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Effectiveness of video game based training along with conventional therapy for upper extremity in people with cerebral palsy

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Abstract

Cerebral palsy is non progressive permanent disorder damage to the developing brain and disorders of the development of movement and posture that cause activity limitation, Participation restriction. The aim of the review is to different video gaming activity used as the treatment programme to improve the motor impairments as well as the cognition level of the child. Here we have search computer bashed on Google Scholar and Pubmed and screening the articles. Different software article used as a Nintendo Wii, Leap motion controlled, Microsoft Xbox, Sony play station, Virtual reality, Gesture xtreme system, Eyetoy application as improving the upper extremities function and abilities. The review concluded video game training is more effective in the upper extremities rehabilitation than only performing conventional therapy.

Keywords: Video gaming, cerebral palsy, upper extremities

Introduction

Cerebral palsy (CP) is a heterogenous permanent neurological disorder caused by non progressive damage to the developing brain and disorders of the development of movement and posture that cause activity limitation, Participation restriction. The motor impairment of cerebral palsy is recurrently go along with by sensory disturbances, perception, intellectual disability, and communication, behaviour, by epilepsy and by secondary musculoskeletal problems. It is the one of the most common cause of disability on the children in worldwide. [1, 2].

In studies reported as the globally the prevalence of the cp in India is 1.5 to 4 per 1000 live births or children. Nair Mk et.al Banerjee et.al & Mathur et.al reported the prevalence of the cerebral palsy in rural and urban as 1.83 and 2.29 in 1000 live birth. First, Hirtz *et al.* reported an overall prevalence estimate of 2.4 per 1000 live births in the United States [2].

Bleeding and threatened miscarriages in prenatal period, birth asphyxia, premature baby and low birth weight in the perinatal period, convulsions, and hyperbilirubinemia in the postnatal period were the common etiological factors for cerebral palsy. Types of CP included spastic quadriplegic, spastic diplegic, dyskinetic, spastic hemiplegic, mixed type, and hypotonic or ataxic along with this type Spastic quadriplegic was the most prevalent subtype of CP among children. Some study show that risk factors of the cp are increase while the very low birth weight and multiple pregnancy than the normal [3].

The aim of the review is to different video gaming activity used as the treatment programme to improve the motor impairments as well as the cognition level of the child.

Material and methodology

A Computer bashed literature search bashed on the Google Scholar and Pubmed. In Recent last five-to-seven-year Article with full text randomised controller trails studies were included. After Screening the through the article here 9 Relevant article included in the review.

Eligibility Criteria

Participation: Person with 5- to 17-year-old diagnosed with Cerebral palsy.

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Intervention: Nintendo Wii, Leap motion controlled, Microsoft Xbox, Sony play station, Virtual reality, Gesture xtreme system, Eyetoy application.

Comparator: Traditional occupational therapy, Physiotherapy, Bobath concept, Neuro developmental training.

Outcome: Abilhand Kids, Visual Motor Integration Scale, Jebsen Tayler Hand Function test, Box and Block Test, Hand held Dynamometer, Strength and power of pinch, Duruoz Hand Index, Minnesota Manual Dexterity, Quality of Upper Extremity Skills Test.

Study Design: Randomized controlled trials.

In the all Studies they have included 5 to 17 year with diagnosed cerebral palsy as well as the GMFCS level 1 to 3 and MMSC level 2 to 4 with the sufficient cognitive level to understand the activity. Child can be able to hold the hand held remote and bend the shoulder and elbow was included in the study. Only one study was included the Botulinm toxin treatment other studies excluded if after botulinm and any Upper extremity surgery, cognitive level is low.

Summary of the review article

Interactive Video game based as training method

The development of commercial gaming consoles in recent years has led to use of such devices as physical training instruments. As the cerebral palsy neurological disorders need long lasting treatment so as a recent advances training virtual reality and intense task-oriented gaming activity to increase the Engagements of the treatment and participation of the daily living tasks.

Video game bashed intensive task, longer training to planning the neuroplastic changes towards the progression of the sensory, motor and cognitive developments [4, 5].

