needs of patients through the ergonomic design of the furniture is the basic criterion for choosing and developing the final design concept. In the initial sketch we try to give a basic shape in the furniture (Fig. 9). The final idea was chosen based on the following criteria as they emerged from the mind map: a) Ensuring the stability of the furniture when moving the patient inside the house b) Choosing the least volume and

weight design c) The ability to store the user's personal small items d) Allowing the user to move freely. The final form of the auxiliary furniture is shown in Fig. 10.

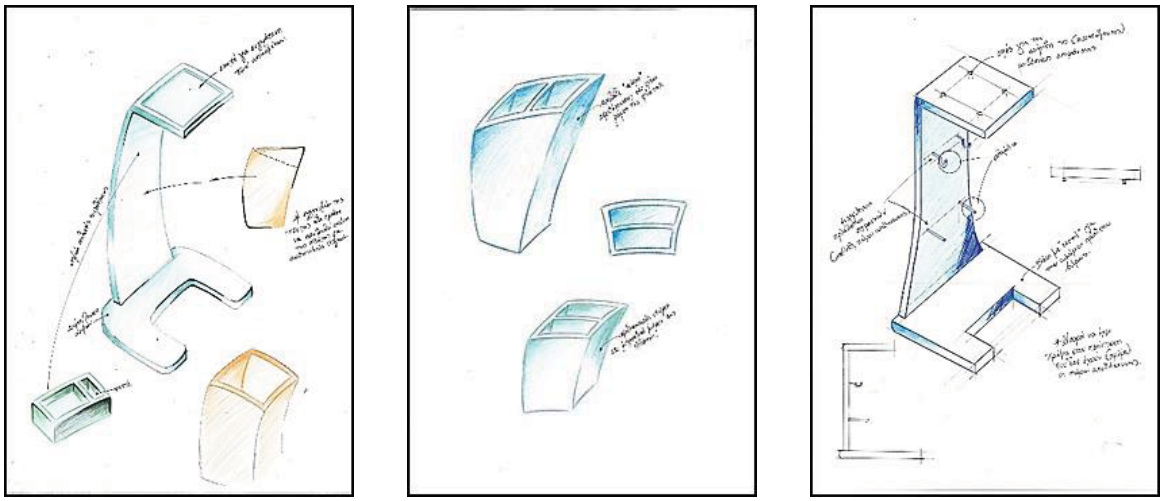


Figure 9: Initial Sketch Designs

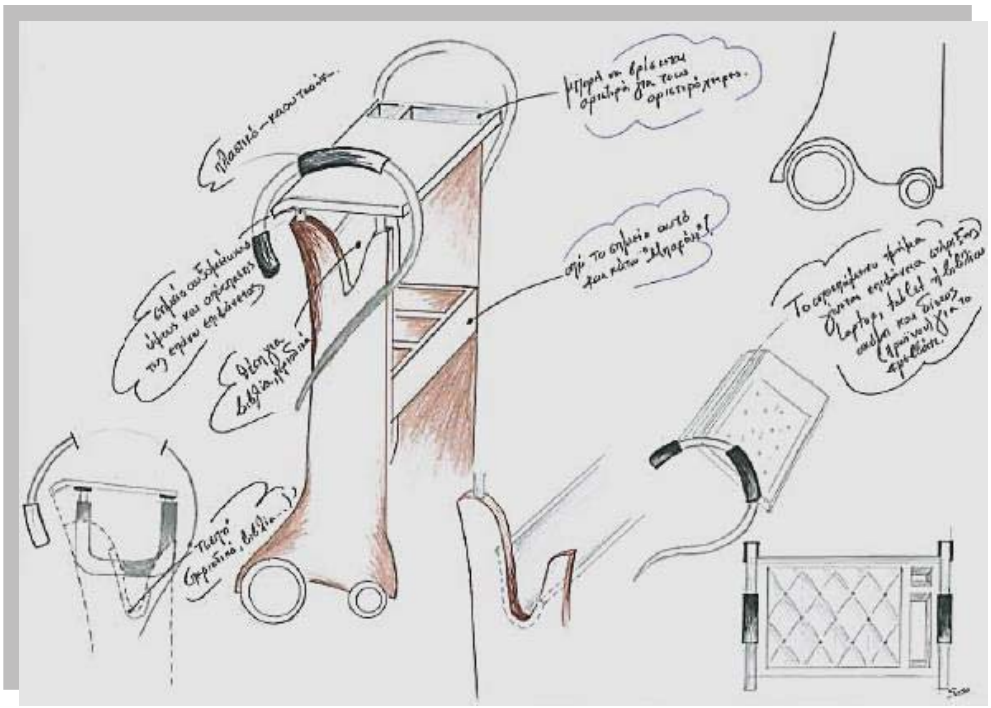


Figure10: Final Sketch

2.2. FINAL 3D CAD MODELING

The final sketch design is the guide for the 3d model in AutoCad 2018 (Fig. 11, 12), during modeling process we are able to find mistakes in initial design and to correct them. After the 3d model design we have to make the construction drawings.

