

CASE STUDY : IMPLEMENTATION OF PHYSIOTHERAPY FOR DELAYED DEVELOPMENT WITH NEURO SENSORY REFLEX DEVELOPMENT & SYNCHRONIZATION (NSMRD&S), NEURO DEVELOPMENT TREATMENT (NDT), AND PLAY EXERCISE MODALITIES**Nasywa Aqiila¹ , Nur Susanti²**^{1,2}D3 Physiotherapy Study Program, Faculty of Health Sciences, University of PekalonganE-mail: nasywaaqiila260@gmail.com**INFO ARTIKEL****Riwayat Artikel:**

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Keywords: Delayed Development, NSMRD & S, Neuro Development Treatment, Play Exercise**DOI:** <https://doi.org/10.62335>**ABSTRACT**

Background: Delayed Development (DD) is a form of developmental delay characterized by motor skill deficits relative to peers; it can affect sensory function, reflexes, muscle strength, functional abilities, and overall growth and development. The prevalence of DD at YPAC Surakarta rose from 116 patients in 2017 to 135 patients in 2018, highlighting the need for appropriate physiotherapy management. Objective: To determine the effectiveness of physiotherapy using NSMRD & S, NDT, and Play Exercise on improvements in sensory function, reflexes, muscle strength, functional ability, and child growth and development. The study employed a descriptive-analytic method using a case study design; assessments utilized sensory and reflex checklists, XOTR, GMFM, and DDST, and the intervention consisted of six therapy sessions. Results: An improvement in personal-social and fine motor development was observed, rising from 62.5% to 87.5% after six therapy sessions. Conclusion: NSMRD & S, NDT, and Play Exercise can reduce problems in Delayed Development (DD). Parents are encouraged to continue regular exercise and stimulation at home to maintain and optimize therapy results.

ABSTRAK

Latar Belakang: *Delayed Development* (DD) atau keterlambatan perkembangan merupakan bentuk hambatan perkembangan yang ditandai dengan defisit keterampilan motorik dibandingkan dengan teman sebaya; kondisi ini dapat memengaruhi fungsi sensorik, refleks, kekuatan otot, kemampuan fungsional, serta pertumbuhan dan perkembangan secara keseluruhan. Prevalensi DD di YPAC Surakarta meningkat dari 116 pasien pada tahun 2017 menjadi 135 pasien pada tahun 2018, yang menunjukkan perlunya penanganan fisioterapi yang tepat. Tujuan: Untuk mengetahui efektivitas fisioterapi menggunakan metode NSMRD & S, NDT, dan *Play Exercise* (latihan bermain) terhadap peningkatan fungsi sensorik, refleks, kekuatan otot, kemampuan fungsional, serta pertumbuhan dan perkembangan anak. Penelitian ini menggunakan metode deskriptif-analitik dengan desain studi kasus; penilaian dilakukan menggunakan daftar periksa sensorik dan refleks, XOTR, GMFM, dan DDST, sedangkan intervensi terdiri dari enam sesi terapi. Hasil: Teramati adanya peningkatan pada aspek perkembangan personal-sosial dan motorik halus, yang naik dari 62,5% menjadi 87,5% setelah enam sesi terapi. Kesimpulan: Metode NSMRD & S, NDT, dan *Play Exercise* dapat mengurangi permasalahan terkait *Delayed Development* (DD). Orang tua disarankan untuk melanjutkan latihan dan stimulasi secara rutin di rumah guna mempertahankan dan mengoptimalkan hasil terapi.

INTRODUCTION

Delayed Development (DD) is a developmental disorder that is still commonly found in children and requires comprehensive treatment. Based on data from YPAC Surakarta, the number of cases of Delayed Development increased from 116 patients in 2017 to 135 patients in 2018 (YPAC Surakarta Primary Data, 2018). This increase in cases indicates that Delayed Development remains a health issue that requires special attention through appropriate and sustainable interventions.

Delayed Development is a condition of delayed development in children characterized by delays in achieving age-appropriate developmental milestones, such as crawling, sitting, standing, and walking, compared to normal children of the same age. Children with Delayed Development may experience delays in one or more aspects of development, including gross motor skills, fine motor skills, language, personal social skills, and functional activities. (Anam, Rahman, & Trisnaningrum, 2021)

Common problems found in Delayed Development include sensory impairments, delayed reflex development, decreased muscle strength, limitations in functional

activities, and growth and developmental disorders. This condition can hinder a child's ability to perform daily activities and reduce their quality of life if not optimally managed.

