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Reflection Article/Essay

Immersive virtual reality in Palliative Care: prospects for Total Rehabilitation

Realidade virtual imersiva nos cuidados paliativos: perspectivas para a reabilitação total

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Abstract

Introduction: Virtual Reality presents itself as a promising tool for improving health technologies and enhancing interventions to improve the functionality and quality of life of patients and families facing progressive diseases and/or life-threatening conditions. **Objective:** This essay discusses the promising role of Immersive Virtual Reality in Palliative Care rehabilitation and proposes the concept of Total Rehabilitation as a possibility to expand the current conception of rehabilitation. **Method:** We present reflections based on the Total Pain theory, typical of Palliative Care, and the inclusion of New Technologies in health, especially in the field of rehabilitation, through documents based on the reflexive line that the authors intend to submit for consideration and public debate. **Results:** The role of Immersive Virtual Reality in health interventions is important and promising, as well as the conceptual proposal for expanding the concept and understanding of Rehabilitation, coining the term Total Rehabilitation. In addition, the reflective process of debate on therapeutic possibilities and their innovations was fostered. **Conclusion:** From Total Rehabilitation, innovations related to health care, whether technological and/or clinical practices, can be improved and made available through interventions in physical and/or virtual environments, having global functionality and human dignity as premises for rehabilitation processes, with actions that involve the physical, social, psychological and spiritual dimensions, as presented by the concept of Total Pain.

Keywords: Virtual Reality, Virtual Reality Exposure Therapy, Palliative Care, Rehabilitation.

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Resumo

Introdução: A Realidade Virtual se apresenta como ferramenta promissora para aprimoramento de tecnologias em saúde e potencialização de intervenções para a melhora da funcionalidade e qualidade de vida de pacientes e familiares que enfrentam doenças e/ou condições progressivas ameaçadoras da vida. **Objetivo:** Este ensaio discute o papel promissor da Realidade Virtual Imersiva na reabilitação em Cuidados Paliativos e propõe o conceito de Reabilitação Total como possibilidade para ampliação da concepção de reabilitação atual. **Método:** Apresentamos reflexões baseadas na teoria de Dor Total, própria dos Cuidados Paliativos, e a inserção das Novas Tecnologias na saúde, especialmente no âmbito da reabilitação, por meio de documentos baseados na linha reflexiva que os autores pretendem submeter à apreciação e ao debate público. **Resultados:** É importante e promissor o papel da Realidade Virtual Imersiva em intervenções de saúde, bem como a proposta conceitual de ampliação do conceito e compreensão de Reabilitação, cunhando o termo Reabilitação Total. Além disso, fomentou-se o processo reflexivo de debate sobre as possibilidades terapêuticas e suas inovações. **Conclusão:** A partir da Reabilitação Total, inovações relativas ao cuidado em saúde, sejam tecnológicas e/ou das práticas clínicas, podem ser aprimoradas e disponibilizadas através de intervenções em ambientes físicos e/ou virtuais, tendo como premissas para os processos de reabilitação a funcionalidade global e dignidade da pessoa humana, com ações que envolvam as dimensões física, social, psicológica e espiritual, tal como apresentado pelo conceito de Dor Total.

Palavras-chave: Realidade Virtual, Terapia de Exposição à Realidade Virtual, Cuidados Paliativos, Reabilitação.

Introduction

Virtual Reality (VR) is defined as the use of computer technology to create, maintain an environment and project the physical presence of a user in it, allowing their interaction with the environment (Cipresso et al., 2018).

VR emerged in the 60s and has been gaining notoriety for the development and improvement of applications and software that optimize means of interaction for users. In addition, the improvement of devices such as immersive glasses and 360° cameras, and their applicability in various sectors, such as education, engineering, military training, healthcare and others, stimulate their growth (Matthews, 2018; Cipresso et al., 2018).

In the health area, particularly in rehabilitation, VR has been presented as a promising tool in the improvement of technologies (Johnson et al., 2018) and potentialization of intervention methods and techniques to improve the quality of life of patients and their families, who face progressive and/or life-threatening diseases or conditions (Cho & Lee, 2019; Izard et al., 2018; Ferguson et al., 2020; Kim et al., 2018).

