

Neuro and psychomotor home therapy for pediatric patients. A case report on the treatment of a child with Miller-Dieker syndrome, severe global delay and tetra paresis

Letizia Pucinotti¹, Marta Abrate², Anna Colombo³, Valeria Borsani² *

1. ASST Rhodense, Local social and health Services – Department of Oncology and Hematological Oncology, University of Milan, Milan, Italy;

2. Maddalena Grassi Foundation, Home Care Service (Cure Domiciliari), Milan, Italy;

3. Don Carlo Gnocchi ETS Foundation, IRCCS S. Maria Nascente, Academic Directorate of the in Neuro and Psychomotor Therapy of the Developmental Age (TNPEE) Degree Course Degree Course, Milan, Italy.

*Correspondence: borsani@fondazionemaddalengrassi.it

KEYWORDS:

Neuropsychomotor; neuromotor; rehabilitation; therapy; home; child; adolescent

ABSTRACT

The study aims to investigate the efficacy of home-based treatment provided by a Neuro and Psychomotor Therapist of the Developmental Age (TNPEE) within a Home Care service for pediatric patients with neuromotor developmental disorders. It focuses specifically on the improvement of the child's skills and the acquisition of new competencies by the parents, facilitated by a personalized care plan. The focus on a single case allowed for an in-depth analysis of the rehabilitative process. Convenience sampling was conducted among patients under the care of a Home Care institution based on their availability to participate in the study, session regularity, and the types of treatments performed. The case involves a child aged 2 years and 4 months diagnosed with Miller-Dieker Syndrome, severe global delay, and tetra paresis. A qualitative assessment was performed at the baseline and after six months of treatment. The home rehabilitation program included individual weekly sessions of physiotherapy and speech therapy, and twice-weekly sessions with the TNPEE. Significant improvements were observed in the child's motor skills, visual tracking, communication, and interaction competencies. The parents demonstrated increased awareness regarding their child's resources and fragilities, becoming more proficient in supporting, stimulating, and caring for him in daily life. A comparison between the obtained results and the literature highlighted significant convergences regarding the efficacy of home-based treatments. However, there is a lack of studies specifically pertinent to the treated pathology and TNPEE interventions at home. The implementation of further research in these fields is encouraged.

1. INTRODUCTION

Neuromotor developmental disorders represent a heterogeneous group of neurological pathologies that manifest during childhood and compromise the normal development of children. These conditions include Infantile Cerebral Palsy (ICP), acquired brain injuries, and genetic syndromes [1]. The literature highlights how these disorders have a significant impact on the patient's motor, sensory, cognitive, and behavioral levels, requiring targeted and early rehabilitative interventions [2]. Recommendations for rehabilitative intervention emphasize the use of a multidisciplinary, personalized, and holistic approach, involving not only the child but also the family and the social context [3]. Furthermore, they underscore the importance of timeliness and intensity to maximize the child's recovery potential, especially in the first years of life when cerebral plasticity is at its peak.

In this context, the Home Care service (C-Dom) constitutes a particularly advantageous solution for pediatric patients with neuromotor disorders, as it allows for timely and direct intervention within the child's family environment, ensuring continuity of care and promoting the active participation of the family in the rehabilitative process. Home Care services are formally recognized as Essential Levels of Assistance (LEA) and are regulated by the National Health Service (SSN) [4]. The activation process

requires a multidimensional assessment of the patient's needs, defining an Individual Care Plan (PAI) and/or an Individualized Rehabilitative Project (PRI) based on the complexity of health, functional, and social needs. The PAI may provide multidisciplinary assistance comprising physicians, nurses, TNPEEs (Neuro and Psychomotor Therapists of the Developmental Age), physiotherapists, speech therapists, occupational therapists, psychologists, and social-health workers (OSS).

