INPLASY PROTOCOL

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Meta-analyses of the Effects of Virtual Reality Training on Balance, Gross Motor Function and Daily Living Ability in Children with Cerebral Palsy

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Review question / Objective: **Cerebral palsy (CP) is a non-progressive, persistent syndrome occurring in the brain of the fetus or infant[1]. The prevalence of CP is 0.2% worldwide, and the prevalence can increase to 20-30 times in preterm or low birth weight newborns. There are about 6 million children with CP in China, and the number is increasing at a rate of 45,000 per year. Virtual reality (VR) refers to a virtual environment that is generated by a computer and can be interacted with.VR can mobilize the visual, auditory, tactile and kinesthetic organs of CP, so that they can actively participate in the rehabilitation exercise.**
Information sources: **Two researchers searched 5 databases, including Pubmed (N=82), Embase (N=191), The Cochrane Library (N=147), Web of Science (N=359) and CNKI (N=11).**

INPLASY registration number: This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 22 April 2022 and was last updated on 22 April 2022 (registration number INPLASY202240137).

INTRODUCTION

Review question / Objective: **Cerebral palsy (CP) is a non-progressive, persistent syndrome occurring in the brain of the fetus or infant[1]. The prevalence of CP is 0.2% worldwide, and the prevalence can increase to 20-30 times in preterm or low birth weight newborns. There are about 6 million children with CP in China, and the number is increasing at a rate of 45,000 per year. Virtual reality (VR) refers to a virtual environment that is generated by a computer and can be interacted with.VR can mobilize the visual, auditory, tactile and kinesthetic organs of CP, so that they can actively participate in the rehabilitation exercise.**

Condition being studied: **Cerebral palsy (CP) is a non-progressive, persistent syndrome occurring in the brain of the**

fetus or infant. The prevalence of CP is 0.2% worldwide, and the prevalence can increase to 20-30 times in preterm or low birth weight newborns. There are about 6 million children with CP in China, and the number is increasing at a rate of 45,000 per year. Insufficiency of movement and abnormal posture are core symptoms of CP, and about 80% of children with CP have dyskinesia. In addition, children with CP also have cognitive, communication, perception-behavioral disorders, epilepsy and other problems, which greatly limit their social participation and seriously affect their physical and mental health and quality of life. Virtual reality (VR) refers to a virtual environment that is generated by a computer and can be interacted with. VR can mobilize the visual, auditory, tactile and kinesthetic organs of CP, so that they can actively participate in the rehabilitation exercise. In this way, the central nerve conduction and peripheral motor control of children can be coordinated and unified, which is conducive to the rehabilitation of children. Gagliardi conducted a longitudinal study on 16 children with CP for 4 weeks, 5 times a week, 30 minutes each time, and the results showed that the children's walking ability and gross motor function improved. However, there was no significant change in daily life. In addition, a recent systematic review also showed that the combination of VR training and conventional rehabilitation training indicates better pure conventional rehabilitation training. It has become a focus of scholars at home and abroad to improve the motor ability, abnormal posture and the quality of life of children with CP.

METHODS

Participant or population: Children with spastic cerebral palsy clinically diagnosed, their race and gender are not limited, and their age is less than 16 years old.Cerebral palsy.

Intervention: Virtual reality training, virtual reality training combined with conventional rehabilitation training or virtual reality training added on the basis of control group training.Virtual reality.

Comparator: Daily physical activities, balance training, conventional rehabilitation training or comprehensive rehabilitation training, etc.

Study designs to be included: Randomized Controlled Trial (RCT).

