

*Review Article***Tele-rehabilitation Model for developmental milestones****Simran Pareek¹, S K Meena² & Neha Jain³***Mahatma Gandhi Occupational Therapy College,**Mahatma Gandhi University of Medical Sciences & Technology, Jaipur***Abstract**

Developmental milestones are indicators of timely desired development in a child. These milestones are used to assess delay or level of development of various milestones in a child. Understanding and visualizing the developmental milestones through the model can help the provider more skilfully to recognize delayed development, enhance earlier interventions and improve outcomes.

The use of Tele-rehabilitation for developmental therapy has been driven by several factors, including the need to overcome geographical barriers. It may also reduce the cost of healthcare as well as enhance access to health care services. Therefore overall improvement is seen in the outcomes of developmental disabilities. Tele-rehabilitation has been documented as an effective tool in providing therapy for a range of conditions, including cerebral palsy and developmental delays.

Tele-rehabilitation may prove to be a revolutionary way in the treatment of developmental delay. It can make therapy more accessible, convenient, and effective, and it can help children with developmental disabilities and delays reach their full potential through visualisation of accurate milestones, age and their prospective developmental therapy.

Keywords

Tele-rehabilitation, Developmental Milestones, Developmental therapy

Introduction

In the process of Tele-rehabilitation, information and communication tools are used to deliver rehabilitation services. There are a number of steps in tele-rehabilitation including assessment of the problem, making treatment plan, monitoring of the effectiveness of the

treatment plan. Occupational therapy (OT) has the potential to provide lifelong services with continuum of care (Shem et al., 2022).

The goal of tele-rehabilitation is to enhance overall patient outcomes by improving accessibility, better patient outcome, consistent follow-up care and improved access to care.

The use of tele-rehabilitation for developmental therapy has been driven by several factors, including the need to overcome geographical barriers, increase access to care, reduce healthcare costs and improve outcomes for children with developmental disabilities. Tele-rehabilitation has been found to be effective in providing therapy for a range of conditions, including cerebral palsy and developmental delays.

Tele-rehabilitation has the potential to revolutionize the way we deliver developmental therapy. It can make therapy more accessible, convenient and effective, and it can help children with developmental disabilities and delays reach their full potential through the visualisation of accurate milestones age and prospective developmental therapy. Various types of physical, mental and psychosocial developments occur all over life. These developmental milestones may be dependent or independent with each other, e.g., physiologic changes and maintenance of haemostasis, physical growth and development, functional development, speech development, intellectual development, personality development, emotional development etc. (Khan et al., 2023).

Sometimes, these developmental milestones are not achieved at proper time and delay or disability can be seen disorders (Khan et al., 2023).

These disabilities or delay in developmental milestones may occur due to neurological disorders or it can be said that due to developmental disabilities, some malformation or malfunctioning can occur in nervous system also that can further affect all over growth, maintenance and functioning of the body. Developmental delays can be seen in infancy or early childhood as inefficiency in one or more aspects, that include intellectual, functional capacity, vision, hearing, speech and overall behavioural traits.

Brain impairment causes developmental disabilities at various facets in children. Child may suffer from poor nutritional status, apathy, trauma and decreased immune response, higher risk of infections. Difficulty in walking and other functional impairments can also be

seen (Ogourtsova, 2022). Muscular coordination, another problem that is quite commonly visible due to brain disability. Infants with delayed muscular development may show difficulty in many normal activities like rolling over or crawling and may exhibit troubled walking up and down stairs in their later age.

The etiology behind it is multifaceted -

1. **Genetic:** Generally developmental tract is similar in a family tree however, developmental delay is not a genetic problem
2. **Environmental:** Developmental delays may also be a result of various environmental influencers that can be precipitated into developmental disorders in later stages
3. **Antenatal:** There are a number of causative factors during antenatal period that can lead to developmental delay -
 - Heritable disorders: Fragile X syndrome, Down syndrome or chromosomal micro deletion and duplications
 - Early maternal infections, (e.g., rubella, cytomegalovirus (CMV), toxoplasmosis)
 - Late maternal infections, (e.g., varicella, HIV, malaria, etc.)
 - Primigravida, Short inter-pregnancy interval, Teen pregnancy
 - Vascular - haemorrhage and occlusion
 - Medications — include antiepileptic drugs (AEDs), cytotoxic
 - Teratogens / toxins —(include smoking, alcohol, opioids) and
 - Poverty
 - **Perinatal:** Perinatal causative factors for developmental delay include intrauterine growth retardation (IUGR), prematurity, periventricular leukomalacia, Hypoxic-ischemic encephalopathy (HIE), perinatal asphyxia, Metabolic - (Hypoglycemia, bilirubin-related neurotoxicity)
 - **Postnatal:** Metabolic disorders, Inborn errors of metabolism, teratogens/toxins, trauma, maternal stress, maltreatment, malnutrition etc. (Khan and Leventhal, 2023)
 - Through this tele-rehabilitation model it was easy to visualize normal gross developmental milestones in multiple developmental disabilities like developmental delay, cerebral palsy, spina bifida, hydrocephalus, Angelman syndrome, down syndrome, muscular dystrophy
 - Developmental model will be proven as a promising tool to provide early intervention services effectively in remote areas. In this concept, therapeutic services are delivered to remote inaccessible areas using telecommunications

technology. Besides being an efficient method, it is cost effective and convenient also

Research Methodology

Observation studies were taken for the present study. Inclusion and exclusion criteria were laid down as per the objectives of the current review. The collected research data was checked for relevance of the content and used for the present review.