The role of the TNPEE within Home Care for the treatment of pediatric patients suffering from neuromotor disorders is not currently described by specific guidelines. A review of the literature has shown a lack of content in this regard and therefore required the inclusion of relevant texts referring to other professional figures treating the same type of patients in the home setting. From the analyzed literature, the efficacy and utility of home therapy emerge. The home environment is a context rich in potential, as it is where the child spends the majority of their time, at least in the first years of life. Home therapy reduces costs and the inconveniences associated with travel and often demonstrates improvement across multiple levels: motor, cognitive, and participation [5,6,7,8,9,10,11,12,13,14,15,16,17]. An additional value concerns the centrality given to the family. Indeed, Home Care favors the execution of intensive treatments, which can also be performed



Copyright: © 2026 by the authors. Submitted for possible open access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

med by caregivers through effective coaching and supervision. This also has an impact on the mental health of the parents, who feel active in the care process and increase their interaction with the child. Consequently, stress levels are reduced, improving the quality of life for the entire family, as highlighted by various authors [10,14,15,16,17,18,19,20,21,22]. Many articles report the need for further studies since, despite proven efficacy, home therapy remains a little-known intervention with limited research. The present work aims to initiate a preliminary theoretical reflection and provide a practical example of the efficacy of the TNPEE's home intervention for patients with neuromotor developmental disorders. The case of a home treatment of a minor patient under the care of a Home Care Provider was followed. The choice of the case was guided by the fact that the patient received a treatment targeted at various areas of development, thus providing a comprehensive framework for the analysis of the rehabilitative program and the complexity of the therapeutic intervention carried out by the TNPEE.

2. MATERIALS AND METHODS

The case of a minor admitted to the Home Care Provider service in October 2023 was selected. The PAI includes 2 weekly nursing visits (for clinical monitoring, management of the Percutaneous Endoscopic Gastrostomy Jejunal PEG-J, and management of respiratory devices), 1 weekly visit by a OSS to assist the caregiver with patient care and hygiene, and 4 weekly visits by rehabilitation professionals according to the PRI. The latter specifies 2 neuro and psychomotricity sessions with a duration of approximately 60 minutes for each therapy session, 1 physiotherapy session, and 1 speech therapy session per week.

The TNPEE conducted the child's assessment upon admission and after 6 months of therapy, following the PRI's validity period.

To investigate the evolution and/or any changes in the managed clinical case, an initial qualitative assessment, on which the goals and interventions of the rehabilitation plan were identified, and a final qualitative assessment were performed. The neuro and psychomotor evaluations used reflect the grid provided by the degree course in TNPEE at the University of Milan [23,24]. These evaluations are composed of the following sections:

- Neuromotor area
- Psychomotor functions
- Behavior, social interaction, and communication
- Cognitive area and play skills

The severity of the neuro-psychomotor profile precluded the administration of quantitative tests and standardized scales, as they would have been non-administrable and of little significance for measuring result outcomes.

2.1 Case Description: Clinical Characteristics

The case presented involves a male child, 2 years and 4 months of age, suffering from Miller-Dieker Syndrome. Miller-Dieker Syndrome is caused by a deletion of contiguous genes on chromosome 17p13.3, which results in classical lissencephaly and characteristic facial features. Furthermore, it is often associated with epilepsy and feeding disorders. This syndrome is classified among rare diseases and shows a prevalence of 11.7 births per million live births [25].

The patient presents with lissencephaly due to a microdeletion of the LIS1 (PAFAH1B1) gene, resulting in severe global delay and hypotonic tetra paresis. He also has a diagnosis of West Syndrome, epilepsy managed with a ketogenic diet, bilateral cryptorchidism with bilateral renal dysplasia, and recurrent urinary tract infections. Numerous episodes of aspiration pneumonia and gastroesophageal reflux disease led to the placement of a jejunostomy in March 2023, with the subsequent start of feeding via PEG-J. Moderate retinal distress is present in both components responsible for photopic and scotopic vision.

The respiratory clinical picture includes stenosis of the left choana, secretions, and sialorrhea, for which the patient is taking glycopyrrolate. Nasal washes are performed at least twice daily even when the patient is stable, with the nocturnal use of high-flow oxygen for desaturation episodes. The patient also utilizes a Percussionaire, showing marked improvement in secretion management. Two attempts were made to initiate use of a cough assist machine, but it was poorly tolerated. During acute phases and increased secretions, the use of a suction aspirator is necessary. The patient does not experience difficulty falling asleep but has frequent nocturnal awakenings (approximately every 30 minutes) with apparent difficulty managing secretions. These episodes resolve after swallowing. During the day, the patient exhibits many moments of somnolence, attributable to poor nocturnal rest.

Current pharmacological therapy consists of: levetiracetam, vigabatrin, and sodium valproate, along with a ketogenic diet for seizure control. Fixed-dose paracetamol before sleep and melatonin are also administered.

