

# Usability of Assistive Technology Products for Daily Life Activities of People with Parkinson's disease

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## 1 Context

Parkinson's disease (PD) is one of the leading causes of physical disability in people over 60 years old. This disease reduces the production of the neurotransmitter dopamine that triggers a sensation of fatigue, progressive tremors, evolving to degrees of muscle stiffness, bradykinesia and changes in posture and instability (ALMEIDA; CRUZ, 2009; SILVA et al., 2010). With the evolution of PD, appear significant motor disorders, making the individual in a need of help in order to perform some or all of their Daily Life Activities (DLA) (ALMEIDA; CRUZ, 2009; SILVA et al, 2010).

Occupational therapists, with the purpose of stimulating functionality, use Assistive Technology (AT) products such as button adapters, cutlery thickeners, dishes with raised edges, support bars, among others, to facilitate the accomplishment of activities, giving more independence to the individual (PELOSI, 2005).

The use of 3D printing for making adaptations for patients with physical dysfunctions is innovative in Brazil. This equipment can enable the development of more appropriate adaptations for the patient, allowing better adjustment, without overlaps and seams, besides being more durable and low cost compared to those existing on the market.

The objective of this study was to evaluate the usability of Assistive Technology products, printed by 3D printing equipment, for daily life activities of patients with Parkinson's disease, considering the variables related to the user and performance of the task (efficiency, effectiveness and satisfaction).

## 2 Methods

The research consisted of one field study, descriptive, observational, cross-sectional. A Comparative Method was used in order to evaluate the usability, in which the evaluation was carried out by Experts, then by Users - evaluations on performance (quantitative) and (qualitative), finalizing with the comparison between both.

The sample was selected in an intentional and non-probabilistic manner, being composed of 05 (five) individuals with PD, attended at the Neurology Clinic of the Clinic's Hospital/Federal University of Pernambuco. Inclusions criteria were: Adults and elderly with idiopathic PD diagnosis, of both genders, without age and education limit, without restriction regarding social class, time of diagnosis and profession, with score above 18 (eighteen) in the Mini Mental State Examination (MMSE) (FOLSTEIN et al. 1975). The exclusions criteria were: people diagnosed with dementia or psychiatric illness; which present any other neurological disease, decompensated systemic diseases and/or orthopedic and rheumatological diseases; which don't have the need to use the AT product in order to improve their performance in daily life activities (aspect identified in the first phase of the study).

In the first stage, the subjects were evaluated based on the clinical picture and performance in the activities. It was developed a universal 3D printed adaptation to utensils compromised daily life activities, such as: adaptations for cutlery, pencil and razor, aiming to adapt the product to the manual grip of the individual. After 30 days, informal interviews were carried out, which included metrics of usability, according to Jordan (1998): efficiency, effectiveness and satisfaction (comfort, safety, task performance). It was also considered the usability measurement criteria established by ISO 9241, such as: analysis on the required characteristics of the product in a specific use context, the interaction process between the user and the product, efficiency (agility in making the task feasible), effectiveness (ensuring the achievement of desired results) and the satisfaction resulting from the use of that product. In order to measure satisfaction, it was used the User Assessment tool with the Quebec Assistive Technology (B-Quest), translated and validated in Brazil in 2014.

In addition, the task analysis was carried out - performing simulations on writing and shaving, brushing teeth and feeding; as they were ambulatory patients, the simulated environment was close to the real one, distinguished with series of steps where were used methods for performing tasks with the product (LEVENTHAL; BARNES, 2008). Quantitative and qualitative data were planed and organized (Microsoft Excel and Word) and the descriptive analysis was applied by simple frequency and number of occurrence.

The project was approved by the Ethics Committee of Research in Human Beings of the Health Sciences Center of the UFPE, under the CAAE registration number 45871615.6.0000.5208, from resolution 466/2012 of the National Health Council.

### 3 Results

Regarding the main socio-demographic aspects of the participants involved in the study (5 subjects), there were 4 males, between 61 and 83 years old, with a completed high school education (2), incomplete (2) and illiterate (1), diagnosed Idiopathic Parkinson's disease (primary disease, not defined cause). As mentioned from the participants, the most compromised activities were: feeding, hygiene, writing and clothing. In this way, 3D adaptation was developed and printed, universal, in order to be used by these patients in the various activities of their daily life.

Regarding the usability attributes related to the product satisfaction (universal adapter), most of the users (3) stated that they were quite satisfied with the dimensions (size, height, length, width) of the TA product, *with the weight (4), ease of adjust (fix) the parts of the resource (3), comfort (4), stability and security of the resource (3)*.

The metrics with more complaints were: a) *Durability of the product* (strength and wear resistance), in which 3 subjects reported being more or less satisfied, due to the rupture of product components, the other subjects mentioned a lot of satisfaction; b) *Efficacy of the product* (how much it meets their needs), in which 2 subjects reported being more or less satisfied and 1 satisfied.

When the interviewees were questioned about items they consider most important, the most cited were: weight, ease of use, effectiveness and adjustments. Among these, efficacy was indicated as an item of dissatisfaction, as already described, pointing to the need to rethink the product design, with requirements that guarantee comfort, safety, efficiency and user satisfaction.

As product recommendations, the following should be highlighted: a) The material used to make the adapter should guarantee more strength and durability, and, at the same time, promote hygiene and maintenance; b) The product must comply with the principles of Universal Design, allowing the use by a greater number of users, but seeking to meet different clinical needs; c) The dimensions of the adaptation should guarantee adequacy to the anthropometric measures of the individual, favoring comfort, decreased muscular fatigue and conservation of energy; d) The adapter should be adjusted to the dimensions of the utensils used in the individuals' daily life (cutlery, razor, pen, among others).

### 4 Conclusions

The research allowed the establishment of requirements for the improvement of adapters (adaptations) printed in 3D for people with PD, aiming independence in the performance of DLA, taking into account usability aspects. However, we recognize that the findings have limitation in the sample size, making it necessary to further the studies with a larger population.

It can be confirmed that studies on product usability can help to identify problems in use, and set requirements for the development of products which better meet the needs of these users.

It is recommended to perform the evaluation of the user's performance in real environment, which was not possible in this study, considering that the patients were in an ambulatory context. In this case, were performed simulations of activities in adapted environments. As developments to the study, we emphasize the need to study the properties of materials used in the adapters, in terms of strength, durability and low cost, in order to guarantee the improvement of the product and spread its application in the daily routine of this population.

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