Physiotherapy plays a crucial role in improving sensorimotor abilities and child development through various therapeutic modalities. Neuro-Sensor-Motor-Reflex Development and Synchronization (NSMRD&S) aims to stimulate sensory and reflex development, Neuro-Developmental Treatment (NDT) focuses on facilitating normal movement and postural control, and Play Exercise is used as a fun and child-specific stimulation tool for motor development.

Based on these issues, this study aims to determine the effect of NSMRD&S, NDT, and Play Exercise on improving sensory development, reflexes, muscle strength, functional activity, and growth and development in children with Delayed Development.

METHOD

This research used a descriptive analytical method with a case study design on a child with Delayed Development undergoing physiotherapy at YPAC Surakarta.

The examination was conducted using several instruments: a sensory questionnaire to assess sensory function, a reflex questionnaire to assess reflex development, an XOTR questionnaire to measure muscle strength, a Gross Motor Function Measure (GMFM) to assess gross motor functional activity, and the Denver Developmental Screening Test (DDST) to assess the child's growth and development.

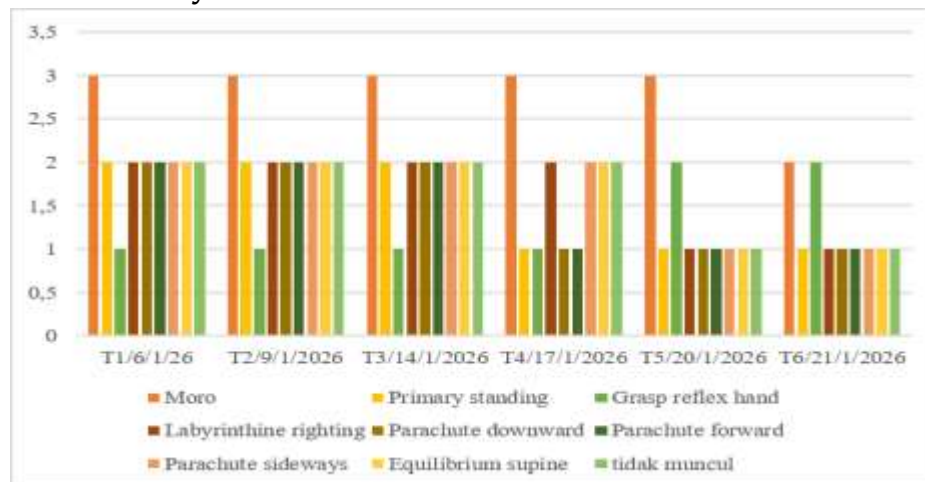
The physiotherapy interventions provided included Neuro Sensory Motor Reflex Development and Synchronization (NSMRD&S), Neuro Developmental Treatment (NDT), and Play Exercise. The therapy sessions were administered six times according to the patient's condition and needs.

Data were collected before and after the interventions. The evaluation results were then analyzed descriptively by comparing the initial and final examination results to determine changes in sensory function, reflexes, muscle strength, functional activity, and growth and development in the child with Delayed Development.

