REVISTA CIENTÍFICA - RECIMA21 ISSN 2675-6218

THE UTILIZATION OF SOFTWARE IN THE COGNITIVE TREATMENT OF PARKINSON'S DISEASE

A UTILIZAÇÃO DE SOFTWARE NO TRATAMENTO COGNITIVO DA DOENÇA DE PARKINSON

LA UTILIZACIÓN DE SOFTWARE EN EL TRATAMIENTO COGNITIVO DE LA ENFERMEDAD DE PARKINSON

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e6106834
https://doi.org/10.47820/recima21.v6i10.6834

RECEIVED: 08/19/2025 APPROVED: 09/19/2025 PUBLISHED: 10/04/2025

ABSTRACT
Parkinson's disease (PD) is a neurodegenerative condition that gradually impairs bodily movement. In addition to motor function, this condition can also affect higher cognitive functions, including memory, cognitive reasoning, and attention. Technological advances have thus emerged as a significant ally in supporting the mental treatment of these patients. The objective of this article is to examine the function of software developed for therapeutic purposes in the cognitive monitoring of individuals with Parkinson's disease, utilizing accessible digital models and personalized stimuli. The objective is not to supplant clinical treatment, which remains indispensable, but rather to augment therapeutic strategies through the integration of computer innovations. The findings of this study underscore the significance of augmenting technological development in accordance with the requirements of the intended demographic, with a view to promoting patient-centred solutions.

KEYWORDS: Parkinson. Cognitive. Software. Health.

RESUMO
A Doença de Parkinson (DP), doença neurológica que afeta os movimentos progressivamente, não atinge somente as funções motoras, mas também as funções cognitivas como a memória, raciocínio e atenção. Desse modo, os avanços tecnológicos têm se apresentado como um grande aliado no suporte do tratamento mental desses pacientes. O artigo tem como objetivo, observar os papéis de softwares desenvolvidos com fins terapêuticos no acompanhamento cognitivo de pessoas com Parkinson, com modelos digitais acessíveis e estímulos personalizados. A proposta não é substituir o tratamento clínico, visto que é essencial, mas reforçar estratégias terapêuticas por meio de inovações computacionais. Os resultados levam para a importância de incrementar desenvolvimento tecnológico de acordo com as necessidades do público-alvo, promovendo soluções centradas no paciente.

PALAVRAS-CHAVE: Parkinson. Cognitivo. Software. Saúde.

RESUMEN
La enfermedad de Parkinson (EP), una dolencia neurológica que afecta progresivamente al movimiento no sólo afecta a las funciones motoras, sino también a funciones cognitivas como la memoria, el razonamiento y la atención. Por ello, los avances tecnológicos han demostrado ser un

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gran aliado para apoyar el tratamiento mental de estos pacientes. El objetivo de este artículo es analizar el papel del software desarrollado con fines terapéuticos en el seguimiento cognitivo de las personas con Parkinson, utilizando modelos digitales accesibles y estímulos personalizados. La propuesta no es sustituir el tratamiento clínico, que es esencial, sino reforzar las estrategias terapéuticas mediante innovaciones informáticas. Los resultados muestran la importancia de incrementar el desarrollo tecnológico en función de las necesidades del público objetivo, promoviendo soluciones centradas en el paciente.

PALABRAS CLAVE: Parkinson. Cognitivo. Software. Salud.

INTRODUCTION

The neurodegenerative disorder, known as Parkinson's Disease (PD), has a chronic and gradual course and affects the motor system, particularly in elderly individuals. The motor symptoms of this condition are widely recognized, including tremors, rigidity, and loss of balance. However, it should be noted that the disease also has a significant impact on cognitive functions such as memory, language, and executive function, which are often treated as a secondary aspect of the condition. These symptoms include dementia and depression. This damage has the potential to exert a significant influence on the patient's autonomy and quality of life (Marques, 2023).

In consideration of the fact that it compromises both comfort and health, technological evolution has resulted in the idealization and combination of a new alternative for assistance, in the form of digital tools capable of assisting in the treatment of various health conditions, including cases of Parkinson's disease. The utilization of software designed for the purpose of mental stimulation and rehabilitation is witnessing a surge in popularity as a complement to conventional treatment modalities.

This software offers customized and interactive exercises with convenient accessibility, thereby providing a valuable addition to existing therapeutic interventions. In light of the aforementioned analysis, the establishment of technological collaboration with PD patients in a straightforward and accessible manner signifies a significant advancement within the domains of health and technology (Eurofarma, 2025). The central question guiding this study is: how can software be effectively utilized in the management of Parkinson's disease?

