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Case Study: Physiotherapy Program in Down Syndrom Patients with Neuro Development treatment Intervention at Dustira Hospital

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Down Syndrome is a genetic disorder in which there is an extra chromosome on chromosome 21. This extra chromosome results in excessive amounts of certain proteins, which can interfere with the body's normal growth and cause changes in brain development. This case study report aims to determine the effect of physiotherapy intervention with Neuro Developmental Treatment (NDT) on improving motor skills in Down Syndrome children. This case study report was carried out in the children's growth and development clinic at the hospital Dustira Cimahi on January 15, 2024 to February 1, 2024. The intervention used is Neuro Development Treatment through a stimulation and facilitation approach. The results of the Early Growth and Development Detection examination from T1 to T6 showed increased developmental achievements in aspects of fine motor skills, observation and speech. The evaluation results of the Gross Motor Functional Measurement examination showed a total score at T1: 11% and T6: 18%, there was an increase in gross motor skills of 7%. Conclusion: Intervention using Neuro Development Treatment is a therapy that has been proven to be effective in improving the motor skills of Down Syndrome children.

Keywords: Down syndrome, Gross motor functional measure, Neuro developmet treatment

INTRODUCTION

The process of child growth and development begins from the womb, infancy, and toddlers. Each stage of the child's growth and development process has its own characteristics, so that if there is a problem in one of the stages of growth and development, it will have an impact on the growth process and subsequent development (Jin et al., 2025). Not all children experience the normal growth and development process, but there are also stages of growth and development that occur abnormally or abnormally (Imani et al., 2023). These abnormal conditions can occur, one of which is at the stage of embryogenesis or at the stage of cell division. The embryogenesis stage starts from the meeting of the egg and sperm until the 4th week of gestation until the mother feels the movement of the fetus, when this process is disrupted, it can result in abnormalities in the process of forming the brain and spinal cord (Purwanto, 2022). Abnormalities in this growth and development period can occur in the form of abnormalities in chromosomes (Pada Vinski et al., 2025).

A chromosome is a structure in a cell that resembles a ribbon that contains genetic information. This structure is located inside the nucleus of the cell and under normal conditions in living things it is found in pairs, in normal cells the number of chromosomes amounts to 23 pairs / 46 pieces (Setiawan et al., 2021).

The most common chromosomal abnormalities are Trisomy Down Syndrome where the normal number of chromosomes is 46 which is a copy of the mother's egg and the father's sperm cell, then in the process of cell division there is an excess of chromosomes in trisomy 21 (Naufal, 2019). Down Syndrome Trisomy 21 is the most common and easiest to identify genetic disorder. The addition of the 21st chromosome causes the amount of certain proteins to be excessive so that it can interfere with the normal growth of the body and cause changes in pre-arranged brain development. In addition, these disorders can cause delays in physical development, learning disabilities, heart disease. even blood cancer/leukemia (Irwanto et al., 2019). Incidence figures Down Syndrome is the largest number in cases of chromosomal disorders (Kennedy et al., 2025).

Based on data from the World Health Organization (WHO), it is estimated that the birth rate of babies with Down Syndrome about 3,000–5,000 per year, with an estimated 1 event Down Syndrome per 1,000–1,100 live births worldwide. WHO also estimates that globally there are currently 8 million sufferers Down Syndrome and it is estimated that this number increases every year (Aranti & Pristianto, 2023). The Basic Health Research Report mentions the incidence rate Down Syndrome by 0.21 percent or 1 in 600 live births in Indonesia (Ministry of Health of the Republic of Indonesia, 2019).

From the recapitulation of visit data at the Growth and Development polyclinic of Dustira Hospital in 2023, there were 669 visits consisting of 473 cases of Cerebral Palsy, 119 cases of Delay development and 72 cases of Down Syndrome (Dustira Hospital, 2023). There are several factors that are considered to be the cause of abnormalities in the chromosome.

Cause Down Syndrome Due to chromosomal abnormalities on chromosome 21, risk factors that result in abnormalities in chromosomes include: genetic factors, exposure to viruses during pregnancy, exposure to radiation, abnormalities in chromosomes, and the mother's age is more than 30 years old during pregnancy (Aranti & Pristianto, 2023). However, the mother's gestational age is suspected to have the greatest influence on the incidence rate Down Syndrome. The higher the mother's gestational age, the greater the risk of giving birth to a child with Down Syndrome. In the gestational age of the mother 20-24 years Risk of occurrence Down Syndrome That is 1:1490, the gestational age of 40 years is 1:106 and the age of 49 years is about 1:11 births. However, children born to mothers under the age of 35 are 80 percent because that age is a childbearing age group (Irwanto et al., 2019). In children Down Syndrome In general, they will experience some health problems and growth and development (Purwanto, 2022) .