3. RESULTS

3.1 Pre-intervention neuro-psychomotor assessment and proposed interventions

The following section outlines the contents of the initial assessment conducted by the TNPEE at the time of intake, including the identification of therapeutic objectives and the corresponding proposed interventions.

3.1.1 Neuromotor area

Assessment data: The child presents with a clinical profile of tetra paresis with axial hypotonia and distal hypertonia. Movement of the four limbs appears



poor and repetitive. The child remains predominantly in a supine position and maintains the head rotated to the left. The upper limbs are flexed and abducted ("candelabrum" position) with the hands mostly closed. The lower limbs are abducted, extended, and externally rotated, with feet tending toward equinus. Positional plagiocephaly on the left side is present, resulting in facial asymmetry. Postural transitions have not been acquired; supine-to-prone rolling and vice versa are possible only with facilitation. In lateral decubitus positions, there is a tendency to hyperextend the head. In the prone position, the child lacks head and trunk control, with only sporadic head lifting occurring if facilitated. There are no joint limitations. Osteotendinous reflexes are hypo-elicitable, and a withdrawal reaction to painful stimuli is present. The deficit in axial and postural control prevents manipulation activities in the absence of manual containment by the operator or positioning within a postural unit. With postural containment and facilitation, the child engages an object placed a few centimeters away and makes reaching attempts, predominantly with the right hand and with the hand closed; movements are not very fluid, not always goal-directed, and bimanual integration is absent.

Objective 1: Postural care.

Intervention 1: Identify and prescribe assistive devices, such as an outdoor postural stroller and a postural unit with an indoor base (Figure 1). Provide guidance to the family regarding postural changes throughout the 24-hour period, the correct use of assistive devices, and their functional potential. Perform passive mobilizations and stretching to maintain joint range of motion and muscle length.



Figure 1. Outdoor postural stroller and a postural unit with an indoor base.

Objective 2: Improvement of postural control competencies

Intervention 2: In a play-based setting and with appropriate facilitations, axial straightening exercises from prone, quadruped, and seated positions. The use of a trunk-pelvis elastocompressive orthosis (Figure 2) is recommended to achieve greater containment and to improve the stability of the trunk and girdles.

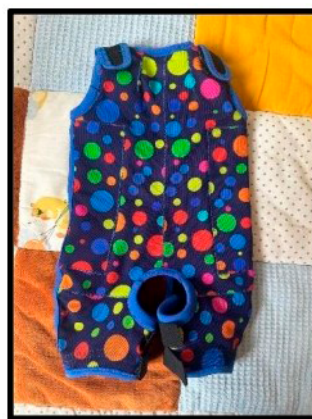


Figure 2. Trunk-pelvis elastocompressive orthosis.

Objective 3: Improvement of dynamic locomotor competencies.

Intervention 3: Facilitation of postural transitions during play activities, seeking maximum active participation from the child.

Objective 4: Enhancement of manual skills and integration of both upper limbs.

Intervention 4: Stimulate reaching skills and facilitate bimanual cooperation using toys of greatest interest that are easiest to grasp (Figure 3). Utilize assistive devices that, once the object is grasped, allow the grip to be maintained, thereby encouraging the child's active movement within the play activity. In these activities, prioritize contexts of maximum postural and perceptual containment, for example, through positioning on a postural unit and the use of a wrap-around cutout table (Figure 4).



Figure 3. Grip aid.



Figure 4. Wrap-around cutout table.



Copyright: © 2026 by the authors. Submitted for possible open access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

3.1.2 Psychomotor functions

Assessment data: The child does not invest in space, as he has not achieved the ability to perform postural transitions or autonomous movements. Occasionally, he explores space and objects with his gaze and through some reaching attempts, though these do not always appear goal-directed. He exhibits poor body awareness and is unable to recognize different body parts on himself or others; he is also deficient on the spatial plane. Intrinsic and Extrinsic Ocular Movements (IOM and EOM) are intact, but with poor visual tracking of both the human face and light sources, characterized by some latency and occasional horizontal nystagmus. A reaction to auditory stimuli is observed, suggesting that the auditory channel is apparently intact. Indeed, he orients himself toward his mother's voice and toward motivating sound sources. From the observation of facial mimicry, he appears to enjoy auditory stimuli (e.g., music) and visual stimuli, especially if luminous. Other sensory channels cannot be formally investigated due to cognitive and communicative deficits, although there appears to be a minimal reaction to tactile stimuli as well.