The objective of this study was to analyze the effects of using software designed to develop technological artefacts that assist in the treatment of Parkinson's Disease. Therefore, in order to achieve the aforementioned results, specific objectives were defined with the aim of: a) discussing, based on scientific evidence, the non-motor manifestations of PD; b) reflecting on the importance of integrating computer technologies as a complement to clinical treatment; c) providing practical and educational information for people with PD and for their families and caregivers; d) presenting the importance of exercising patients and users of the software to develop lost facial expressions, complementing and aiding the treatment of PD.

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In consideration of the conditions presented by the investigation of the object of study, the scope of this research was delimited to the investigation of technological solutions applied specifically to cognitive stimulation, excluding approaches focused specifically on motor or pharmacological aspects. In order to proceed with a meaningful discussion of the use of technology in the treatment of PD, it is first necessary to understand the current state of play in this field.

Therefore, it is crucial to comprehend and acknowledge the subject matter presented, supported by scientific evidence, objective justifications, and critical analysis. This analysis should encompass a comparative perspective on PD and other neurodegenerative diseases, such as Alzheimer's and other types of dementia. It is noteworthy that Parkinson's disease receives minimal attention when discussing the utilisation of technologies, particularly software, as a component of treating symptoms.

Despite the existence of numerous digital tools designed to facilitate cognitive stimulation, memory monitoring and support for caregivers in cases of Alzheimer's disease, there remains a lack of alternative solutions that are tailored to the specific needs of individuals living with Parkinson's disease. Moreover, the significance of this research is underscored by its relevance in addressing the favourable outcomes previously observed with the utilization of existing software programs for the treatment of PD. These programs have exhibited remarkable efficacy in the domain of cognitive function rehabilitation and the employment of technologies in the management of neurodegenerative diseases.

Research is the key to finding digital solutions that address this reality, looking to the future with greater care, inclusion and an improved quality of life for those living with this condition every day.

THEORETICAL BACKGROUND

Parkinson’s Disease

PD is a neurodegenerative condition defined by the progressive loss of neurons, resulting in motor and non-motor impairments (Braak *et al.,* 2003). The most prevalent motor symptoms encompass resting tremors, muscle rigidity, reduced movement speed, and postural instability (Ministry of Health, 2023). However, the clinical manifestation can vary between patients, as it can be influenced by genetic factors. The disease typically progresses in a gradual manner, significantly interfering with the quality of life of the individual affected. According to estimates by the World Health Organization (WHO), approximately 8.5 million individuals worldwide are affected by Parkinson's disease.

The clinical diagnosis of this condition is made on the basis of the observation of symptoms and the exclusion of other neurological conditions. Treatment is symptomatic in nature, involving the administration of drugs that increase or mimic the effects of dopamine. Despite the absence of

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a definitive cure, early interventions have been demonstrated to yield substantial improvements in patients' functional symptoms. Despite the presence of motor symptoms, PD has the capacity to induce cognitive changes that gradually evolve as the clinical condition progresses.

As Fonoff (2024a) have demonstrated, the aforementioned alterations include deficits in memory, attention and executive functions, with particular difficulties in recalling information. These initially mild alterations can progress to dementia, further compromising the patient's autonomy. Dementia associated with Parkinson's disease (PD) has been shown to impact various cognitive functions, including verbal fluency, planning ability, and mental processing speed. This condition is widely regarded as one of the most disabling factors associated with PD. Multidisciplinary support, incorporating neurological and psychological monitoring in conjunction with cognitive rehabilitation therapies, is imperative for the preservation of mental functions.

It is imperative to acknowledge that the management of Parkinson's disease should extend beyond a mere pharmacological approach, encompassing complementary therapeutic modalities such as physiotherapy, speech therapy, occupational therapy, and psychological support. Continuous monitoring facilitates adaptations to the patient's needs over time, promoting greater autonomy and quality of life (Fonoff, 2024b). Information and family support are of paramount importance, given the profound emotional and social impact of the disease's progression.

Research indicates that up to 80% of patients develop mild cognitive impairment or dementia in advanced stages (Aarsland *et al.,* 2020), with comorbidities such as depression exacerbating the condition. In the context of this situation, cognitive rehabilitation has emerged as an essential complementary approach. The advent of contemporary medicine, electronic technology and artificial intelligence has enabled health and technology professionals to develop applications that facilitate effective rehabilitation.