Growth and development in children with Down Syndrome cannot be optimal and they are prone to growth and developmental delays in various areas, including decreased muscle tone and growth disorders due to hypotonia, which are characteristic Down Syndrome which occurs in about 80% of all children with Down Syndrome (Waqas et al., 2025). Hypotonia is a consequence of a neuropathological course Down Syndrome and is not a specific medical disease, but is a possible symptom of various diseases and disorders that affect the control of motor nerves by the brain and muscle strength (Imani et al., 2023). Because of the weakness of the patient's muscle tone Down Syndrome will have difficulties in the developmental stage such as rolling, sitting, crawling, standing and walking so that it requires treatment by child physiotherapy (Lisnaini, 2021).

Physiotherapy is a form of health service aimed at individuals and/or groups to develop, maintain and restore body movement and function throughout the life span by using manual handling, movement improvement, equipment (physical, electrotherapeutic and mechanical), functional training, and communication (Ministry of Health of the Republic of Indonesia, 2015). The role of physiotherapy in cases Down Syndrome Among them is to help strengthen postural tone so as to increase the ability of motor movements to help patients perform functional movements according to the stage of achieving the patient's chronological age (Ministry of Health of the Republic of Indonesia, 2015).

Management of physiotherapy in cases Down Syndrome One of them can use interventions with Neuro Development Treatment (NDT) for improving motor function and normalizing muscle tone by influencing muscle patterns, protective reaction exercises, and balance reactions in accordance with the level of motor development of the child's age so as to facilitate the position to sit, crawl and stand with good posture reactions (Imani et al., 2023). One effective physiotherapy intervention for children with Down Syndrome is Neurodevelopmental Treatment (NDT), which focuses on improving motor function and normalizing muscle tone through facilitation of optimal movement patterns. NDT emphasizes exercises that enhance postural control, balance reactions, and protective responses, all of which are essential for achieving age-appropriate motor milestones such as sitting, crawling, and standing with proper posture (Shields et al., 2022). Recent studies have reinforced the effectiveness of NDT. (Shields et al., 2022) highlighted that NDT-based interventions significantly improved trunk control and postural stability in children with hypotonia, a common characteristic of Down Syndrome. Similarly, (Yana et al., 2024) found that targeted NDT strategies led to measurable gains in gross motor function and adaptive motor planning compared to baseline measures (Miznerova et al., 2025).

In contrast to play therapy, which primarily aims to enhance socio-emotional development through expressive play, or sensory integration therapy, which addresses sensory processing difficulties, NDT is more focused on neuromotor control and the development of functional movement patterns. While play therapy can foster engagement and motivation, and sensory integration can modulate sensory inputs, they often lack the structured, task-specific approach that NDT offers in addressing delayed gross motor skills and poor muscle tone in Down Syndrome. Therefore, while complementary therapies may be beneficial in a multidisciplinary approach, NDT stands out for its targeted, evidence-based focus on improving functional movement through facilitation of normal motor development, making it a cornerstone in the physiotherapeutic management of Down Syndrome (San Martín Valenzuela et al., 2024).

Neuro Developmet Treatment is a therapy that uses directed exercises to improve the integration of information from the body's tactile, vestibular, and somatosensory receptors. Approach Neuro Development Treament It is based on the awareness that people with brain injuries tend to have limited movement patterns that they can perform. Therapeutic approach Neuro Tevelopment Treament It is considered a comprehensive therapeutic management approach that focuses on relevant daily motor functions (Qian et al., 2024). Therapy Neuro Tevelopment Treament Usually used to rehabilitate infants/children with Cerebral Palsy, Down Syndrome, and other motor developmental disorders (Aranti & Pristianto, 2023).

The purpose of this case study is to determine the effect of providing Neuro Development Treatment in helping to improve motor skills in children with Down Syndrome at Dustira Hospital.

METHODS

The research method used in this study is a case study, which allows for an in-depth exploration of a single

subject over a defined period. Case studies are particularly valuable in pediatric physiotherapy because they enable detailed observation of therapeutic responses, especially when interventions are individualized and dynamic in nature. The subject in this study is Dustira Hospital, an 8-month-old infant diagnosed with typical Down Syndrome (DS) presentation. This case was selected intentionally due to the absence of comorbid conditions such as congenital heart defects, epilepsy, or sensory impairments, which could potentially confound motor development outcomes. The choice of this subject aligns with the study's aim to examine the isolated effects of Neurodevelopmental Treatment (NDT) on motor progression in a typical DS profile. The physiotherapy intervention was conducted at the Growth and Development Clinic of Dustira Hospital, Cimahi, over a period of three weeks, from January 15, 2024 to February 1, 2024. The program followed standardized NDT guidelines, emphasizing facilitation of normal movement patterns, inhibition of atypical postures, and promotion of postural control and balance responses. The intervention also incorporated Gross Motor Function Measure (GMFM) assessments to objectively evaluate changes in motor function pre- and post-therapy.

