INPLASY

Effects of virtual reality technology on exercise capacity and negative emotion in patients with cardiac rehabilitation: a Meta-analysis

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ADMINISTRATIVE INFORMATION

INTRODUCTION

Review question / Objective The prevalence of cardiovascular disease patients is increasing year by year, and although cardiac rehabilitation is an important measure for secondary prevention, the effect is still less than ideal, virtual reality technology as an effective supplement to rehabilitation methods is getting more and more attention, the purpose of this Meta-analysis is to evaluate the efficacy of virtual reality technology on the exercise capacity and negative emotions of cardiac rehabilitation patients.

P: Cardiac rehabilitation suitable population
I: virtual reality technology
C: Conventional cardiac rehabilitation
O: Improvement in exercise capacity, psychological state (anxiety, depression, stress)
S: RCT.

Condition being studied Cardiovascular disease (CVD) remains the leading cause of death in the world, with more than 23.6 million people expected to die from CVD in 2030 . The prevalence of CVD in China is in a continuous rising stage, with an estimated 330 million current CVD patients . Cardiac rehabilitation (CR) is a holistic, cost-effective healthcare strategy that includes pharmacological, exercise, nutritional, psychological, and maladaptive behavioral interventions and has been shown to be effective in reducing readmission, mortality, and the risk of cardiovascular events in patients with CVD, as well as improving health-related quality of life . Currently, cardiac rehabilitation has been incorporated into clinical guidelines by several authoritative societies, including the Chinese Medical Association, the American Heart Association, the American College of Cardiology, the European Society of Cardiology, and the National Institute for Health and Clinical Excellence of the United Kingdom, and has been recommended for use in the secondary prevention and rehabilitation of a wide range of cardiovascular diseases, such as coronary artery disease, heart failure, and post-cardiac bypass grafting . However, the overall utilization of cardiac

rehabilitation is usually low. With a large population base in China, the number of hospitals conducting cardiac rehabilitation is 13.2 hospitals per 100 million population, and the participation and completion rates of cardiac rehabilitation are much lower than those of developed countries . A recent study showed that only 18.7% of patients who participated in outpatient cardiac rehabilitation in 2017-2019 completed more than 24 rehabilitation sessions . The incorporation of new rehabilitation methods can improve the overall outcome of cardiac rehabilitation. Virtual reality (virtual reality,VR) technology is a cutting-edge technology with computer technology as the core and multidisciplinary intersection of graphics, simulation technology, and sensing technology . It simulates reality through multiple perceptual channels such as vision, hearing, touch, and smell, generating a realistic sensory world, allowing users to interact perceptually with the virtual world and simulate real experiences . Virtual reality has been used in aerospace, medical-surgical, industrial manufacturing, transportation, military industry, and other fields . According to the 2019 White Paper on Virtual Reality Industry Development, VR technology can effectively solve the problems faced by the medical industry such as high risk of hands-on practice, low repeatability, and shortage of training resources due to its realistic scene presentation, prior plannability, and repeatability of the process . It has been widely used in the medical field for home rehabilitation exercises for patients with stroke , total hip replacement, cancer , pain, and dementia . Meanwhile it has been gradually applied in all stages of cardiac rehabilitation, but its effectiveness and practicality are still being explored, and its practical application effect has not yet been publicized. This study provides a reliable basis for the clinical application of VR in cardiac rehabilitation by conducting Meta-analysis of Randomized Controlled Trails (RCT) of cardiac rehabilitation in the form of VR versus the traditional form.The prevalence of cardiovascular disease patients is increasing year by year, and although cardiac rehabilitation is an important measure for secondary prevention, the effect is still less than ideal, virtual reality technology as an effective supplement to rehabilitation methods is getting more and more attention, the purpose of this Meta-analysis is to evaluate the efficacy of virtual reality technology on the exercise capacity and negative emotions of cardiac rehabilitation patients.