Rehabilitation Software

Rehabilitation software has become a recognized instrument in the treatment of various neurological, cognitive and motor conditions. These programs characteristically comprise interactive, adaptive and personalized exercises intended to restore or compensate for impaired functions, in addition to providing continuous monitoring of the patient's progress.

Neuroplasticity, defined as the brain's capacity for reorganization in response to external stimuli, forms the theoretical foundation for the utilization of digital interventions (Klein; Jones, 2008). The efficacy of therapeutic software in the domain of cognitive stimulation has been demonstrated by the utilization of RehaCom (for stroke rehabilitation) and Lumosity (for Alzheimer's disease). These software applications employ systemic and personalized exercises to enhance cognitive function. However, while digital tools are available for diseases such as Alzheimer's (e.g. MindMate), no such tools exist for PD, thus indicating a market gap (Dorsey *et al.,* 2020).

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Scrolling Therapy (Eurofarma) is an exception that merits particular attention, given its promising results in improving cognitive and motor functions in patients diagnosed with PD. The accessibility of the design, with activities adaptable to the severity of symptoms, demonstrates the potential of technology to address unmet needs.

However, the development of software for PD necessitates a more meticulous approach, encompassing the incorporation of intuitive interfaces (to compensate for tremors) and the integration with conventional therapeutic modalities such as physiotherapy and speech therapy. The theoretical basis highlights the urgency of investing in digital technologies for PD, aligning scientific evidence on neuroplasticity with the practical needs of patients. The analysis of Scrolling Therapy and other relevant methodologies in the methodological section will facilitate an assessment of the practical manifestation of these principles, thereby offering insights that will inform future innovations.

METHOD

The present study is characterized as a qualitative research, where epistemologically it is classified as exploratory and descriptive, and as for the means, the research is classified as bibliographical, as it has data collection in digital material (Merriam, 1998).

Bardin (2011) posits that the selection of these typologies is substantiated by the necessity to comprehend extant literature and the applications of technologies to facilitate the mental treatment of individuals diagnosed with PD. The research sample utilizes secondary data, with a focus on the analysis and interpretation of content relevant to the subject.

A comprehensive search strategy was employed, encompassing Web of Science and Scopus searches. The primary focus of this strategy was on identifying scientific articles published between 2010 and 2024, in both Portuguese and English languages. In this particular instance, the systematization process advocated by Creswell (2010) involved the utilization of inclusion or exclusion criteria. The selection of articles was conducted in accordance with a set of inclusion and exclusion criteria (Sousa, 2025).

Then, the articles accepted were those written in English or Portuguese which addressed themes related to digital sciences and cognitive rehabilitation. With regard to the latter, articles were excluded if they did not meet the stipulated language criteria, if they were published outside the specified period between 2010 and 2024, or if they did not address the theme under study (Sousa, 2018).

The article provides a descriptive analysis of software and digital tools aimed at therapeutic support for cognitive functions in patients with Parkinson's disease. The objective of this study was to analyze the conditions of use reported by researchers in these journals with regard to the use of software, its functionalities, practical applications, therapeutic objectives, and the benefits achieved or intended (Sousa, 2024).

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The documents subjected to analysis pertain to a population of individuals diagnosed with Parkinson's disease who exhibited specific cognitive symptoms at an initial or intermediate stage.

This delimitation also takes into account the possibility of adherence to the use of technologies with less need for constant mediation by third parties, allowing for a more direct observation of the impacts of digital intervention on the daily lives of these individuals. The sampling method that will be adopted is non-probabilistic by criteria, also known as purposive sampling.

The selection of this particular sample was driven by the necessity to identify participants who met specific criteria pertinent to the research objective, thereby facilitating a more targeted analysis of the efficacy of software utilization in supporting cognitive treatment (Creswell, 2010).

The methodology employed in this study will be content analysis, a technique that, as Bardin (2011) asserts, aims to identify patterns, reported effects, limitations, and benefits observed in documented experiences. This approach facilitates a critical understanding of the impacts of these technologies, even in the absence of primary data, thereby contributing to reflection on the role of digital innovation in the non-pharmacological treatment of PD.

RESULTS AND DISCUSSION

The extant literature review, based on the studies surveyed, shows that the use of software and digital technologies in the treatment of Parkinson's disease has been consolidating in a promising way to support cognitive and motor functions.