The therapy sessions were conducted twice per week, with each session lasting approximately 45 minutes. Specific NDT-based exercises were tailored to the child's developmental level and goals, including:

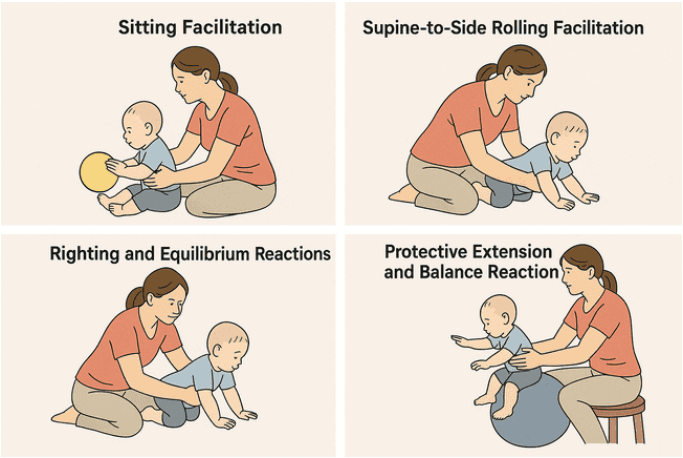

Figure 1. Sitting Facilitation

The therapeutic approach employed in the intervention included a series of facilitation techniques aimed at promoting postural control and motor development. Sitting facilitation (see Figure 1) focused on encouraging midline orientation and trunk control, which are critical for establishing stable seated posture and preparing the child for further motor tasks. To promote transitional movements and improve trunk dissociation, supine-to-side rolling facilitation was used, aiming specifically at initiating segmental trunk rotation—a key milestone in developing coordinated movement patterns. Furthermore, the therapy incorporated righting and equilibrium reactions, which were carried out in both supported sitting and prone positions. These exercises helped the child to adjust their posture in response to changes in body position or external stimuli, enhancing overall balance and coordination. Lastly, protective extension and balance reactions were introduced by applying gentle perturbations while the child was seated. This method was essential in training the child's ability to extend the arms reflexively for support when balance was challenged, thereby improving their safety responses during movement and postural instability.

These techniques were implemented with hands-on facilitation by a trained pediatric physiotherapist, following core NDT principles: handling, alignment, and movement control based on the child's readiness and response. Data collection used both primary sources (direct clinical observation, therapist documentation, GMFM scores) and secondary sources (medical history, parent interviews, and growth monitoring records). The data analysis followed an interactive qualitative model, consisting of four stages: data collection, data reduction (thematic coding), data display (categorization of motor changes), and conclusion drawing. Changes in gross motor ability were interpreted in relation to the NDT intervention, as well as through comparison with expected developmental norms for infants with DS (Sugiyono, 2019).

RESULTS AND DISCUSSION

The initial examination was carried out on the patient directly on January 15, 2024. Starting with a subjective examination, information was obtained that the patient's parents complained that their child at the age of 8 months was not able to roll actively, was not able to sit, laugh and stand.

The results of the anamnesis in the patient's parents obtained historical information that when the patient was 3 months old, the patient's parents felt anxious about the condition of their child who looked weak and not actively moving, then the parents took their child to the hospital, after carrying out the examination, the results of the doctor's diagnosis were obtained that the patient was declared to have *Down Syndrome*, then the patient is referred to the growth and development polyclinic to carry out therapy twice a week. The woman is pregnant at the age of 33 years and is the 3rd pregnancy out of 2 live births, at the beginning of pregnancy the mother often feels nausea, weakness, stress, no appetite until 5 months of gestation so that she experiences weight loss. The mother gave birth at the midwife's practice, the birth process is normal, 38 weeks of months,. The patient was born slightly yellow but his bilirubin level was not checked and no treatment was carried out. The patient was born with a birth weight of 3.6 kg and a length of 50 cm was the third child of two live pregnancies (Amadio et al., 2025).

Physical examination (vital signs) and function

Physical examination carried out on the patient was obtained as a body temperature of 36.5°C, Blood pressure was not carried out, Pulse rate 98/minute, Breathing 34/minute, Nutritional status within normal limits, Weight 5.9 kg, Height 73 cm, Head circumference 38 cm below the normal size of an 8-month-old child (Normal 41 cm - 46 cm).