Effectiveness of the WII based interactive video games with the Conventional therapy

This Finding are supported Jane Elizabeth Sajan *et al*, Shamekh Mohamed El-Shamy PhD *et.al*, Michiel J. A. Jannink *et al*. found that wii based video game group perform as tennis, basket ball & boxing exercise and conventional therapy group perform passive stretching of the elbow and wrist flexion weight bearing exercise, Strengthening exercise of the antagonist muscle spastic muscle, protective extensor trust stimulation. Upper limb functions, assessed by grasp domain, showed significant improvement in the intervention group then control group. Wii games that have chosen (tennis and boxing) encouraged upper body movement more than lower body movement. Also, power and pinch grip increase in the intervention group than the control group but the spasticity reduce in the control group So the study conclude that the wii training pulse conventional therapy to improve the hand grasping [6].

Efficacy of Neuro developmental technique Combined with Nintendo Wii

In these study Nintendo Wii combine with NDT and only NDT as a control group for 45 min twice a week for 6-week programme found that the Quality of Upper Extremity Skills Test & Jebsen Tayler Hand Function test statistically significance Improvement in upper limb function in Nintendo Wii combine NDT compare to the only NDT. As

well as the effort of the upper limb function, speed and independence level like daily activity task is increase in the Nintendo Wii combine with NDT compare to the only NDT [8].

Video based game training

In this study the randomly allocated in the one of two group as pre video game and post conventional therapy or pre conventional and post video game training session. In video game was application as xbox console was based on the kinetic device motion analysis and this gaming activity selected based upon the active range of motion of paralytic limb, visual motor coordination, sensorial & proprioception. According to selection of the above therapeutic approaches the game included the Kinect Adventures Package like Space pops, Rally ball, 20.000 leaks and sports activity like boxe and volley and bawling like bimmutal activity was perform. According this study was found that the Quality of Upper Extremity Skills Test mainly the manual grasping and Upper limb dissociative movement item more statistically significant in the intervention group than the control group. We found that video-game based therapy is a feasible and well-accepted exercise to be performed by children with cerebral palsy as a complementary strategy to conventional therapy in order to increase the amount of paretic arm movements [9].

Effect of the Virtual reality on Motor function & Daily life activities

In the study the two group allocated in one intervention group was virtual reality based game like Air challenges, Boxing trainer, Jet run, wall breaker performed and control group was tradinationally occupational training group include were activities motor skills and daily activities, such as dressing, feeding, playing table and ball games, writing, painting, drawing, and doing puzzles. For 8 week duration and 45 min for 16 session. In study found that the both the group was improvement in motor function of upper extremity and independence level but in the competition the intervention group is more (< 0.001) statically significance than the control group. purpose of the study that virtual reality to enhancing the motor function and improving the functional status of the fine motor an visual motor performance, speed, upper limb coordination because this gaming activity perform the repeated movement as well as give the positive feedback [10].

Upper extremity Video Gaming Rehabilitation

In these study Intervention group were Nintendo Wii fit improve upper limb function and Leap motion controller for the hand and grip function and control group was only in NDT. Here the activities were includes in the tennis and boxing and for the Leap motion controller were activity included catpach and Leap ball. Study outcome bashed on the CHAQ, MMDT, DHI. Study found that the LMC and video bashed game superior effect in the manual dexterities than the control group. Grip strength was statically significance in both group but higher significance in the Nintendo Wii fit and LMC group. Comparison of CHAQ and DHI scores between the two groups prior to and following treatment is shown there was statistically significant difference only in CHAQ-eating score between the groups after the treatment in favor of control group ($p < 0.05$). Effect sizes were small to large significantly for

improved scores of CHAQ in both of groups. Effect sizes were medium to small significantly for VGBT and control group (effect size; 0.67, 0.48, respectively) ^[11].

Effectiveness of Computer assisted gaming after Botulinam toxin

In the only one study found that the no any evidence to computer assisted gaming activity in the hand function of the cerebral palsy but it is better engagement in the rehabilitation of the cerebral palsy and which was being evaluated as a supplement to traditional rehabilitation exercises that were essential for the full benefits of botulinum toxin to be realized ^[12].

Conclusion

The review explained that the video game based training intervention significantly than the traditional therapy. Video game based training to improve the upper extremity dissociation; Grip strength and power also enhance the independence level, motor visual coordination. According to the motor control and motor learning theories to emphasize the motivational and repetitive of the intense task, so this video game based combine with the traditional rehabilitation effect on upper extremity.

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