As posited by Marques *et al.,* (2023) and Sousa (2024), non-motor symptoms of PD, including memory loss, changes in attention, and difficulty in reasoning, have been shown to have a substantial impact on patients' quality of life. In this context, the utilization of therapeutic software emerges as a complementary strategy for cognitive rehabilitation. The following is a list of the main software and technologies used:

Scrolling Therapy

Scrolling Therapy, a product of a collaborative effort between the creative agency Dentsu and Eurofarma, with support from the Brazil Parkinson's Association (2025), serves as a prime example of the potential of these digital tools. The evaluations have demonstrated enhancements in concentration and the execution of tasks that demand short-term memory and logical reasoning skills. These abilities are pivotal to patients' daily autonomy.

The software was launched in ten countries and has been utilized by over 45,000 medical professionals. The software was developed with the objective of improving symptoms within a period of twelve weeks of daily use. The Scrolling Therapy tool is available free of charge globally on Google Play and the Apple App Store and can be downloaded in three languages: The languages under consideration are Portuguese, English and Spanish.

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The application under discussion employs Artificial Intelligence (AI) in order to facilitate the execution of facial exercises by its users. The tool is activated by movements of the forehead, eyebrows, nose, and other facial expressions. These movements have been shown to strengthen the facial muscles and complement treatments for this type of condition, especially in cases of facial muscle atrophy and hypomimia. The system is characterized by its ease of use and capacity for automatic integration with patients' social networks, specifically Facebook and Instagram. This integration has the potential to mitigate the physical limitations imposed by the disease. This approach fosters enhanced autonomy and improves social interaction, thereby enhancing patients' quality of life.

Scrolling Therapy has proven to be an efficacious intervention for emotional symptoms frequently associated with Parkinson's disease (PD), including apathy and mild depression. Interacting with technology in a playful and everyday way has been shown to provide positive stimulation for patient engagement, promoting a sense of personal progress and autonomy. An examination of user reports indicates an enhancement in self-esteem, as well as an inclination to engage in daily activities, including those that were formerly eschewed. Such impacts, although less extensively investigated, are fundamental to overall well-being.

The utilisation of the platform on a daily basis has the potential to function as a reinforcing motivational mechanism, thereby becoming integrated into the subject's routine as a component of self-care. This contributes not only to treatment adherence but also to the patient's social rehabilitation. The therapeutic aspect thus transcends the physical and reaches significant psychosocial dimensions.

Another salient point pertains to its accessibility, which is noteworthy in view of the fact that it does not necessitate the use of costly equipment or intricate infrastructure. This attribute renders it a viable alternative in low-income contexts or regions characterized by constrained access to specialized physical therapy services. Its integration with common mobile devices facilitates the incorporation of the tool into the patient's daily life, thereby eliminating geographical and logistical barriers. Furthermore, the utilization of facial movements as the primary method of command ensures that the application accommodates each user's motor limitations, adapting to their capabilities without inducing frustration. This personalized digital inclusion contributes to a more humanized and efficient experience.

The application is positioned as a contemporary and available supplement to the treatment of Parkinson's disease, in conjunction with other therapeutic resources. Consequently, this approach serves to reinforce the potential for a more holistic and patient-centred model of care.

Revparkinson

Another significant instrument in this field is the RevParkinson application (app), which was developed by academics at the Federal University of Amapá (UNIFAP). This app provides support

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for the management of drug treatment and enables users to monitor the progression of PD symptoms. The distinguishing characteristic of RevParkinson is the incorporation of features that not only serve to remind patients about their medication but also monitor the progression of both motor and non-motor symptoms, thereby providing greater control over the progression of the disease in each individual patient.

The app's validation tests took place in three stages of technical testing:

- **Stage 1:** 20 UNIFAP academics were recruited to use the app and provide feedback. As a result, bugs in the registration process and display errors were reported.
- **Stage 2**: 12 students were selected for testing. Notification errors were noted.
- **Stage 3:** 20 more academics were selected. The app was used without apparent errors, with a fluid and simple experience, as predicted in the app requirements survey.

In addition to the highlighted features, the app stands out for its adaptable structure, which allows for the incorporation of new features based on user feedback in future updates. This increases the diversity of usage options and enables continuous improvement. The intuitive interface facilitates navigation for those with limited technological experience, which is crucial in the context of neurodegenerative diseases such as Parkinson's disease, ensuring favorable simplicity.