Functional examinations were carried out on patients, the following data were obtained,

Table 1.
Function check

Function check	Information
Sensory abilities	Visual: normal Olfactory : not done Auditory: BERA test results of the patient are known to have hearing loss in the right and left ears in the moderate category but it is recommended to wear hearing aids.
	Tactile : able to respond
Equilibrium conditions	Static: Facial expressions are less expressive, able to control head movements, move both hands, trunk and limbs appear weak. Dynamic: In the prone position, the patient is able to lift his head about 45° but the weight still rests on the elbow.
Postural tone	On the examination of postural tone by palpation, it was found that there was a weakness of postural tone in the whole body, especially the trunk muscles, pelvic area muscles and both lower limbs.

Base on table 1, he function check revealed that the patient has normal visual abilities and intact tactile responses, while olfactory function has not been assessed. BERA test results indicate moderate bilateral hearing loss in both ears, with a recommendation for the use of hearing aids to support auditory input. In terms of equilibrium, static control shows limited facial expressiveness, but the patient is able to control head movements and move both arms, though the trunk and lower limbs appear weak. Dynamically, in the prone position, the patient can lift the head to approximately 45 degrees, but still relies on elbow support, indicating reduced upper body strength. Postural tone assessment through palpation highlights generalized hypotonia, particularly in the trunk, pelvic region, and lower limbs, suggesting the need for targeted intervention to improve muscle tone and postural control

Special inspection

Special examinations carried out on patients include primitive reflexes and motor ability using GMFM (*Gross Motor Function Measurement)*. Primitive reflex is a movement pattern that appears spontaneously in newborns. Reflex function is very important for babies, which is a survival method for babies until their cognition is perfectly formed. Mature motor development is characterized by the integration of primitive reflexes. Normally, reflexes will disappear or be integrated according to the child's age and the abilities he has achieved. If a child does not achieve reflexes according to his age, then it is suspected that the child has a disorder in the growth and development process (Naufal, 2019).

Table 2.
Examination of primitive reflexes

Primitive Reflex	Result	Information
ATNR	Negative (-)	Usual
STNR	Negative (-)	Usual
Moro	Negative (-)	Usual
Sucking	Negative (-)	Usual
Rooting	Negative (-)	Usual
Palmar / Plantar Grasp	Negative (-)	Usual
Babinski	Positive (+)	Abnormal

Base on table 2, the examination of primitive reflexes shows that most reflexes assessed were within normal limits. The Asymmetrical Tonic Neck Reflex (ATNR), Symmetrical Tonic Neck Reflex (STNR), Moro reflex, sucking reflex, rooting reflex, as well as the palmar and plantar grasp reflexes all presented negative (-) results, indicating that these primitive reflexes have been appropriately integrated, which is typical and expected for developmental age. The absence of these reflexes suggests normal neurological maturation in those aspects. However, the Babinski reflex was found to be positive (+), which is considered abnormal beyond infancy. A positive Babinski sign, characterized by dorsiflexion of the big toe and fanning of the other toes upon stimulation of the foot's sole, may indicate upper motor neuron involvement or delayed maturation of the corticospinal tract. This finding warrants further neurological evaluation to determine the underlying cause and its potential impact on motor development and function.

GMFM (*Gross Motor Function Measurement)* is a measuring tool for checking the function of motor movements specifically for children. This GMFM is used to monitor the growth and development of children who have normal growth and gross motor growth and development delays due to growth defects or impaired growth (Naufal, 2019).

Table 3.
GMFM Inspection

Dimension	Score
A. Lying down and rolling	59.6%
B. Sitting	0%
C. Crawling and kneeling	0%
D. Standing	0%
E. Walking and jumping	0%
Total Score	**11.9%**

Base on table 3, The Gross Motor Function Measure (GMFM) assessment, which evaluates motor function across five key dimensions, indicates significant motor limitations in the patient. In Dimension A (Lying down and rolling), the patient achieved a score of 59.6%, showing partial ability to perform basic movements such

as rolling from supine to prone or vice versa. This suggests that while some foundational motor patterns are present, they are not fully developed or consistently executed. However, the scores for Dimension B (Sitting), Dimension C (Crawling and kneeling), Dimension D (Standing), and Dimension E (Walking, running, and jumping) were all 0%, indicating an absence of functional skills in these areas. The patient is currently unable to maintain an independent sitting posture, perform transitional movements such as crawling or kneeling, or engage in upright weight-bearing activities such as standing or walking. The total GMFM score of 11.9% reflects a very limited overall gross motor function, emphasizing the need for intensive therapeutic intervention focusing on postural control, strength development, and motor pattern training to promote functional mobility and independence.

Evaluation results

One of the physiotherapy problems that occur in children *with Down Syndrome* is the weakness of postural tone which causes delays in growth and development, especially their motor skills, so the goals of physiotherapy programs that can be carried out include helping to improve motor skills according to the stages of their growth and development.

