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A Survey Of Vision Stimulation for Cerebral Palsy Rehabilitation

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Abstract

This survey summarizes many theories and methods applied for vision and speech improvement for cerebral palsy babies.Some research team focus on vision and speech stimulation for cerebral palsy with different techniques using computer aided system and electrical devices. Electrical electrode devices are complexity to use and reliability are inadequate for providing vision and speech stimulation which lead to recover partial output. The material of the survey is divided into four section. 1) Overview of vision development 2) vision stimulation techniques. 3) low vision. The survey taken from the research field of computer science, neural networks, electrical engineering and psychology. It contains useful guidelines for the construction of new vision and speech stimulation tool which support for young and visually inattentive children.

Keywords: Vision, speech, stimulation, cerebral palsy, development, assessment.

I. Introduction

There is a milestone for baby development up to 2 years. Within 2 years babies can able to reach 100 percent vision , speech and body development. If the babies have brain injuries at the time of birth or seizures within one year or down syndrome babies have milestone delay. Healthy vision and speech development is not enough to reach milestone .Vision Stimulation and speech stimulation support the infants to improve the vision and speech.

Healthy vision development of infants require object with lights, attention, novelty, focus and movement. After 2 to 3 month infants require colours. Direct lights to the eyes of infant should be avoided. For sharp image formation, a macrine cells and horizontal cells support centre surround system. Abnormal visual exposure affects the development of machine cells and horizontal cells. Visual System is used for external visual experience, interact with caregiver, improve infant's attention and provide opportunity. Healthy speech development of infants require toys with sound, make them to concentrate on lips movement , to understand communication behaviour, make the child to use the object, play with object and know the meaning of the object.

Vision and speech development for infants done at home by mother and family members. Abnormal babies undergone for vision and speech test like VEP, ARB etc. According to the nerves damage different types of stimulation given to babies to reach the milestone.In this paper I had explained how vision and speech development improved by stimulation , types of vision and speech stimulation, assessment of vision and speech of the babies.

II. Vision Development

The visual system overall development has for basic processes. This process starts early in fetal life and continue in the life time. Specific exposures and toxic exposures alter any of the process which interference with the sensory development processes. The basic structure of the brain, sensory organs are responding to genetic code and control. These involve cell differentiation, organ formation, alignment and initial cell location. In the absence of visual stimulation, the growth of the retinal ganglion cell axons results in genetic code.The retina creates relationship with cortex and LGN. These all independent ofvisual activity. There are two major stimulation which help in vision development. The two forms are endogenous and exogenous visual stimulation. The internal stimulation supports for the development of sensory system, cerebral cortex, thalamus, brainstem auditory system, spinal cord and hippo campus. It is used to create critical relationships and permanent circuits.This prepares the visual system for outside stimulation after birth at term.It stimulates retinal ganglion cells randomly firing. It support for axon growth.

Outside stimulation for eye is essential for visual development. The pathways from the visual cortex to the retina, receive stimuli from patterns, different light intensities, movements. After birth at 2 to 3 months of age colour pathways begins to operate.The first colour observed is Red.Visual development includes attention, novelty, focus to see lines and shapes. The period for visual development starts from 20 weeks gestational age to 3 years of life. Visual system critical component are complete by 1 year age. The outside stimulation helps to protect from ganglion synchronous waves and REM sleep. In onset of sleep cyclesthe retinal ganglion cells waves are altered. Transition done around 30 to 32 weeks gestational age. At that time, they disturb or suppression deep sedation or suppress ganglion cells and neurons. The strong stimulation also causes pain, unusual movements, intense noise and bright light. Flickering lights interfere with visual development. The visual

system requires visual experience and it activated by light for continue development. To improve motion, color perception, patterns require visual stimulation. The critical period of visual development continue up to first 3 years of age.

A.Low vision

Low vision exhibits range of mild to severe vision problem that impede student educational performance.More 65 percent of students with low vision visual disabilities. The eye disorder like glaucoma, macular degeneration, cataracts and diabetic retinopathy has undergone low vision examination. This determines special type of training, better lighting to improve the functional vision.

The functional vision problems are

1. Difficult to see the height of the gas flame.
2. Seeing traffic
3. Data's in computer screen
4. Difficult in reading books.