Criteria for the sample collection

2 criteria via inclusion and exclusion criteria were used for the collection of samples.

Inclusion Criteria

- The participants must be of motor developmental disability
- Age: 3 months-3 years
- Both males & females
- Parents of participants must be aware of using technology either have devices to use tele-rehabilitation

Exclusion Criteria

- Participants with any physical deformity
- Low network coverage area
- Participants living with different time zones
- Participants with different language

Electronic Database Searching

The data base searched from PubMed, online journal, access open, google scholar.

Data Extraction and Quality Assessment

Articles were selected using PRISMA flow diagram. Eligibility criteria were determined on the basis of relevance, appropriateness content clarity and research methodology. Two independent reviewers assessed the articles. Details of the participant, year of publication, method, treatment plan and results were taken in the extracted data.

Data Analysis

There were three steps of data analysis -

Step 1: Obtained data was tabulated and classified under different headings as author's name, study design, year of publication, method, sample size, type of intervention, components of intervention and result of the study

Step 2: Identifying the findings of the studies

Step 3: Categorising the findings: The outcomes of the studies were categorised under the headings of the effect of enhanced occupational therapy intervention on the study the effect of participation in leisure and recreational activities on quality of life of the parents of disabled children

Results

Potentially relevant 250 articles were selected for the present reviewed study. Out of which 200 studies were included and 25 articles were excluded on the basis of inclusion and exclusion criteria

Characteristics of the Articles

Out of the 10 studies included in the review, all the reviews were qualitative study. Majority of the study were performed in clinical settings. Year of publication for these review articles were published in-between 2009 to 2023.

1.

Author - Tatiana Ogourtsova et al.

Time of publication - 22 July 2022

Research design - Systematic Review

Number of participants - 29 randomized trails

Sample characteristics - Developmental disabilities

Theme - For individualistic care, tele-rehabilitation is a very effective tool

Sub-Theme - Beneficial effects of tele-rehabilitation in improved outcome of child and parent with developmental disabilities

2.

Author - Isha Akulwar, Tajane et al.

Time of publication - February 03, 2021

Research design - Clinical trial

Sample characteristics - Paediatric neuro-rehabilitation disorders

Theme - It makes parents more capable in meeting their disabled child's needs

Sub-Theme - Examination of tertiary care centre in India for providing alternative model for delivery of neuro-rehabilitative services for paediatric patients

3.

Author - Goris Hung KN et al.

Time of publication - 16 April, 2019

Research design - Systemic review

Sample characteristics - Home patients

Theme - It is an alternative option for occupational therapy, in terms of home care

Sub-Theme - To examine tele-rehabilitation & current practices in occupational therapy

4.

Author - Jessica M.Aguilar et al.

Year of publication - 2018

Research design - Randomized control trial

Number of participants - Parent of 113 children (3-9 year of age)

Sample characteristics - Childhood Brain Injury

Theme - Executive dysfunction can be improved by Online counselling of parents

Sub-Theme - Effectiveness of Internet Based Interacting Together to reduce executive dysfunction

5.

Author - Giuseppina Sgandurra et al.

Year of publication - 2018

Research design - Randomized Control trial

Number of participants - 42

Sample characteristics - Infants with congenital brain lesion

Theme - Neuro-developmental delays by congenital lesions in brain can be significantly improved

Sub-Theme - Care Toy was used in this study for home care of infants who had congenital brain lesions

6.

Author - Emmah Baque, Lee Barber et al.

Year of publication - 6 May 2016

Research design - Randomized control trial

Number of participants - 60

Sample characteristics - Acquired brain injury

Theme - Strength of the lower limb was significantly improved in this study

Sub-Theme - A web-based model was used to improve gross motor capacity of children

7.

Author - Diane L. Langkamp et al.

Year of publication - February 2015

Research design - Case Study

Number of participants - 4 cases

Sample characteristics - Developmental Disabilities

Theme - Asynchronous telemedicine was used to improve developmental disabilities in children and youth

Sub-Theme - To study impact of telemedicine in improving developmental disabilities in children

8.

Author - Jana Cason

Year of publication - 2011

Research design - Case study

Sample characteristics - Children with early intervention

Theme - Tele-rehabilitation can be used for consultation in remote areas

Sub-Theme - It can be used as an adjunct delivery model for early intervention services

9.

Author - Peder E Blide et al.

Year of publication - 2011

Research design - Interventional Study

Number of participants - 9 children (9-13 years of age)

Sample characteristics - Cerebral palsy

Theme - Internet is a quite feasible way to counsel patients with cerebral palsy

Sub-Theme - Home based training was given through internet to children affected with cerebral palsy

10.