Interventions given to patients *Down Syndrome* be *Neuro Development Treatment (NDT)*, which is a method for improving motor function and normalizing muscle tone by affecting muscle patterns, protective reaction exercises, and balance reactions in accordance with the level of motor development of the child's age so that it can stimulate and facilitate the position to sit, crawl and stand with good posture reactions. NDT has several method that is: inhibition of abnormal posture and dynamic muscle tone, stimulation of hypertonic muscles, and facilitation of normal movement patterns (Angita, 2019). In patients in this case study, NDT was used with a stimulation and facilitation method approach.

Figure 2. Sensory Stimulation and Postural Tone
Source: primary data

Base on figure 2, sensory stimulation is a fundamental component in the application of Neurodevelopmental Treatment (NDT), as it serves to enhance the processing of sensory input critical for motor development and control. In the context of therapy, various forms of stimulation—such as tactile (touch), proprioceptive (joint and muscle sense), and vestibular (balance and spatial orientation)—are strategically utilized to elicit appropriate motor responses. Primary data collected during therapy sessions reveal that children receiving structured sensory input demonstrated improved body awareness, attentiveness, and engagement in movement-based tasks. By targeting the sensory systems, therapists can modulate arousal levels and provide the central nervous system with meaningful experiences that support neuroplasticity and adaptive function. Sensory stimulation not only facilitates postural adjustments and movement coordination but also creates the foundation for higher-level motor planning and functional activity, which are key objectives in NDT (Ahmed et al., 2025).

Figure 3. Stimulation For Postural Tone Reinforcement
Source: primary data

Base on figure 3, Postural tone refers to the baseline level of muscle tension that supports posture and prepares the body for voluntary movement. In NDT, the regulation of postural tone is a primary goal, as abnormalities in tone such as spasticity (hypertonia) or floppiness (hypotonia) can significantly impair functional movement. The primary data from therapy sessions indicate that specific NDT techniques, including guided weight shifts, trunk activation, and facilitation of key points of control, contributed to observable improvements in postural tone regulation. Children with initially high or low tone showed greater stability and control in sitting, standing, and transitional movements after consistent intervention. These changes are crucial because normalized tone allows for more efficient and purposeful movement, enabling children to participate more actively in daily tasks. Thus, postural tone is not only an indicator of neuromotor status but also a critical therapeutic target in achieving the functional outcomes of NDT (Simsek et al., 2025).

Figure 4. Sitting facilitation exercise
Source: primary data

Base on Figure 4, sitting facilitation is a core therapeutic strategy in Neurodevelopmental Treatment (NDT), aimed at improving postural control, trunk stability, and midline orientation. In the primary data collected during therapy sessions, sitting facilitation exercises were applied to encourage children to activate their trunk muscles, maintain upright posture, and develop balance reactions while seated. Through guided manual support at key points of control—such as the pelvis, lower ribs, or shoulders—therapists helped the child achieve and maintain a functional sitting posture. This positioning is crucial in NDT, as it serves as a foundation for engaging in purposeful movement and interacting with the environment. The data demonstrated that consistent sitting facilitation led to increased independence in transitions (e.g., from sitting to standing), improved head control, and more stable upper limb use for play or reaching activities. These outcomes highlight the importance of sitting facilitation in promoting motor function and overall developmental gains within the NDT framework (Rashed et al., 2025).

In this case, the patient received 6 physiotherapy interventions which were carried out at T1 (1st therapy): January 15, 2024 to T6 (2nd therapy): February 1, 2024, the results of the evaluation were obtained as follows:

Table 4. Results of GMFM examination evaluation

Dimension	Score					
	T1	T2	T3	T4	T5	T6
A. Lying down and rolling	60%	63%	73%	84%	92%	92%
B. Sitting	0%	0%	0%	0%	0%	0%
C. Crawling and kneeling	0%	0%	0%	0%	0%	0%
D. Standing	0%	0%	0%	0%	0%	0%
E. Walking and jumping	0%	0%	0%	0%	0%	0%
Total Score	**11 %**	**12 %**	**14 %**	**16 %**	**18 %**	**18 %**

Table 4 shows the results of the evaluation of children's gross motor skills based on five dimensions of GMFM, namely: A) Lying and rolling, B) Sitting, C) Crawling and kneeling, D) Standing, and E) Walking and jumping. From the six measurement points (T1 to T6), the increase only occurred in dimension A (Lying and Rolling), from 60% at the beginning of the intervention (T1) to 92% at the end point (T6). The other dimension showed no change at all, remaining at 0%, which means the child has not achieved that ability during the evaluation period. Overall, the total score only increased from 11% to 18%. If viewed descriptively, this increase appears to be a positive trend, particularly in aspects of torso control and the initiation of rolling motions. However, analytically and clinically, it is questionable the significance of the change in total score of 7% over six evaluations. In the context of rehabilitation interventions or occupational therapy, these changes are minimal and may not have reached the threshold of minimal clinically important difference (MCID) that shows a real functional benefit for the patient. This means that despite progress in one dimension (A), overall there has been no improvement that has a wide impact on children's gross motor function (Zhang et al., 2025).