RESULT AND DISCUSSION

RESULT

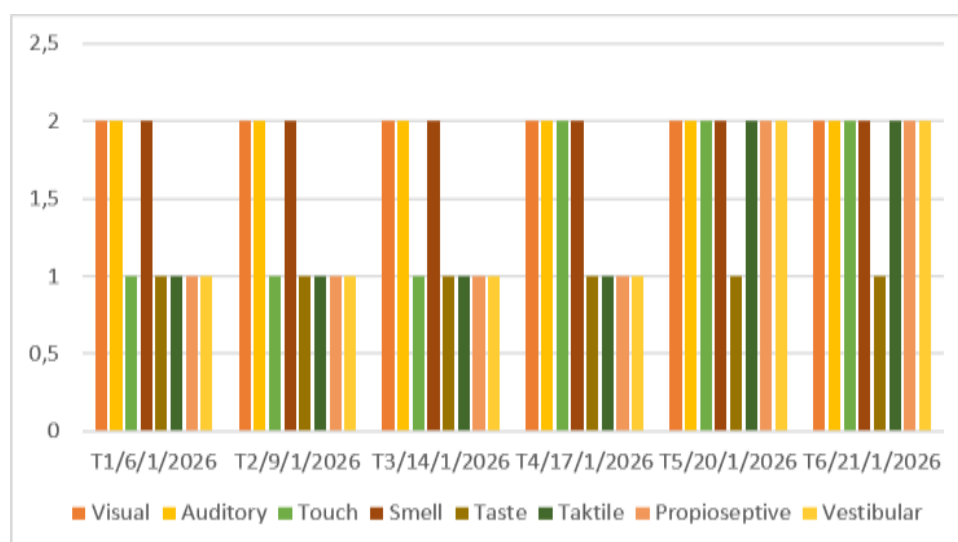
1. Sensory



The sensory ability graph shows a trend of improvement in touch, tactile, proprioceptive, and vestibular aspects over six sessions of therapy. These changes indicate that consistent sensory stimulation can aid the central nervous system in processing sensory information. Providing NSMRD&S and Play Exercise allows children to gain a variety of sensory experiences, improving their ability to receive, recognize, and respond to environmental stimuli. This improvement in sensory function also contributes to increased motor control and the child's ability to adapt to daily activities.

2. Reflex

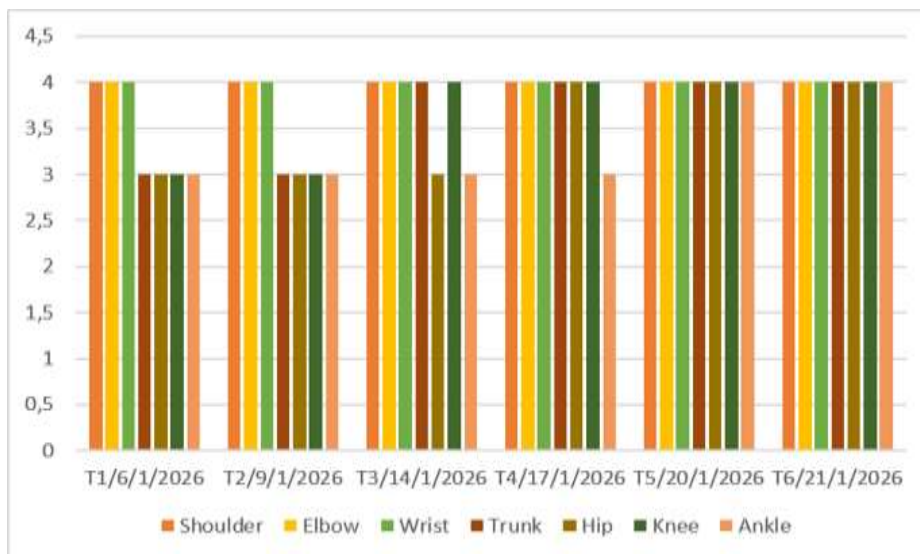
Graph 2. Evaluation of reflex



Based on the reflex graph, the child's developmental reflex abilities increased from 5 months of age during the initial therapy to 7 months during the sixth therapy. Furthermore, several developmental reflexes, such as primary standing, parachute reaction, labyrinthine righting, and equilibrium reaction, began to emerge during the final evaluation. These results indicate the maturation of the nervous system, supported by stimulation through NSMRD&S, NDT, and Play Exercise, resulting in a more optimal reflex integration process.

3. Muscle Strength

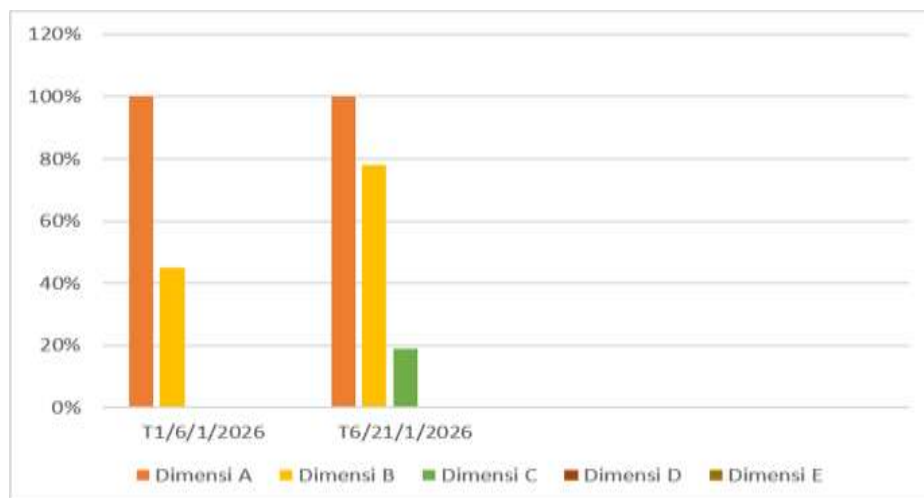
Graph 3. Evaluation of muscle strength



The muscle strength graph shows improvements in the trunk, hip, knee, and ankle muscle groups after six sessions of therapy. At the initial assessment, most muscle groups were still in the T (trace contraction) category, which then increased to X (full active movement) category at the final evaluation. These changes indicate that the NSMRD&S and NDT interventions provided were able to increase neuromuscular activation, improving muscle contraction ability and supporting the child's motor activity.