Virtual Reality Exposure Therapy (VRET) is understood as a therapeutic technique, in a virtual environment, which allows the participant to experience a sense of presence in an immersive, three-dimensional and interactive computational environment that

minimizes the nullification behavior and facilitates the emotional involvement (Gerardi et al., 2010).

In this context, clinical studies demonstrate the effectiveness of VRET in health care. Its use has been directed to diseases, conditions and symptoms, such as pain treatment (acute and chronic), for its attenuation and/or distraction from invasive therapies (Ahmadpour et al., 2019), fatigue (Ioannou et al., 2020), sleep disorders (Lee & Kang, 2020), stress control (Vaquero-Blasco et al., 2021), phobias, anxiety and depression (Felnhofer et al., 2019), motor rehabilitation (Tieri et al., 2018), among others. In addition, VRET can facilitate the understanding and acceptance of the disease by the patient and their families, as well as the work of motivational aspects to start and maintain treatment (Hsieh, 2020), affirmation of life and acceptance of death as a natural process, in addition to stimulating social interaction, affectivity and spirituality (Murdoch & Davies, 2017; Wijma et al., 2018).

Thus, it is important to encourage the incorporation of VRET into care plans that aim at actions to maintain and gain functional reserve, as well as delay the decline of global functionality, positively impacting the quality of life and dignity of care symbionts (patients, family members/caregivers and multidisciplinary teams) (Hsieh, 2020; Nwosu et al., 2021).

In the meantime, Palliative Care (PC) stands out as a technical-scientific framework needed to guide care plans. PCs present an approach that aims to prevent and alleviate suffering and to promote dignity, better quality of life and adaptation to progressive diseases and/or conditions for adults and children living with serious health problems, acute or chronic, complex and/or life threatening, as well as to their families (Gómez-Batiste & Connor, 2017). It is based on the concept of Total Pain by Cicely Saunders (Miccinesi et al., 2020) – which understands that not only the physical components of pain must be considered, but also the social, psychological and spiritual dimensions.

In this sense, the objective of this work is to present a reflection on perspectives of Immersive Virtual Reality for the rehabilitation of patients in Palliative Care and to propose a rehabilitation concept that considers technological transformations as promising for health care. As a basic premise, the Total Pain theory was used, incorporating a multidimensional view of human pain and suffering to rehabilitation, thus, presenting the concept of Total Rehabilitation.

Therefore, this essay was built based on the choice of references that seek to reflect the position and reflective line of the authors, according to the perspective of Total Pain (Miccinesi et al., 2020), coined by Cicely Saunders — considered the precursor of the Modern Palliative Care — as well as more recent concepts related to Palliative Rehabilitation Care, proposed by Rebecca Tiberi and endorsed by the World Health Organization (WHO) (Tiberini & Richardson, 2015; World Health Organization, 2018).

Immersive Virtual Reality in the Fields of Health and Rehabilitation

Changes in the demographic and epidemiological profiles of populations, with an aging population and a higher prevalence of chronic conditions in the global morbidity and mortality profile, in addition to the progressive increase in health costs, due to the intense focus of care and privilege of hospital-centered care models focused on the the

use of high technological density diagnostic and therapeutic technologies have triggered changes in the health care model in different countries towards care closer to the territory and innovative strategies, such as Intermediate Care. Thus, there is a fertile space for the presentation of methodologies that meet the world's health needs with quality, effectiveness and efficiency, especially in the area of Rehabilitation (Tieri et al., 2018).

Hence, the combination of the rehabilitation protocol with the use of new technologies (including robotics, computer interfaces of the brain, non-invasive brain stimulators, neuroprosthetics, wearable device for movement analysis, tablet for neurological rehabilitation and Virtual Reality) can provide better projections of results for rehabilitation. Among these technologies, a growing amount of scientific evidence points to Immersive Virtual Reality (immersive VR) as a promising tool for enhancing outcomes in Rehabilitation (Izard et al., 2018; Montana et al., 2019; Qian et al., 2020; Zhu et al., 2021).