The unchanged score on dimensions B to E indicates that the child has not shown progress in the ability to sit, crawl, stand, or walk, which is an important component of advanced motor development. This may be due to cognitive limitations, muscle tone, or an underlying neurological condition. In addition, it is necessary to pay attention to whether the therapeutic approach used is too focused on the initial posture (lying and rolling) so that it does not target further motor development. Methodologically, it is important to list whether there is a control measure, sufficient duration of intervention, and whether the techniques used have evidence of effectiveness in other studies. Without this, it is difficult to conclude that the interventions carried out were the main factor in the observed increase in GMFM scores. Mechanism of the training process *Neuro Development Treatment* By stimulating and facilitation techniques by carrying out approximation and propioceptive tactile stimuli of muscles and joints to produce muscle tone from hypotonus to normal controlled by the motor cortex, cerebellum, basal ganglia, midbrain, vestibular system, spinal cord, and neuromuscular system with the mechanism of interaction between the elastic properties of connective tissue and muscle fibers, as well as motor activity units which are the basis of motor control (Imani et al., 2023).

The evaluation carried out on patients after six times of therapy was found that the intervention with Neuro Development Treatment given by physiotherapy was able to improve gross motor movement ability. This is in line with the results of research presented by Imani et al in the journal entitled "The Effect of Neuro Developmental Treatment Exercise on Muscle Tone and Motor Ability in Children *Down Syndrome*" he stated that the provision of training with *Neuro Development Treatment* proven to be quite effective in helping the

treatment of patients with *Down Syndrome*. This is evidenced by the results of research conducted by Imania, et. al in 2017 to 2020 which was carried out at RSAB Harapan Kita. The results of the study concluded that the *Neuro Development Treatment* Routinely every week for 12 months can improve the muscle tone and motor ability of the respondents. The average muscle tone, which was originally only 0.20, has experienced a significant increase of 0.87 to 1.07. Motor ability measured by GMFM also experienced a significant increase of 55.93 from 10.01 to 65.94 (Imani et al., 2023).

In the implementation of physiotherapy with Neuro Developmet Treatment intervention given by physiotherapists to patients, it has not provided maximum improvement due to several reasons, namely in the condition of children *with Down Syndrome* there is a chromosomal abnormality that causes complications of health problems in the patient so that the patient is prone to experiencing pain so that it interferes with the schedule of therapy implementation because the patient must be given treatment and rest, this condition affects the progress of therapy results which are only carried out twice a week. In addition, the patient's family has not run *the home program* optimally as recommended by the physiotherapist because they experience several obstacles such as limited parental time and saturation factors in carrying out the program that must be done every day so that it affects the improvement of therapy results.

Improvements in Fine Motor, Observational, and Speech Abilities

Throughout the intervention sessions, children demonstrated holistic developmental progress, particularly in the domains of fine motor skills, observation, and speech. These areas, though distinct, are interrelated and essential for functional independence, learning, and social interaction. Fine motor skills showed measurable improvement as children engaged in structured and play-based activities that enhanced their hand strength, dexterity, and coordination. Tasks such as grasping small objects, using pencils and crayons, manipulating puzzle pieces, or buttoning clothing became increasingly manageable. These gains suggest not only enhanced neuromuscular control but also greater confidence in completing daily living tasks independently. Simultaneously, children exhibited enhanced observational abilities, which are crucial for cognitive development and adaptive behavior. Initially, many children displayed minimal interest in their surroundings or difficulty in maintaining focus. However, through repetitive and visually engaging tasks like matching games, imitation activities, and structured routines, they began to develop better attention span, visual tracking, and the ability to notice patterns or anticipate events. This improvement in observation enabled them to follow multi-step instructions more effectively and become more responsive to environmental cues and social interactions (Guidetti et al., 2025).

In terms of speech and language development, significant progress was noted in both expressive and receptive skills. Many children transitioned from using isolated words or gestures to forming short phrases and engaging in simple conversations. Through methods such as storytelling, singing, picture-based communication, and interactive play, their vocabulary expanded, and their articulation became clearer. Moreover, children began to express their needs, feelings, and ideas with increasing confidence, participating more actively in communicative exchanges. Overall, the simultaneous improvement in fine motor skills, observational abilities, and speech highlights the comprehensive impact of the intervention. These developments not only support academic readiness and daily functioning but also foster greater social participation and emotional expression. This integrated growth reflects the importance of a multidimensional approach in early childhood development or therapeutic programs.