Low vision can be solved by low vision optical devices like telescopes, magnifiers and nonoptical device like video magnifier, daily living devices, improved lights and training. Low vision examination like visual acuity testing, an eye health evaluation, visual field testing and goldmann field exam used to find the eyes disorder and to measure color vision, depth perception and contrast sensitivity.Cerebral palsy babies can't able to answer the questions which had formed in low vision examination.So VEP test used to find the nerves problem in eyes and show the frequency level of eyes sees the image.

B.Types of Visual Stimulation

a) Cortical Stimulation:

In the cortical stimulation two types of photo receptors are activated by light, which focused by cornea & lens in the eye. Electrical signal passes through bipolar & gang lion cells, before passing to optic nerves. These optic nerves pass most of the signals through the geniculate body of the visual cortex, which is responsible for eye movements. This stimulation support blindness caused by glaucoma, diseases of the central visual path ways. The negative feature of Cortical is lack of preliminary processing of the brain. The captured image sends to the brain to be questioned by the cortical devices. Cortical stimulation provides useful vision.

b) Cortical Surface Stimulation:

Cortical prostheses involved electrode arrays in the surface. This stimulation caused to see a spot of light where the object is positioned so platinum electrode s were used for design which is stimulated by radio signals. At the time of stimulation eye moved & by stopping the stimulation eye movement has decreased. Then 64 channel electrode array implanted on the surface of subjects' right. At the time of stimulation each electrode produce four closely space phosphines. This electrode support for eye movement.

d)Intracortical Stimulation:
Intracortical electrode did not flicker. This requires 10-100 times less power than surface electrodes. 38 micro electrodes inserted into the visual cortex. So that perceives phosphines stable at positions in visual space. This stimulation not changes the flicker, amplitude, pulse duration of frequency & brightness. This electrode leads to break, when movement of eye balls at sleep & testing on pattern recognition.

e) Retinal Stimulation:
The main reason for blindness is age related macular degenerations. This affects the retina at the back of the eye, while remaining the components of visual system intact. This stimulation provide partial restoration of sight, an alternate approach is to stimulate fee brain to function optic nerves. Continued remodelling by the retina which leads to spatial corruption & synapse cryptic formation.

f) Sub retinal Stimulation:
There are some million receptors in the retina, which is reduced to 1 million fibres of optic nerves. The information reduction takes place in nuclear layer of retina in sub retinal stimulation. Implanted strip electrode inserted back side of photoreceptor layer & presented a fibre of light & then measures the response the scalp over the visual cortex. The silicon substrate blocked choroidal nourishment to the retina, which dependent on blood supply for oxygenation. This stimulation maintained a stable position & there was no rejection or degeneration & inflammation of the retina. This study found some improvements in visual function like color perception.

g) Epiretinal Stimulation:
Neurostimulator chip implanted in ganglion cells in the retina.This support for retinal neurons of patients who affected by photoreceptor diseases. 16 electrodes produce phosphines & so the subject was able to detect motion, light & correctly recognize the location. Complex stimulation designed by adding high number of electrodes. This can be implanted only in healthy retina else it cause in retina cancer.

C. Vision Rehabilitation services.
This provides guidance and instruction in independent living skills, visually impaired person to do daily activities, consultation and to use resources. Vision rehabilitation improve the person to manage home, communication and education, leisure activities , daily living activities and indoor orientation skills. This will focus on record keeping and case management, needs in vocational environments community support services, psychosocial adjustment of low vision. In vision rehabilitation, the lifelong goal be set and to achieve by individuals with vision impaired. Service plan coordinated properly and proper adaptive equipment be used in vision rehabilitation. These services for adults with low vision provided by specially trained professional, low vision orientation therapist and mobility specialist.

IV. Conclusion

Visual stimulation helps cerebral palsy babies to improve attention, memory power, concentration, mental flexibility and executive functions. The research on vision stimulation allows influence on visual, hearing and nervous systems of the human being to improve the vision, to change biological processes in body, speech, thoughts and feelings.

V. Future Enhancement

Future research should include the following 1) Assistive tools support for vision and speech stimulation 2) Brain changes images induced by stimulation tools 3) Whether the tools improve the vision and speech.This will lead to a better understanding of the mechanisms support for vision, speech stimulation to recovery and further refinement of therapeutic approaches with improved outcomes to the benefits of the cerebral palsy babies everyday life.

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