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A mini-review

Impact of Deep Diaphragmatic Breathing with Virtual Reality on Blood Pressure in Patient with Hypertension: A mini Review

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ABSTRACT

Virtual Reality (VR) offers a promising drug-free approach to relaxation for people with psychiatric issues. Studies show VR relaxation not only helps manage stress but also promotes positive emotions and decreases blood pressure.

Compared to traditional relaxation techniques, VR requires less mental effort and delivers a more significant boost in positive feelings.

The results of the current review indicate that VR with deep diaphragmatic breathing may be associated with a blood pressure-lowering effects for adult people with hypertension. Also VR technology can be used as a good facilitator of different practices for stress reduction and treatment of chronic pain (for example by meditation practices). The immersive and interactive nature of VR adds a positive effects for different modalities as it creates a semi-real environment and give the patient the sense of achievement.

Keywords: Virtual Reality; Breathing Exercises; Hypertension; Stress.

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INTRODUCTION

Hypertension is a common and serious health problem, with significant morbidity (e.g., heart disease, stroke, kidney problems, and other complications). The number of adults aged 30 to 79 with hypertension has increased significantly over the past 30 years, with about half of these individuals unaware of their condition. Also, a large proportion of people with hypertension live in developing countries [(1)]. The use of antihypertensive medications and lifestyle modifications have been advocated treat hypertension in adults, to decrease the associated morbidity and mortality. The control of hypertension can decrease cardiovascular risks. However, pharmacological treatments for hypertension often have limitations in effectively managing the condition and may cause side effects. Therefore, individuals with hypertension should also consider lifestyle and behavioral changes to decrease their blood pressure and reduce the risk of associated cardiovascular comorbid conditions [(2)]. Hypertensive adults who engage in relaxation techniques (e.g., diaphragmatic deep breathing exercises (DDB)) had been reported to be an effective intervention for improving of the autonomic functions and is highly advocated for prevention or amelioration of hypertension. It is reported that, hypertensive adults engaged in slow and deep breathing exercises for several weeks can experience significant reductions in both systolic and diastolic blood pressure [(3)].

Deep diaphragmatic breathing, characterized by slower, deeper, and more prolonged expiration, can help reduction of the sympathetic tone, leading to a sense of relaxation [(4)]. Chronic exposure to stress can contribute to different physical health conditions, compromising cardiovascular conditions, diabetes, cancer, and hypertension. Hypertensive adults also have an elevated total peripheral resistance with reduced sensitivity of the arterial baroreflex due to autonomic dysfunction. Thus reducing stress seems to be a good treatment option for lowering of higher blood pressure [(5)]. Virtual reality (VR) therapy has become increasingly popular as a tool for managing stress and anxiety, particularly in situations where traditional therapies are not accessible [(6)].

Linking these facts, we could suggest that, the use of deep diaphragmatic breathing with virtual reality will augment the relaxation effect of both techniques and thus have a role in the control of blood pressure among adult patients, especially when the resistance to medications is present.

RESEARCH OBJECTIVE

The current mini-review aimed to provide a rapid approach for available data about the combination of virtual reality and deep diaphragmatic breathing for patients with hypertension.

SEARCH STRATEGY

A scoping reviews are undertaken to delineate the emerging concepts and applications of virtual reality and DDB for reduction or control of blood pressure a particular field of research. The main research databases were (PubMed, Science Direct, SpringerLink and Wiley Interscience). Available evidence was reviewed and summarized in the following discussion.

DISSCUTION

Hypertension is a chronic disease with a diverse and complex etiology. It included, but not limited to, genetic and behavioral causes. Hypertension is linked to the psychosocial stress in previous studies. Stress, anxiety, depression and chronic mental conditions are increased all over the world, especially on the workplace [(7)]. Chronic stress can lead to high blood pressure due to the sustained elevation of blood pressure levels. The autonomic nervous system, including both the sympathetic and parasympathetic branches, plays a significant role in the regulation of the blood pressure and heart rate through the baroreflex mechanism. Managing stress is an effective strategy for lowering blood pressure [(8)].

Deep breathing exercises can be beneficial for reducing both physiological and psychological stress. Also, they may improve respiratory function and help lower high blood pressure [(9)].

The emergence of VR technologies is presently shaping the healthcare system. It is now being used in different healthcare interventions. VR is a computer-generated three-dimensional environment, in which subjects interact with the created environment as if they were inside it (real sensation). Its use in respiratory rehabilitation is growing to improve overall health and well-being [(10)]. VR can be an effective and promising non-pharmacological treatment option for non-psychiatric inpatients experiencing symptoms of anxiety, apathy, depressive mood, and hyper-tension, among others [(11)]. A study conducted by **Klainin-Yobas *et al.*** [(12)] found that modern lifestyles often hinder relaxation practices. Busy schedules and limited time can make it difficult to find opportunities and suitable environments for relaxation. Furthermore, the study suggests that a lack of time for relaxation can exacerbate stress in working-aged adults, potentially leading to elevated stress levels and hypertension. This finding aligns with numerous previously published studies.

The National Institute for Health and Care Excellence (NICE) guidelines emphasize the importance of lifestyle factors in managing hypertension and highlight the need for non-pharmacological interventions in treatment programs. Also, stress reduction should be considered as a behavioral target [(13)]. Also, **Cernes & Zimlichman** found that guided breathing approaches along with lifestyle modification therapies may help as a first treatment step for mild hypertension who do not develop any hypertension related complications (e.g., cardiovascular complications, renal disease, or diabetes). Medications must be introduced after a couple of months of failed non-pharmacological therapy. DDB exercises may be advocated for subjects who cannot achieve full control of hypertension with medications alone or cannot tolerate the potential side effects of pharmacologic therapy [(14)]. A more recent study demonstrated that device-guided breathing exercises, which reduce the respiration rate (RR) and modify respiratory pattern, can effectively reduce the blood

pressure. Moreover, deep and slow breathing can increase the sensitivity of the baroreflex, heart rate variability, improve blood flow to small vessels, and decrease peripheral arterial resistance, ultimately leading to a reduction in blood pressure [15].

In contrast to previous findings, a study conducted by **Park and Lee** suggests that VR games may be beneficial for older patients with hypertension. However, this study confirms that only fixed-background full-immersion VR games should be used in the rehabilitative methods of the respiratory system. Moving backgrounds can negatively impact static balance and lead to adverse effects such as eye fatigue and dizziness [16].

On the contrary, A systematic review of randomized controlled trials on Adverse Effects of VR Interventions in Psychiatry, done by **Lundin *et al.*** included 73 studies. Seven of these studies reported worsening of the clinical symptoms or an increased the risk of fall. Another 21 studies recorded no side or adverse effects and failed to recognize such like effects (e.g., cyber sickness). Furthermore, 45 of these 73 studies made no mention of adverse effects whatsoever [17].

The main advantage of virtual reality added to DDB comes from its interactive and immersive features. It has the potential to revolutionize breathing exercises and DDB by making them engaging and enjoyable [18,19]. It also stimulates the patient active participation in DDB creating the sense of presence and control. The VR immerses the patient in an environment as the real world. This immersive nature can help in reduction of stress and anxiety during DDB and subsequently reducing blood pressure [20].

Conclusion: Patients with hypertension who receive deep breathing exercises in combination with VR relaxation media, along with a pharmacological treatment, may experience greater improvements in systolic and diastolic blood pressure..

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