Immersive VR presents, in the field of health, a kind of revolution that ranges from concepts related to forms of treatment and care, changes in intervention methods and training in different specialties such as physiotherapy, psychology, medicine, nursing, occupational therapy, physical education and others (Izard et al., 2018; Cipresso et al., 2018).

In addition, VRET is an alternative to traditional therapies, being understood as a computer-based, virtual, three-dimensional, interactive and immersive treatment technique, which allows the participant to experience a sense of presence, reducing the avoidance behavior of therapies and facilitating the emotional involvement of the patient (Gerardi et al., 2010).

The concept of "presence" is central to theorizing about advanced virtual environments such as Immersive VR. Presence can be characterized as the sense of being at the center of the observational perspective and, at the same time, at the center of its construction (Weber et al., 2021). It is a complex psychological feeling of immersion in VR that involves the sensation of physical presence and the possibility of interacting and reacting as if the user were in the real world. The greater the level of realism of the presented stimuli, the more the user's expectation will be congruent with the reality expectation. Thus, "presence" can be understood as the perceptual illusion of non-mediation.

With Immersive VR, the professional has control over the planned intervention, limited only by the characteristics of the software used in the experience content (Gerig et al., 2018; Pardo et al., 2018). Thus, the professional will be able to offer a safe and private context for the patient, facilitating their accession, engagement and adherence. In other words, the mediation of the virtual experience by the professional is extremely important for therapeutic success (Johnson et al., 2018).

However, for such effects to be evidenced, issues related to the stage of disease progression and/or condition in which the patient and/or family members/caregivers are found (initial, intermediate, advanced and/or mourning) need to be considered, as well as necessary individual physiological adaptations, technological limitations and specificities of the use of Immersive VR for each stage of life.

The power of Immersive RV is its immersive and interactive relationship, which works to bring subconscious memories into conscious awareness (Matthews, 2018). The

potential of VR is staggering, especially when it comes to using avatars and action-driven digital representations, often in real time. Psychological experiments point to changes in behavior after virtual experiences with avatars. These changes include greater confidence, because their avatars have characteristics considered privileged and desired by users, for example, height, appearance, or better situation/functional and health capacity (Blascovich & Bailenson, 2011). In addition, the incorporation of body shadow can represent a class of high-priority stimuli that acts by "pushing" attention to the body itself, contributing to cognitive and motor recovery and strengthening the sense of presence (Russo et al., 2017).

VR presents itself as a safe environment that allows the patient to explore and test hypotheses, as well as develop more effective coping skills, strengthening psychological functions that have become weakened or deviated by the aging process itself, anxiety or intense trauma, in addition to illness or treatments (Gerardi et al., 2010; Matthews, 2018).

VRET, therefore, can represent itself as a portal to the imagination, being a space in which patients can unpack their own memories, imaginations and experiences and create their own reality. Doing so can help change the reality for which they were treated, overcome fears, traumas or conditions related to stress and other conditions (Buyuk et al., 2021; Felnhofer et al., 2019; Gerardi et al., 2010). Patients bring their own memories and transform a computer-generated fantasy world into a place they recognize, past or present, that awakens a connection to their own history.

The application of VR systems for the rehabilitation of a variety of deficits resulting from nervous system injuries is increasing. The rehabilitation of patients with cerebrovascular accident sequelae stands out, especially regarding the functionality of the upper extremities (Cho & Lee, 2019; Tieri et al., 2018). Several VR systems for upper limb rehabilitation have been developed and tested around the world, following different therapeutic methods and concepts: systems to train reaching movements based on the imitation of a virtual instructor; based on haptic devices (tactile devices, which provide sensory feedback to users when they touch virtual objects); general movement training by mental rehearsal, imitation of nonparetic arm movements; among others (Tieri et al., 2018).