Author - Jana Cason

Year of publication - 2009

Research design - Pilot study

Sample characteristics - Early intervention

Theme - Tele-rehabilitation is a cost effective method to cater to the therapeutic needs of rural children

Sub-Theme - Effects of conveying early tele-rehabilitation care to rural parents was studied

Conclusion

After studying the various articles related to Tele-rehabilitation in developmental disabilities.

Besides fewer studies conducted on tele-rehabilitation in developmental disabilities I tried, created and studied a model related to it i.e. tele-rehabilitation model in developmental disabilities through which I concluded that tele-rehabilitation model will demonstrates the normal gross motor developmental milestones with their prospective age of achieving. It helps parents to observe and identify normal milestones that should be achieved at proper age along with their developmental therapy.

It will help to achieve age-appropriate developmental milestones (Neck control, Rolling, Sitting, Crawling, Kneeling, Standing and Walking) by improving range of motion, strength, mobility, posture, endurance for independent function. Thus, improves child's ability to negotiate his or her environment.

Tele-rehabilitation is a very effective tool for distant patients suffering from brain disabilities. It is quite comparable with other modes of treatment and are much better than leave a person without treatment. In fact paediatric medical care can include blend of in-person counselling with tele-rehabilitation follow-ups in coming future. Moreover, it is evident from various studies that tele-rehabilitation is a feasible and cost effective tool to convey long-lasting training to brain disabled children and families.

Training to the parents is more efficacious in improving developmental disorders in underprivileged children.

Tele-rehabilitation is an effective tool in enhancement of family capabilities to take care of their child's requirements with continuity of care with the help of a team approach. That's why it is very important to focus on. After studying the whole literature in table, I concluded that Tele-rehabilitation model will play a major role in improving different motor impairment conditions but there are less models created on paediatric tele-rehabilitation models.

References

- Shem, K., Irgens, I. & Alexander, M. (2022). Getting started: Mechanisms of tele-rehabilitation. Chapter in Tele-rehabilitation: Principles and Practice. Editor: Alexander, M., Elsevier, ISBN - 978-0-323-82486-6
- Khan, I. & Leventhal, B.L.. (2023). Developmental Delay. [Updated 2023 Jan 22]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing
- Ogourtsova, T. (2022). Tele-rehabilitation for the Mental Health of Children with Physical Disabilities and Their Families. *Physical & Occupational Therapy In Pediatrics*. 43(2), 176-181
- Bilde, P.E., Kliim-Due, M., Rasmussen, B. *et al.* (2011). Individualized, home-based interactive training of cerebral palsy children delivered through the Internet. *BMC Neurol*. 11:32, doi: 10.1186/1471-2377-11-32.
- Aguilar, Jessica M., Cassidy, Amy E., Shultz, Emily L. BS; Kirkwood, Michael W., Stancin, Terry, Yeates, Keith Owen, Taylor, H. Gerry & Wade, Shari L. (2018). A Comparison of 2 Online Parent Skills Training Interventions for Early Childhood Brain Injury: Improvements in Internalizing and Executive Function Behaviors. *Journal of Head Trauma Rehabilitation*, 34(2), 65 - 76. DOI: 10.1097/HTR.0000000000000443
- Akulwar-Tajane, I. & Bhatt, G.D. (2021) Tele-rehabilitation: An Alternative Service Delivery Model for Pediatric Neurorehabilitation Services at a Tertiary Care Center in India. *Int J Phys Med Rehabil.*, 9(S3), 1000001-1000009
- Goris Hung, k.N. & Kenneth NK Fong (2019). Effects of tele-rehabilitation in occupational therapy practice: A systematic review. *Hong Kong J Occup Ther.*, ;32(1):3-21. doi: 10.1177/1569186119849119
- Sgandurra, G., Biagi, L., Fogassi, L., Sicola, E., Ferrari, A., Guzzetta, A., Tosetti, M. & Cioni, G (2018). Reorganization of the Action Observation Network and Sensory-Motor System in Children with Unilateral Cerebral Palsy: An fMRI Study. Neural Plasticity after Congenital Brain Lesions, <https://doi.org/10.1155/2018/6950547>

Emmah, B., Sakzewski, L., Barber L. & Boyd, R.L. (2016). Systematic review of physiotherapy interventions to improve gross motor capacity and performance in children and adolescents with an acquired brain injury. *Brain Inj.* 30 (8), 948-59. doi: 10.3109/02699052.2016.1147079

Diane, L. Langkamp, Mark, D. McManus & Susan, D. Blakemore (2015). Telemedicine for children with developmental disabilities: a more effective clinical process than office-based care. *Telemed J E Health*, 21(2): 110-4. doi: 10.1089/tmj.2013.0379

Jana Cason (2011). Tele-rehabilitation: an adjunct service delivery model for early intervention services. *Int J Telerehabil.*, 24;3(1):19-30. doi: 10.5195/ijt.2011.6071

Jana Cason (2009). A pilot tele-rehabilitation program: delivering early intervention services to rural families. *Int J Telerehabil.*, 4;1(1):29-38. doi: 10.5195/ijt.2009.6007