METHODS

Search strategy Computerized searches were performed on PubMed, The Cochrane Library, Embase, Web of Science, scopus, ProQuest, OVID, CINAHL, SinoMed, China Knowledge Network (CNKI), Wanfang database, Wipro database and ReadShow database. The search timeframe was from the construction of the database to June 2, 2023. The search strategy used a combination of subject terms and free words, which was adjusted according to the rules of different databases. The Chinese search terms include "cardiac rehabilitation/cardiovascular rehabilitation/cardiac rehabilitation therapy", "virtual reality/virtual reality technology/virtual/ spiritual realm technology/virtual reality/virtual reality exposure therapy". English search terms include "Cardiac Rehabilitation/Cardiovascular Rehabilitation" "Virtual Reality/Educational Virtual Reality/Instructional Virtual Reality". Reality/ Educational Virtual Reality/Instructional Virtual Reality" "Virtual Reality Exposure Therapy/Virtual Reality Immersion Therapy/Virtual Reality Therapy" "Exergaming/Active Video Gaming/Virtual Reality Exercise/Exergame"" Video Games/Computer Games" "virtual reality system/virtual reality head mounted display/virtual reality simulator/ Wii/ Kinect".

Participant or population Cardiac rehabilitation suitable population.

Intervention Virtual reality technology.

Comparator Conventional cardiacrehabilitation.

Study designs to be included RCT.

Eligibility criteria Inclusion criteria: ① Research subjects: cardiac rehabilitation suitable population, including patients with acute myocardial infarction, chronic heart failure, patients who have undergone coronary artery bypass grafting (CABG), percutaneous coronary intervention (PCI), heart valve surgery, etc., and are older than 18 years old; ② Measures: the implementation of cardiac rehabilitation based on virtual reality technology in the intervention group, and the use of conventional cardiac rehabilitation in the control group; ③ Endings Indicators: the outcome indicators include the relevant indicators reflecting the patients' exercise ability, psychological state (anxiety, depression, stress), and if the same research project is reported separately using different outcome indicators, the data related to this paper will be extracted; ④ Type of research: publicly published randomized controlled trials (RCTs) at home and abroad. The language is not limited. Exclusion criteria: ① the type of study does not match: non-RCT, such as qualitative studies, case

reports, reviews, etc.; ② unable to extract valid outcome data from the literature; ③ duplication of published literature; ④ unable to access the full text of the literature.

Information sources PubMed, The Cochrane Library, Embase, Web of Science, scopus, ProQuest, OVID, CINAHL, SinoMed, China Knowledge Network (CNKI), Wanfang database, Wipro database and ReadShow database.

Main outcome(s) Exercise capacity;Psychological state (anxiety, depression, stress).

Additional outcome(s) Quality of life; cardiac function; adherence.

Data management Endnote.

Quality assessment / Risk of bias analysis Cochrane Tool.

Strategy of data synthesis Data collected from the literature were further evaluated and analyzed using RevMan 5.3 software. Mean difference (MD) or standardized mean difference (SMD) and 95% confidence interval (CI) were used as analytical statistics for continuous variables. When $P > 0.1$ and I2 < 50% indicated statistical homogeneity of results across studies, the fixed-effects model was used for analysis; when $P \leq 0.1$ and I2 $\geq$ 50% indicated statistical heterogeneity across studies, the random-effects model was used to analyze the data, and subgroup and sensitivity analyses were performed to determine the source of heterogeneity as appropriate. Studies that could not be analyzed by Meta-analysis were only analyzed descriptively, and differences were considered statistically significant at $P < 0.05$.

Subgroup analysis Conditions for subgroup analyses were not met in this paper, so subgroup analyses were not performed.

Sensitivity analysis After deleting any of them, the combined results of the rest of the literature were not significantly different from what they would have been without deletion, which means that the sensitivity analysis was passed.Sensitivity analysis was performed by removing single studies at one time and observing the changes in the overall combined effect values. Revman software was used to analyze the effect of single studies on the combined effect values of changes in indices such as exercise capacity, anxiety, depression, and stress, and no articles were found to exist that affected the combined effect values of the outcomes.

Country(ies) involved China.

Keywords Virtual Reality Technology;Cardiac Rehabilitation;Exercise Training; Negative Emotions;Meta-analysis.

Contributions of each author
Author 1 - Zhang Meijun.
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