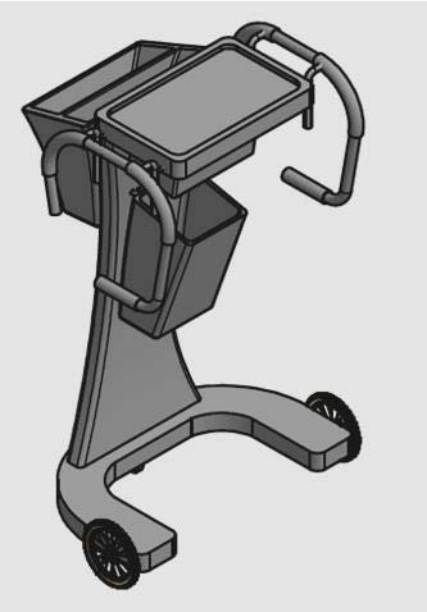
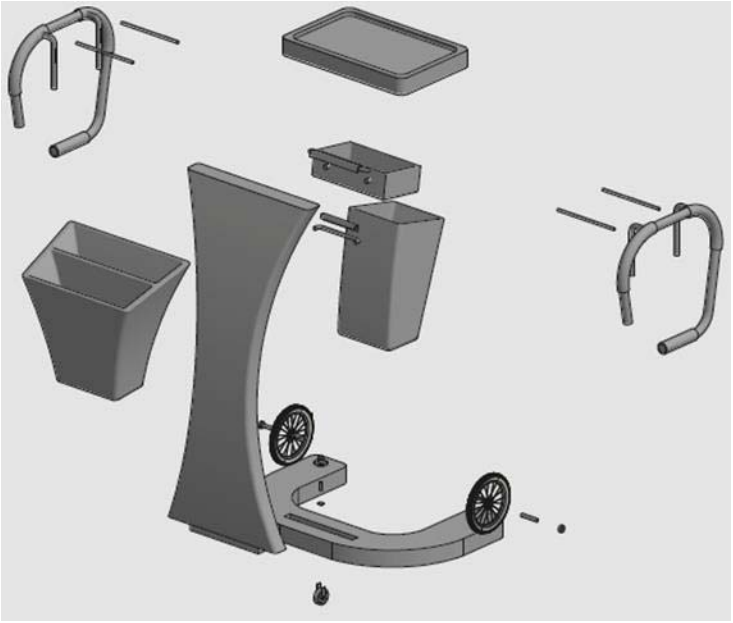


Figure 11: Final 3d Modeling Figure



12: Exploded view of 3d Model

CONCLUSIONS

The idea of designing an auxiliary furniture started from the need of people who, after a surgery involving the vertebral region and then at the stage of rehabilitation. During the rehabilitation phase, the patient should be able to serve their needs at home in the best possible way. This is where the present research focused. It was considered necessary to provide answers to questions concerning the process of patient transition from rehabilitation to normal lifestyles. In the first stage, what is deprived of these people as well as the needs that are created by returning to the home, since others are less able to self-service. Those who know best this information are none other than the patients themselves for whom it is intended to design such auxiliary furniture and by themselves to use it. So it was to draw up a questionnaire which would include all those questions that would be able through the answers that would emerge to "describe" the form, the functions, the materials, the design, any additional benefits but and the cost of furniture.

The analysis of the results of the questionnaires in conjunction with brainstorming, mind map and storyboard determine the initial design of the auxiliary furniture. The answers to the questionnaire show that users would like to have such furniture. They expressed their opinion on the cost of auxiliary equipment, their preference for the construction of the morphology and the use of its parts, as well as the existence or not of auxiliary storage areas. Finally, it was considered very practical to be detached into the individual sections and said that after the recovery phase it could be used as a daily use furniture.

The functional and morphological features which proposed in the questionnaires are those that were depicted in the first sketches. The general morphology of the furniture should give a picture of robust design and stability, while at the same time it should serve in a distinctive way the very specific needs of the users. Storage spaces should be clearly visible and serve accordingly, giving many activities to the user of the furniture. Its basic functions should be user-friendly and easy to implement. The ease of moving

within home was also considered a very important feature of the furniture.

In the final sketches, we had to include the income data from the previous stage Keep those data that are thought to meet the purpose for which they were designed and meet the ergonomic and functional requirements. There were also some new sketches, which better cover the need for discretion. Among other things, some thoughts had to be made about the future use of furniture with a different function. The final drawings, based on the final drawings, provide detailed design details of the resulting design data.

Some further thoughts on improving the furniture are presented below: a) Add sensors to avoid collision with furniture and surfaces inside the house. This function on such a furniture could be a further advantage for the added safety of the users. It can be an extra function which could be a choice to purchase the furniture b) Choosing colors in the different parts of the construction. Different coloring of the parts of the furniture could be a choice of users c) use by people with different mobility problems after the design changes d) Second use of the furniture after the first one.

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