It is evident that, after VR training, neuroplasticity causes cortical reorganization, in which cortical activation is reorganized from contralesional activation (before VR) to ipsilesional (after VR); that is, there is a change in the cortical organization of the affected limb from the ipsilateral hemisphere to the contralateral hemisphere after VR intervention (Jang et al., 2005). This is probably due to the fact that VR may have promoted the practice-dependent reorganization resulting from the increased amount of use of the affected limb in relevant motor tasks (Jang et al., 2005).

In addition, VR allows for relaxation therapies and stress management in people in confined or isolated environments (such as hospitals), especially when combined with individual preferences for the creation and choice of virtual environments (Anderson et al., 2017; Johnson et al., 2020; Perna, 2021). Furthermore, VRET also facilitates the understanding and acceptance of the disease by the patient and their families, affirmation of life and acceptance of death, in addition to stimulating social interaction and spirituality (Murdoch & Davies, 2017; Wijma et al., 2018; Hsieh, 2020; Nwosu et al., 2021).

We believe that, like other multidimensional care techniques in Palliative Care, this can also be extended to family members/caregivers and a multidisciplinary team, in order to alleviate the burden generated by the care process. Safeguarding the proportions and singularities of the family and caregivers, we can evidence the application and effectiveness of Virtual Reality related to a feeling of empathy, strengthening of social interaction and affective bonds, and also in the important work of mourning, as well as impacts that may occur positive communication between patient, family and multidisciplinary team (Nwosu et al., 2021; Wang et al., 2020).

The use of VR is also highlighted in the training and improvement of the technique to perform procedures (more or less invasive), communication of bad news, in addition to a feeling of responsibility and empathy, thus aiming to raise awareness of the multidisciplinary team involved in the care process (Lee et al., 2020; Nwosu et al., 2021; Wang et al., 2020). Furthermore, stress, a high burden of responsibility and a feeling of guilt for the death are examples of aspects that can be worked on with health professionals using VR.

We emphasize that, in order to efficiently achieve the desired results, the use of VR must be guided by the phase of care in which the patient, family and multidisciplinary team are. Thus, dialogue between the multidisciplinary team, patients and family members is possible to design the therapeutic project, in which VR may have applicability either as neoadjuvant or as adjuvant treatment, and even with possibilities of main treatment, depending on clinical conditions and desire of those involved (Cortés-Pérez et al., 2020; Kim et al., 2020).

In addition, once VRET is defined and included in the care plan, the focus on the patient should be prioritized, guided by the therapeutic project designed and not just by technology. A single, generic amount of immersive experience will not suit everyone, requiring flexibility and uniqueness in treatments. What is important is the correct "dose" of VR for each patient, understanding that some may need more realism or more interventions in a virtual environment, while for others, fewer VR sections and/or different strategies may be indicated, without computational mediation, such as mentalization.

In this sense, we must not lose sight of what is truly important: maintaining and strengthening the therapeutic relationship; increasing the empowerment, autonomy and independence of patients and their families; and improving the quality of care and patient access to Palliative Care.

Palliative care, in turn, is based on a model of total, active, comprehensive care, which is legitimated by the right to die and face the disease process with dignity. This type of care values the culture, spirituality, traditions, desires and beliefs that permeate the course of care and the patient's end-of-life processes, also considering the family and the multidisciplinary team responsible for conducting health care (Gómez-Batiste & Connor, 2017).

The core areas of Palliative Care seek to go far beyond the relief of physical symptoms, but to integrate the physical, psychological, social and spiritual aspects of care practices, enabling the person to prepare for their death in such a complete, complex and constructive as possible, which presupposes integration between the people involved (patient/family/team), endowed with an adequate communication process for the control of symptoms of physical, psychological, social and spiritual pain – Total Pain

(Miccinesi et al., 2020) – and overcoming major challenges of teamwork, such as managing conflicts in a constructive and creative way, in favor of a common good: respect for the autonomy and well-being of the person in Palliative Care (Gómez-Batiste & Connor, 2017).