CONCLUSIONS

A case study on physiotherapy programs in Down Syndrome cases with Neuro Development Treatment intervention in hospitals. Dustira, there was an effect between before and after intervention with Neuro Development Treatment routinely for 6 times on the improvement of motor skills in children with Down Syndrome. The evaluation of the results of the GMFM examination obtained a total score at T1: 11%, T2: 12%, T3: 14%, T4: 16%, T5: 18%, and T6: 18%. Meanwhile, the DDTK examination obtained results of increased achievement in fine motor aspects, observation aspects and speech aspects in the ability of children aged 8 weeks. These results show that the provision of Neuro Development Treatment intervention is able to improve motor skills in children with Down Syndrome.

REFERENCE

Ahmed, M. M., Al Areefy, A. A., & Alsayegh, A. A. (2025). Does Neurodevelopmental Approach of Physical Therapy Have an Impact on Gross Motor and Cognitive Function of Non-obese Children with Autism Spectrum Disorder (ASD)? A Randomized Controlled Trial. *Journal of Disability Research*, *4*(1), 1–11. [Crossref] [Publisher]

Amadio, E., Cimini, L., Ruotolo, I., Carlizza, A., Berardi, A., Marini Padovani, A., Sellitto, G., Fabbrini, G., & Galeoto, G. (2025). Rehabilitation Treatment for Shoulder Pain in Parkinson's Disease: A Pilot Study. *Journal of Clinical Medicine*, *14*(4), 1–12. [Crossref] [Publisher]

Anggita, M. Y. (2019). *Modul Pembelajaran Terapi Latihan Fungsional*. Universitas Esa Unggul. [Publisher]

Aranti, W. A., & Pristianto, A. (2023). Pengaruh Pemberian Neurodevelopmental Treatment, Play Therapy, dan Neuro Senso Terhadap Peningkatan Motorik Kasar Pada Anak Down syndrome. *Physiotherapy Health Science (PhysioHS)*, *5*(1), 18–25. [Crossref] [Publisher]

Guidetti, M., Marceglia, S., Bocci, T., Duncan, R., Fasano, A., Foote, K. D., Hamani, C., Krauss, J. K., Kühn, A. A., Lena, F., Limousin, P., Lozano, A. M., Maiorana, N. V., Modugno, N., Moro, E., Okun, M. S., Oliveri,

S., Santilli, M., Schnitzler, A., … Priori, A. (2025). Is physical therapy recommended for people with parkinson's disease treated with subthalamic deep brain stimulation? a delphi consensus study. *Journal of NeuroEngineering and Rehabilitation*, *22*(1). [Crossref] [Publisher]

Imani, Rusdiyah Nur, Agustina, D., & Andreas, A. M. (2023). Pengaruh Latihan Neuro Developmental Treatment (Ndt) Terhadap Tonus Otot Dan Kemampuan Motorik Pada Anak Down Syndrome: Analisis Data Sekunder. *Jurnal Fisioterapi dan Kesehatan Indonesia*, *03*(01), 2807–8020. [Crossref] [Publisher]

Irwanto, Wicaksono, H., Ariefa, A., & Samosir, S. M. (2019). *A-Z Sindrom Down*. Pusat penerbitan dan percetakan Universitas Airlangga. [Publisher]

Jin, J., Doan, J., Fernandez, C., Nguyen, S., Spencer, C., & Kleschevnikov, A. M. (2025). Early postnatal GABAB antagonist treatment normalizes inhibitory/excitatory balance in neonatal Ts65Dn mice, a genetic model of down syndrome. *Experimental Neurology*, *386*(September 2024), 115171. [Crossref] [Publisher]

Kemenkes RI. (2015). *Peraturan Menteri Kesehatan Republik Indonesia Nomor 65 Tahun 2015 tentang Standar Pelayanan Fisioterapi* (Vol 3).

Kementerian Kesehatan RI. (2019). *Riset Kesehatan Dasar 2018*.