Objective 1: Enhancement of body awareness.

Intervention 1: Infant massage is taught to the parents with the objective of strengthening the parent-child relationship and supporting the child's proprioception through touch and gentle mobilization. Furthermore, stimulations with objects of different shapes and consistencies are proposed to support proprioception starting from tactile stimulation.

Objective 2: Enhancement of neurovisual competencies.

Intervention 2: Selection of high-visual-contrast toys that are more motivating for the child. Creation of contrasting colored backgrounds to delimit the field of visual exploration and allow for a better engagement with the object (Figure 5). Creation of panels from which stimuli are presented in different areas of the visual field (Figure 6). Provide advice to parents on visual stimulation methods, such as soft ambient lighting and backlighting.



Figure 5. High-contrast board.



Figure 6. Board used for saccadic movements.

3.1.3 Behavior, social interaction and communication

Assessment data: The child alternates between periods of active wakefulness, during which he appears responsive to the proposed stimuli (albeit with a latency period), and moments of somnolence. The face is moderately expressive, conveying sensations of pleasure or distress, which are also communicated through vocalizations or crying, as the child is non-verbal.

Objective 1: To stimulate relational engagement.

Intervention 1: Perform bodily and tonic-emotional play to foster relational exchange. Support these activities with songs and verbal input that is appropriately modulated at a prosodic level to encourage and stimulate the child. Share these strategies with the parent and establish routine activities to be carried out with the child.

Objective 2: Use of gaze for communicative purposes.

Intervention 2: Begin making small choices through gaze between two toys and activate the toy only when the child looks at it, thereby encouraging the use of gaze for requestive purposes. Share these strategies with the parents to ensure therapeutic continuity and increase moments of exchange with the child.

Objective 3: To begin identifying shared "yes" and "no" signals.

Intervention 3: Attribute an affirmative meaning to the smile and a negative meaning to a grimace or the absence of reaction. In this case as well, it is necessary to share the strategy with the family to maintain communicative consistency.

3.1.4 Cognitive area and play skills

Assessment data: The child demonstrates severe global delay. Attention spans regarding various stimuli last only a few seconds. He is unable to structure a play activity autonomously, but he expresses which stimuli are of interest to him by slightly increasing his attention span or visual tracking attempts.



Objective 1: Identification of preferred and accessible play proposals.

Intervention 1: Propose stimuli that elicit different sensory channels to identify those that arouse the greatest interest in the child, such as musical activities or activities that stimulate the visual channel. Additionally, identify play activities that are easily activated based on the child's residual motor resources.

Objective 2: Acquisition of the cause-effect relationship.

Intervention 2: Implementation of adapted games and activities that provide immediate feedback as a result of the child's motor activation.

3.1.5 Home Setting for the treatment

To initiate the treatment, in agreement with the family, a suitable corner of the house was identified to conduct the therapeutic sessions. The choice fell upon a space that presented adequate characteristics in terms of dimensions, lighting (such as the presence of a dimmable window), and access to various work surfaces, such as proximity to a sofa, which allows for operation on surfaces at different heights. The necessary material for the sessions was selected, including a mat composed of interlocking plastic squares, chosen for their ease of cleaning, and a washable cloth. Furthermore, particular attention was paid to the selection of play materials, prioritizing multisensory objects that would stimulate different perceptual channels: high-contrast visual materials, objects pleasant to the ear, and materials with different textures to stimulate the tactile channel (Figure 7).

Once the setting was prepared and the material selected, the specific treatment for each of the intervention areas was structured, as previously outlined.

3.2 Post-intervention neuro-psychomotor assessment

The following section outlines the contents of the final assessment conducted by the TNPEE after 6 months of treatment.

3.2.1 Neuromotor area

The child presents with hypotonic tetraparesis, characterized by greater hypotonia at the axial level and a tendency toward distal hypertonia in the hands. Movements of the four limbs appear poor and repetitive, albeit with greater activation of the lower limbs. Currently, in the supine position, when a small bell is attached to each limb, the child is able to perform repetitive flexion and extension movements of the four limbs, alternating between the upper and lower extremities. Postural transitions have not yet been achieved, and without prompting, the child remains in a supine position with the head slightly rotated to the left; however, when activated by luminous and auditory stimuli, he is now able to rotate his head toward the right. In the supine position, the upper limbs are flexed and abducted (in a "candelabrum" position) with the left hand remaining mostly closed, whereas the right hand tends to explore the object when stimulated with sensory tools.