4. GMFM

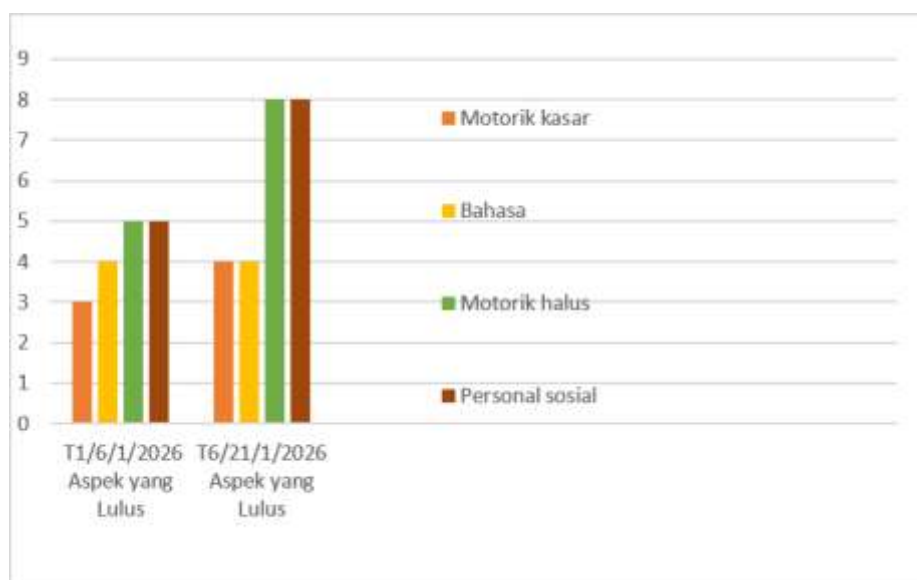
Graph 4. Evaluation of GMFM



The GMFM measurement results showed an increase in the total score from 29% in the first therapy session to 39.4% in the sixth therapy session, a 10.4% increase. Improvements were particularly evident in the sitting and crawling dimensions, indicating improved postural control and motor coordination. The increase in the GMFM score indicates that the intervention supported the development of the child's gross motor skills and functional activities.

5. DDST

Graph 5. Evaluasi of DDST



The DDST graph shows development in the personal-social and fine motor skills during the therapy period. Progress in the personal-social skills indicates an increase in the child's ability to interact and participate in simple activities with the surrounding environment. Meanwhile, development in the fine motor skills indicates improved hand-finger coordination when manipulating objects. These results are believed to be related to the implementation of Play Exercise, which provides opportunities for children to learn through directed play activities, thereby simultaneously supporting the development of motor skills and social aspects.

Discussion

In terms of sensory aspects, the provision of NSMRD&S and Play Exercise during six therapy sessions had a positive impact on improving sensory functions in the form of touch, tactile, proprioceptive, and vestibular in children with Delayed Development. These improvements indicate that the sensory stimulation provided can support the sensorimotor integration process, thus improving children's responses to various environmental stimuli. This finding is supported by research (Karimah, 2018) which states that NSMRD&S plays a role in optimizing sensorimotor integration, as well as research (Sitanggang, Anggraini, & Puspitasari, 2022) which explains that play activities can help improve sensory processing abilities in children.

In terms of reflexes, the administration of NSMRD&S, NDT, and Play Exercise during six therapy sessions showed improvements in reflex integration in children with Delayed Development. These changes were characterized by a reduction in primitive reflexes, namely the Moro Reflex and Grasp Hand Reflex, and an increase in the emergence of developmental reflexes such as Primary Standing, Labyrinthine Righting, Parachute Reaction, and Equilibrium Reaction. These improvements indicate an increase in the nervous system maturation process that contributes to the ability to maintain posture and balance. The results of this study are supported by (Karimah, 2018) and (Anggraeni & Susanti, 2021), who explain that NSMRD&S and NDT can facilitate the integration of developmental reflexes through sensorimotor stimulation and the development of more functional movement patterns. Furthermore, (Anam et al., 2021) reported that play activities (Play Exercise) can support gross motor development, thereby helping the process of reflex integration and movement control in children with Delayed Development.