Kennedy, J. T., Wisch, J. K., Dincer, A., Roman, J., Gordon, B. A., Handen, B., Benzinger, T. L. S., Head, E., Mapstone, M., Christian, B. T., Tudorascu, D. L., Laymon, C. L., Hartley, S. L., Lao, P., Brickman, A. M., Zaman, S. H., & Ances, B. M. (2025). Decoding brain structure to stage Alzheimer's disease pathology in Down syndrome. *Alzheimer's and Dementia*, *21*(2), 1–9. [Crossref] [Publisher]

lisnaini. (2021). *fisioterapi pediatri neuromuskuler dan genetik*. Universitas Kristen Indonesia. [Publisher]

Miznerova, B., Reissigova, J., Vasa, L., Frank, J., Hudec, M., Rodina, L., Herynkova, A., Havlik, J., Tintera, J., Rydlo, J., Ibrahim, I., O'leary, V. B., Cerna, M., Jurickova, I., Pokorna, M., Philipp, T., Hlinovska, J., Stetkarova, I., & Rasova, K. (2025). Virtual reality-based neuroproprioceptive physiotherapy in multiple sclerosis: a protocol for a double-arm randomised assessor-blinded controlled trial on upper extremity function, postural function and quality of life, with molecular and functional MRI assessment. *BMJ Open*, *15*(1), 1–10. [Crossref] [Publisher]

Naufal, A. F. (2019). *Mengenal dan Memahami Fisioterapi Anak* (widodo agus (red); 1st ed). Muhammadiyah University Press.

Pada Vinski, D. S. P. V., Nugroho, A. K., Vinski, N. C., Dollar, D., & Gunawan, D. (2025). Exploring the Role of Stem Cell Therapy in Improving Cognitive and Physical Outcomes for Down Syndrome Patients. *Journal of World Science*, *4*(1), 142–151. [Crossref] [Publisher]

Purwanto, Y. (2022). *Fisioterapi Oediatri Neonatal Care* (W. Pratiani (red); 1st ed). Penerbit Buku Kedokteran ECG.

Qian, G., Perzanowska, E., Kozakiewicz, M., Ewertowska, P., Yu, H., & Ossowski, Z. (2024). Immediate effects of Vojta Therapy on gait ability in down syndrome patients: a pilot study. *Frontiers in Neurology*, *15*(8). [Crossref] [Publisher]

Rashed, M. F., Mohamed, M. A., Mohamed, N. E. R., & Mansy, M. El. (2025). Evaluation of laser acupuncture versus physical therapy intervention in management of bruxism in children: a randomized controlled trial. *BMC Oral Health*, *25*(1). [Crossref] [Publisher]

San Martín Valenzuela, C., Ramírez Murcia, E., Aznar-Requena, E., García Sotolongo, D., Rosas-Martín, R., & Sánchez-Sánchez, M. L. (2024). Gait physiotherapy with motor imagery in people with Parkinson's disease: a protocol for randomized control GAITimagery trial. *Frontiers in Neurology*, *15*(January), 1–11. [Crossref] [Publisher]

Setiawan, H., Setiawan, D., Mustopa, A. H., & Ariyanto, H. (2021). *Pengetahuan dasar konseling genetik pada pasien thalasemia*. cv. eureka media perkasa.

Shields, N., Mizzi, N., Buhlert-Smith, K., Strydom, A., Prendergast, L., & Hocking, D. R. (2022). A 12-week exercise programme has a positive effect on everyday executive function in young people with Down syndrome: a pilot non-randomised controlled trial. *Journal of Intellectual Disability Research*, *66*(12), 924–938. [Crossref] [Publisher]

Simsek, F., Naci, B., Kilicoglu, M. B., Alkan, Z., Topcuoglu, O. M., Gormez, A., Hafiz, G., & Okyar, A. F. (2025). Can Manual Therapy Alter Muscle Stiffness in Patients With Spinal Accessory Nerve Injury? *Otolaryngology - Head and Neck Surgery (United States)*. [Crossref] [Publisher]

Sugiyono. (2019). *Metode Penelitian Pendidikan (Kuantitatif, Kualitatif, Kombinasi, R&D dan Penelitian Pendidikan)*. Afabeta. [Publisher]

Waqas, S., Ahmad, A., Goulardins, J. B., Hassan, Z., Hanif, A., & Tariq, M. (2025). Conjunct Effects of Transcranial Direct Current Stimulation with Mirror Therapy on Motor Control and Muscle Performance in Spastic Quadriplegic Cerebral Palsy Children: A Randomized Clinical Trial. *Journal of Multidisciplinary Healthcare*, *18*, 1195–1216. [Crossref] [Publisher]

Yana, M., Kavlak, E., & Güneş, M. (2024). Combined sensory integration therapy plus neurodevelopmental therapy (NT) versus NT alone for motor and attention in children with Down syndrome: a randomized controlled trial. *International Journal of Developmental Disabilities*, *70*(5), 849–856. [Crossref] [Publisher]

Zhang, X. N., Zhang, S., Liu, C. Y., Ni, Z. H., & Lv, H. T. (2025). Caregivers' experience of having a child with Down syndrome: a meta-synthesis. *BMC Nursing*, *24*(1). [Crossref] [Publisher]