Eligibility criteria: (1) P (Population) for research objects: children with spastic cerebral palsy clinically diagnosed, their race and gender are not limited, and their age is less than 16 yearsold. (2) Interventions for I (Intervention) experimental group: virtual reality training, virtual reality training combined with conventional rehabilitation training or virtual reality training added on the basis of control grouptraining. (3) C (Comparison) for control group interventions: daily physical activities, balance training, conventional rehabilitation training or comprehensive rehabilitation training,etc. (4) O (Outcome) for outcome indicators: balance function was evaluated by Berg Balance Scale (BBS) and Pediatric Balance Scale (PBS); Gross motor function was evaluated using the Gross Motor Function Measure Scale (GMFM), including GMFM-66, GMFM-E and GMFM-88; The ability of daily living was assessed by Pediatric Evaluation of Disability Inventory (PEDI) and The Functional Independence Measure for Children(WeeFIM). (5) S (Study design) for study type: Randomized Controlled Trial(RCT).

Information sources: Two researchers searched 5 databases, including Pubmed (N=82), Embase (N=191), The Cochrane Library (N=147), Web of Science (N=359) and CNKI (N=11).

Main outcome(s): A total of 16 articles were included, involving 513 children with CP. Virtual reality training can improve the balance function of children with CP (PBS: MD=2.06, 95%CI (1.15, 2.97), $P<0.01$; BBS: MD=3.66, 95%CI (0.29, 7.02), $P=0.03<0.05$) and gross motor function(SMD=0.60,

95%CI (0.34, 0.87), P＜0.01). But there is still certain disagreement on the impact on daily living ability (SMD=0.37, 95%CI (-0.04, 0.78), P=0.08>0.05), after removing the source literature with heterogeneity, virtual reality training can improve the social function of children with cerebral palsy (SMD=0.55, 95%CI (0.30, 0.81), P < 0.01).

Quality assessment / Risk of bias analysis: All 16 RCTs described the generation of random sequences, among which, 6 RCTs described methods of allocation concealment, 6 RCTs applied the blinding method to researchers and subjects, 6 RCTs were used blinding method to raters, and all 16 RCTs had complete data and did not selectively report.

Strategy of data synthesis: Data analysis was performed using Revman 5.3 software and following the PRISMS guidelines. The Q statistic test (P value) and I2 were used to test for heterogeneity. If there had been statistical heterogeneity between studies (I2>50%, P<0.1), a random effect model would have been used for meta-analysis; otherwise, the fixed effects model would have been used. In this study, GMFM-66, GMFM-88, and GMFM-E were combined for gross motor function, and PEDI and WeeFIM were combined for daily living ability. Therefore, Standard Mean Difference (SMD) was used to calculate, and other indicators used the Mean Difference (MD) to calculate. Each effect size was given a point estimate and 95% confidence interval (CI). When P<0.05, there was a significant difference between the intervention group and the control group, proving that Meta-analysis results were statistically significant. Publication bias testing was performed using Stata 16.0.

Subgroup analysis: A subgroup analysis in terms of cerebral palsy type, training frequency, and period. The cerebral palsy was divided into hemiplegia, diplegia and other types, whose results showed that, compared with the control group, VR training only improved the gross motor function of children with hemiplegia greatly(P4 days/week, whose results showed that, compared with the control group, VR training >4 days/week significantly improved the gross motor function of children with CP (P<0.01). The training period was divided into <6 weeks and ≥6 weeks, whose results showed that, compared with the control group, both groups showed significant improvement on the gross motor function of children with CP (P=0.0008<0.01 , P = 0.002 < 0.01).

Sensitivity analysis: To explore sources of heterogeneity, a sensitivity analysis was performed by successive elimination of studies, see table 3. After excluding Acar2016, there was no significant change in heterogeneity, SMD=0.45, 95%CI (0.07, 0.89), P=0.020.1, then the fixed effect model was used for analysis. SMD=0.55, 95%CI (0.30, 0.81), P<0.0001, indicating that, compared with the control group, the VR training significantly improved the social function of children with CP; After excluding other studies, there was no significant change in heterogeneity, and the P values of the effect sizes were all greater than 0.05. Therefore, Atasavun Uysal2016 may be a source of heterogeneity.

Country(ies) involved: China.

Keywords: virtual reality; cerebral palsy; balance; gross motor activities; activities of daily living; Meta.

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