The Concept of Total Pain

With regard to symptom prevention and control, it is essential to consider "symptom" as everything that the patient assesses as a problem (Miccinesi et al., 2020). From the concept of Total Pain, it is possible to understand that it is not only the physical components of pain that must be considered, but also the emotional, social and spiritual dimensions. Currently, this concept is expanded to any symptoms, that is, it is essential to highlight the individual and subjective character of symptoms, as well as the interaction between biological, sensory, affective, cognitive, behavioral, social and cultural factors in determining, interpretation and expression of the symptoms presented (Gómez-Batiste & Connor, 2017).

Prevention and control of symptoms are central aspects of palliative care. Although there are specificities of each professional area, everyone who works must be able to identify symptoms and know basic management techniques and/or their referrals. Listening, support and guidance to family members are, therefore, inherent to care.

Pain is a symptom that has a great impact on quality of life, influencing mood, sleep and activities of daily living (ADL), with regard to basic, instrumental and advanced ADL (Tiberini & Richardson, 2015). Other symptoms, such as anorexia, depression, anxiety, constipation, dysphagia, dyspnea and asthenia, can also affect the patient's social, familiar and work relationships. For this reason, symptom control allows the individual to do what they consider important, providing a reduction in suffering, especially in the end-of-life phase (Gómez-Batiste & Connor, 2017).

Support for the family must also be considered in PCs, as they share the suffering with the patient. Thus, the care process extends to the network of family relationships, with a concern with the grieving process, before and after death. The advantages of PC are based on the possibility of better coping with death, promoting its acceptance and minimizing the physical and psychological suffering of both the patient and their family (Gómez-Batiste & Connor, 2017). Therefore, when faced with a patient undergoing palliative care, the active participation of the family in the process is essential.

Rehabilitation in Palliative Care

Palliative Rehabilitation Care is carried out by interdisciplinary teams to develop response plans not only to physiological aspects, but also to the psychological, social and spiritual needs of patients and their families/caregivers (Franklin & Cheville, 2015; Tiberini & Richardson, 2015).

However, we advocate that rehabilitation be understood and carried out in a transdisciplinary way, as well as planned interventions in the domains of care (physical, social, psychological and spiritual) at the same time. The fractioning of rehabilitation actions, or too much emphasis on one dimension to the detriment of the others, favors the iatrogenic potential of rehabilitation actions, not respecting the individual's

complexity and the advances in science to improve the quality of life, global functionality and dignity of the human person.

In PC, rehabilitation must seek multidimensional results that go beyond those specifically related to the disease state, such as functionality and quality of life parameters. In this sense, rehabilitation strategies contribute to PC, maintaining and, if possible, promoting the patient's functionality during a period of expected systemic decline, in addition to providing ways to prevent or slow down deleterious complications, such as generalized deconditioning, breakdown and contractures and aspects related to other dimensions of care (Franklin & Cheville, 2015; Tiberini & Richardson, 2015).

Generally, rehabilitation plans are developed based on the six functional domains for Functional Independence Measure scores: personal care; sphincter control (bowel and bladder); Communication; social cognition; social interaction; and problem solving and memory. Thus, rehabilitation in PC constitutes a continuous integration of services that must start concurrently with the diagnosis and treatment of the disease. PC patients can benefit from carefully selected interventions designed to maintain or even restore key elements of their function (Tiberini & Richardson, 2015).

In this sense, meeting the multidimensional needs of patients, families and professionals, as well as those that emerge from the care process itself, is a complex and challenging task. The expansion of the health paradigm, as well as of conceptions about health care, point to the importance of combining care practices with advances in biomedicine and technology. The incorporation of new methods and techniques in care can serve as a facilitator to the great challenge of consolidating bonds between professionals and patients and producing care based on a broad and multidimensional perspective, viewing health care as an ongoing process, but also as an event, due to the idiosyncratic construction inherent in each encounter.

Thus, VR is evidenced as a tool that enables interventions in a complete and safe way, associated or not with standard treatment, enhancing and reaching aspects that conventional therapy often cannot by itself. In addition, Immersive VR can be used for interventions in different areas of knowledge, as well as for aspects related to health and its physical, social, psychological and spiritual domains. Thus, we defend the incorporation of VR in therapeutic rehabilitation projects, based on the concept of Total Pain, which expands the professional vision regarding the holistic care of patients and families.