In terms of muscle strength, six sessions of NSMRD&S and NDT therapy contributed to increased muscle strength in the trunk, hip, knee, and ankle regions in children with Delayed Development. These changes indicate that the sensorimotor stimulation provided can support the neuromuscular system, thus optimizing postural control and motor skills in children. This finding is supported by research (Anggraeni & Susanti, 2021), (Aranti & Pristianto, 2023), and (Ahsani & Rakasiwi, 2022), which explains that the application of NSMRD&S and NDT can help improve muscle function, improve motor control, and support the development of children's motor skills.

In terms of functional activities, six sessions of NDT and Play Exercise therapy had a positive impact on children's functional abilities, as indicated by an increase in GMFM scores from 29% to 39.4%, particularly in the sitting dimension. These results indicate the development of gross motor skills, postural stability, and movement coordination required for daily activities. This finding is supported by research (Aranti & Pristianto, 2023) which explains that NDT can help improve children's movement control and motor function, as well as research (Sitanggang et al., 2022) which states that play activities can provide sensorimotor stimulation that contributes to increased functional abilities.

In terms of growth and development, the NSMRD&S and NDT interventions provided over six sessions of therapy demonstrated progress in child development based on the DDST results. This progress was seen in the personal-social and fine motor skills. These results indicate that the stimulation provided can support children's ability to interact with their environment and improve skills involving fine motor coordination. The findings of this study align with those of (Anggraeni & Susanti, 2021), who explain that NSMRD&S contributes to children's skill development, and those of (Aranti & Pristianto, 2023), who state that NDT can support motor development by improving body control and movement coordination.

Sensory Evaluation Using Sensory Blanks

Based on the results of the sensory evaluation after six physiotherapy interventions, improvements were obtained in the touch, tactile, proprioceptive, and vestibular aspects. In the initial evaluation, all four aspects still showed impairments, then improved to reach the normal category in the 5th therapy and maintained until the 6th therapy. This improvement indicates that the combination of NSMRD&S and Play Exercise interventions is able to provide adequate sensory stimulation, thereby helping the sensory integration process and improving the child's ability to receive and respond to stimuli from the environment.

Reflex Evaluation Using Reflex Blanks

The reflex evaluation results after six sessions of therapy showed an increase in the child's developmental reflex abilities, from the equivalent of 5 months to 7 months of age. This change was marked by the emergence of several developmental reflexes, such as primary standing, parachute downward, parachute forward, parachute sideways, labyrinthine righting, and equilibrium reaction, which were not previously present in the initial evaluation. This improvement indicates that the therapy provided was able to facilitate the reflex integration process, thus supporting the development of better posture and movement control in children with delayed development.

Muscle Strength Evaluation Using XOTR

After six sessions of therapy, muscle strength increased in the trunk, hip, knee, and ankle muscle groups. At the initial examination, these muscle groups were still in the tonus category without active movement (T), but then improved to normal joint movement (X) at the final evaluation. This increase in muscle strength contributed to

improved postural stability and the child's ability to perform developmentally appropriate motor activities.

Functional Activity Evaluation Using GMFM

Functional activity evaluation using GMFM showed an increase in the total score from 29% in the initial therapy to 39.4% in the sixth therapy session. Improvements were particularly evident in the sitting and crawling dimensions, indicating development in gross motor skills, postural control, and balance. These results demonstrate that NDT and Play Exercise can gradually improve children's functional abilities, enabling them to increasingly perform age-appropriate activities.

Growth and Development Evaluation Using DDST

The results of the growth and development evaluation using the DDST after six sessions of therapy showed improvements in fine motor skills and personal-social skills. In the fine motor skills, there was an increase in the ability to scratch beads, move cubes, and hold objects using the thumb and fingers. Meanwhile, in the personal-social skills, there was an increase in the ability to play ball with the examiner, imitate activities, and drink from a cup. Overall, these results indicate that the physiotherapy intervention provided was able to support the achievement of developmental milestones in children who had previously experienced delays.

CONCLUSION

Based on the evaluation results after six sessions of therapy, the provision of NSMRD&S, NDT, and Play Exercise had a positive impact on children with Delayed Development. Improvements were seen in sensory aspects, reflexes, muscle strength, functional activities, and child growth and development. These results indicate that the physiotherapy intervention provided was able to support optimal child development. To maintain the therapy results, consistent stimulation and exercise are required at home with parental guidance.

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