The system enables the detailed recording of symptoms over time, creating an individualized history that can be shared with healthcare professionals to promote a more accurate and personalized approach to clinical follow-up. According to Francisco *et al.,* (2024), the development of the application involved technical, usability, and accessibility criteria, reinforcing its potential as a support tool in medical practice and self-care.

RevParkinson emerges as an innovative tool for supporting the treatment of Parkinson's disease by combining simplicity, functionality, and accessibility. It favors patient autonomy and contributes to more effective monitoring of symptom progression. Furthermore, it has the potential to be incorporated into care routines, benefiting both patients and healthcare professionals. In this context, technology emerges as an ally in promoting quality of life and personalized disease management, fostering autonomy and offering numerous benefits.

Augmented Reality

In addition, technologies such as augmented reality (AR) have been shown to significantly benefit rehabilitation. A study by Halim and Merhy (2020) showed that using AR devices with audiovisual stimuli promotes functional and cognitive improvement in patients with Parkinson's disease (PD). These resources make therapy more motivating and accessible and can be used in clinics and at home with professional supervision.

The application of AR in the context of PD is a significant advance in neurofunctional rehabilitation, particularly as it enables the simulation of everyday activities within a safe and

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controlled environment. This feature promotes the progressive readaptation of patients by stimulating the mind and helping to maintain functional independence. Furthermore, by integrating visual and auditory stimuli with bodily movements, AR improves the sensorimotor response, thereby enhancing the effectiveness of therapy. Using these technologies can also generate objective data on patient performance, enabling personalized treatment adjustments.

As technological devices become more accessible, health professionals gain a complementary monitoring tool, which could lead to their inclusion in public health programmes (Halim; Merhy, 2020).

Furthermore, Loureiro *et al.,* (2012) analysed virtual therapy based on platforms such as Nintendo Wii and found that it improved patients' balance and quality of life.

The tests were conducted with six PD patients, with an average age of 65. The participants underwent therapy activities using Wii Fit (an exercise game developed for the Nintendo Wii console). As a result, interactive games increased motivation, improved functional reach and reduced the perceived effort of daily activities, all of which are important for fall prevention and greater autonomy. The article emphasizes that virtual reality therapy exercises can be a useful tool for improving balance in patients with PD (Halim; Merhy, 2020, p. 660).

Consequently, these findings demonstrate that the utilization of software and emerging technologies in the treatment of PD extends beyond mere motor rehabilitation, concurrently providing indispensable cognitive stimulation. However, studies indicate limitations, including the necessity for patients to adapt to new technologies and the requirement for more robust clinical trials to substantiate this evidence. (Souza, 2025).

It is therefore observed that the integration of personalized digital tools in the treatment of PD is an effective strategy to complement traditional clinical treatment, increasing patient engagement, promoting autonomy, and significantly improving quality of life, even when the tools are not yet fully developed. In order to validate the long-term efficacy of AR, further studies employing larger samples and standardized methodologies are required.

The integration of technological innovation and humanized care should be the central focus in the subsequent stages of the development of these tools. In this regard, Loureiro *et al.,* (2012) demonstrate how interactive therapies increase motivation and generate positive impacts on the quality of life of patients with PD.

From this standpoint, technological advances must be accompanied by strategies with ongoing support, ensuring that AR resources are used appropriately and efficiently. It is imperative to recognize the significance of training for professionals, patients, and caregivers in order to optimize the anticipated benefits.

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Virtual Reality

Virtual reality (VR) technology is also employed to assist people with PD, but in contrast to AR, it generates an entirely novel and immersive digital environment. Conversely, AR superimposes digital components onto the physical world. The analysis of the extant studies revealed that non-immersive technologies are the most widely used. These technologies primarily utilize consoles such as the Nintendo Wii and the Xbox 360, equipped with Kinect, which are connected to a monitor and employ software designed specifically for these video games.

The classification of VR modalities can be approached through a tripartite lens, with immersive, semi-immersive, and non-immersive categories being the fundamental taxonomical framework. This classification system is predicated on an analysis of the interaction between the user and the virtual environment. The system's capacity for immersion is contingent upon the extent to which external stimuli is minimized.

Semi-immersive systems offer partial isolation, while non-immersive technologies do not isolate the user from the real world. In their seminal study, Maidan *et al.,* (2017) assess the extent of brain plasticity in patients suffering from PD, who are undergoing cognitive-motor training. To this end, functional magnetic resonance imaging is employed, with the experimental group being subjected to a treadmill and an immersive VR simulator with two modes: free walking and walking with obstacles.