Rehabilitation must be understood and dealt with in the broadest way, from its conceptual aspect to its technical and instrumental considerations. Based on the incredible potential shown by VRET, we present a conceptual proposal for rehabilitation, consistent with technological advances and evidence of best health practices, based on humanized care, centered on the person and sensitive to the dimensions of Total Pain.

Total Rehabilitation: a Conceptual Proposal

In view of the benefits and innovations evidenced by the incorporation of Immersive VR to the field of health and rehabilitation, we questioned incorporations to the current concept of rehabilitation and presented the concept of Total Rehabilitation, aiming at

a rehabilitation based on holistic work oriented towards preservation, gain and/or maintenance of the overall functionality and dignity of the patient and their families, who face diseases and/or conditions that threaten their physical, psychological, social and/or spiritual integrity, as well as for the improvement of health and quality of life, through physical and/or virtual environments, with interventions oriented towards physical, psychological, social and spiritual dimensions, whose therapeutic project is constructed and conducted under the perspective of inter or transdisciplinarity and intersectoriality.

From the perspective of Total Rehabilitation, new therapeutic possibilities and innovations are evidenced, with interventions that can be improved and/or discovered, expanding the therapeutic offer to improve the health, rehabilitation and quality of life of patients, families and staff involved in care and support.

Thus, the change in the way of life and relationship of individuals with new technologies, in particular VR, as well as its incorporation as a therapeutic tool, can unfold in a transformation of the biomedical paradigm through, not only the incorporation of new methods, techniques and instruments of care, but the projection, degree of importance and prioritization that these methods may acquire in the health care universe in the future.

Thus, this concept coined by the authors allows for the expansion of the view of health professionals – and users – regarding therapeutic and rehabilitative possibilities. From it, the object of attention of rehabilitation expands beyond the physical dimension, including the psychological, social and spiritual dimensions as inherent to the processes of life and illness and, therefore, necessary for consideration in therapeutic plans. In addition, it presents a horizon of actions that mix standard and virtual interventions or even performed entirely in virtual environments.

This, in turn, requires training and professional specialization in the context of rehabilitation in a virtual environment, which is still not carried out and deserves special attention by Higher Education Institutions and curriculum guidelines in health. This perspective goes beyond what we find today in academic health education; however, it denotes a high degree of updating and orientation towards the best practices evidenced by Evidence-Based Medicine.

Final Considerations

This manuscript presents a reflective process about new technologies and the potential of Virtual Reality in the field of health and starts a discussion by expanding conceptions about rehabilitation in different dimensions - physical, psychological, social and spiritual - with a view to enhancing paths and results in health through Immersive Virtual Reality.

Based on this perspective, we propose the concept of Total Rehabilitation. We believe that, according to the contextual basis presented, this perspective is surrounded by scientific and metaphysical plausibility; thus, it allows for reflection and expansion of the vision of health professionals and users facing new perspectives for health promotion, in addition to prevention, recovery and rehabilitation interventions.

In addition, we emphasize the power of Immersive Virtual Reality not only as a therapeutic possibility concomitant with traditional methods of rehabilitation, but also

for a possible dimension of care and interventions performed entirely in virtual environments, which, in turn, highlights a demand for professionals specialized in virtual rehabilitation.

Of course, this perspective goes beyond what we currently find in the academic training of health professionals. However, if we remember that a few decades ago we did not even imagine that Immersive VR would reach such visibility and use in therapeutic health processes, what could prevent Immersive VR and its improvements from contributing to a revolution in clinic and in the ways of thinking and operationalizing care in health?

It is possible to perceive the beginning of a new era in which new therapeutic possibilities are emerging. Thus, Immersive Virtual Reality presents itself as a revolutionary element in the future of health, particularly in rehabilitation. The future is now!

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Author's Contributions

Breno Augusto Bormann de Souza Filho and Érika Fernandes Tritany were equally responsible for the conception of the manuscript, with effective participation in the process of analysis, data interpretation, writing and critical review of the content. All authors approved the final version of the text.

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