While the control group was confined to using the treadmill, it was observed that the experimental treatment enabled greater activation in the cerebellum and middle temporal gyrus. Consequently, the repercussions on changes in brain activation patterns have been shown to improve functional capacities, thereby aiding in the management of complex everyday situations and reducing the risk of falls. This phenomenon can be attributed to the development of goal-based skills, the increased demands on attention, and the enhancement of motivation.

Table 1 contains the studies included in the review, arranged by author and year of publication. The table also indicates the applicability of the technology in Parkinson's disease and the contributions that the work has made.

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Table 1. Studies using virtual reality therapy for Parkinson's disease (2019)

Author	Applications	Contributions
MELO, G. E. L. *et al.,* (2018)	Walking training with non-immersive VR to improve walking (motor coordination) and physical fitness.	As effective as treadmill training in terms of increasing walking distance, improving gait time variables, and reducing fatigue. In terms of physical fitness, the treadmill is more effective.
MAGGIO, M. G. *et al.,* (2018)	Cognitive and behavioral recovery with semi-immersive VR.	Improvement in cognitive functioning (executive and visuospatial skills).
GANDOLFI, M. *et al.,* (2017)	Home-based balance training to improve postural stability with non-immersive VR.	A viable alternative for reducing postural instability.
MAIDAN, I. *et al.,* (2017)	Assessment of brain activation of motor and cognitive aspects using immersive VR.	Dependence on frontal regions decreased, which apparently resulted in improved function, perhaps reflecting increased brain efficiency.
ROBLES-GARCIA, V. *et al.,* (2016)	Training with motor imitation therapy focused on hypometria using non-immersive VR.	It suggests that it increases the effect of motor practice and reduces hypometria.
YANG, W. C. *et al.,* (2016)	Balance training, walking training, and quality of life with non-immersive VR.	There was no significant difference between VR balance training and conventional training. Both were effective in improving balance, walking, and quality of life.
SANGUINETI, D. C. M. *et al.,* (2016)	Contribution to quality of life with non-immersive VR.	It benefits quality of life, especially when it encompasses mobility, emotional well-being, stigma, and cognition.
LIAO, Y. Y. *et al.,* (2015)	Training for obstacle course performance and dynamic balance.	Significant improvement in obstacle crossing performance and dynamic balance, supporting the implementation of training.
SANTANA, C. M. F. *et al.,* (2015)	Contribution to quality of life with non-immersive VR.	It contributed positively to quality of life, with significant improvements in mobility, emotional well-being, stigma, and cognition.

Source: elaborated by the authors (2025)

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CONCLUSION

The integration of scientific rigor with user-centred design in cognitive software represents a substantial advancement in the non-pharmacological management of PD. While the potential impact of this technology is significant, its actual benefits will be contingent on the implementation of policies that ensure equitable access and sustained collaboration among developers, healthcare professionals, and patients. The humanization of technology, through the application of caring principles, has the potential to transform the landscape of healthcare. This study also demonstrated that the care of individuals with PD encompasses a broader scope than merely addressing motor symptoms, which, it must be acknowledged, are of significant importance.

Therapeutic software such as Scrolling Therapy and RevParkinson can help to improve patients' daily lives, offering them hope and autonomy. The challenges of caring for patients are manifold, especially when considering the financial obstacles to funding research of this scale and ensuring access to the necessary technologies. The visibility of people with Parkinson's is also a complex issue, since most people see little hope for treatment and have limited knowledge of the disease because it is distant from the reality of so many.

The results obtained reveal persistent gaps in PD care, highlighting the urgent need to invest in accessible, scientifically validated solutions. The complexity of the disease requires varied responses, and when used well, software is a significant step in the right direction.

Another important point is the positive outcomes achieved through the use of new technologies and innovative software in treating the disease. Although this tool requires further improvements and adjustments due to limitations in studies and technologies, which are still scarce in some respects, and changes are needed to support each patient individually, the software has proven to be highly effective.

As discussed earlier, it is also important to highlight the significant role that AR and VR have played in PD care. The use of new technologies and tools, such as those developed for the Nintendo Wii and Xbox 360, has provided invaluable assistance to PD patients.

Despite the difficulties encountered, it is clear that health and technology professionals are doing commendable work. The positive results are crucial proof that the combination of health and technology contributes most significantly to improving the quality of life of society in general.

Technologies such as these significantly benefit society and offer hope that more digital innovations will emerge in the future, providing collective benefits similar to those presented in this analysis.

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