The lower limbs are abducted, extended, and externally rotated, with the feet tending toward equinus. The child performs rolling if facilitated by a slight push from either the scapular girdle or the pelvic girdle on both sides. During rolling toward the left, the child frequently leaves the right upper limb behind the trunk, but when stimulated, he is able to bring it forward toward the floor. Conversely, he is able to execute a complete roll toward the right if positioned and facilitated correctly.

In axial straightening from prone, with the upper limbs flexed, postural control appears to be impro-



Figure 7. Collage depicting the materials used during the therapeutic sessions, selected to stimulate the patient's auditory, visual, and tactile channels.



Copyright: © 2026 by the authors. Submitted for possible open access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

ving; the child lifts his head from the surface and is now able to maintain it for approximately twenty seconds, exhibiting more fluid and controlled movements, especially if the surrounding environment provides auditory or luminous stimuli. If physically contained at the level of the shoulders and hips, the child remains in the posture with the head elevated for about twenty seconds, also succeeding in rotating his head toward the right and toward the left while tracking the stimulus. No joint limitations are present, and no pain is reported.

The osteotendinous reflexes are hypo-elicitable, whereas a withdrawal reaction to painful stimuli is reported, characterized by a slight arrest reaction, a grimace as if in discomfort, and, in cases of greater distress, crying. When maintaining a posture on either lateral decubitus side, the child tends to retroflex the head, but if correctly positioned, he maintains it aligned with the midline axis for a few dozen seconds.

If supported at the level of the hips, the child maintains a seated posture, with legs abducted, for a few seconds. After this period of time, the child requires support at the level of the spine and head to maintain the posture. Limited control of the head and trunk is reported. The deficit in axial and postural control precludes manipulation activities in the absence of containment; it is therefore necessary to provide support during manipulation activities, which can be delivered either manually by the operator or through positioning within the postural unit. Indeed, to foster reaching (which appears greater on the right), it is useful to place the child on his side or within the postural unit, even though when seated, the child preferably keeps his head tilted to the right and slightly rotated to the left.

Currently, however, with postural containment and facilitation, the child engages an object or a human face placed at a distance of a few centimeters and makes reaching attempts, opening and closing the right hand, while the left remains mostly closed. Reaching appears poor, with oculomotor/visual-motor coordination difficulties, but it tends to be goal-directed. Furthermore, at present, reaching movements appear consecutive if the stimulus captures the child's attention, and particularly if elicited by caregivers or the therapist. However, poor integration and dissociation between the limbs are reported.

IOM and EOM (intrinsic and extrinsic ocular movements) appear intact. The child is able to perform moderate visual tracking if the stimulus is placed against a high-contrast background. The stimuli tracked by the child primarily include: the interlocutor's face, high-contrast objects illuminated with a small flashlight, light sources, and/or acoustic objects that provide auditory facilitation. Furthermore, occasional horizontal nystagmus is present.

The parents are now more aware regarding the correct modalities for positioning the child and alternate between the various recommended postures

throughout the day. They also know how to use the different assistive devices and present effective proposals for motor activity.

3.2.2 Psychomotor functions

The child does not invest in space, as he has not achieved the ability to perform postural transitions autonomously. Currently, however, if a stimulus of interest is present, he explores space with his gaze and makes reaching attempts that tend to be goal-directed. The child exhibits poor body awareness and is unable to recognize different body parts on himself or others. The child is deficient on the praxic plane and executes neither simple praxies nor referential praxies. He now turns toward the interlocutor's voice and toward sound sources of various music. He particularly enjoys auditory stimuli, especially the human voice or the music of a musical instrument, somatic stimuli such as infant massage, and visual stimuli, particularly if luminous; this is deduced from non-verbal communication aspects, such as facial mimicry and posture. With acoustic instruments, if positioned close to the right upper limb, he is able to perform small movements to shake the object and generate the auditory stimulus. Motor attempts increase when encouraged by parents and therapists. Furthermore, in the supine position, when a small bell is attached to each limb, the child is able to perform repetitive flexion and extension movements of the four limbs, alternating between the upper and lower extremities. The parents are now more aware of their child's competencies and fragilities and are able to identify play proposals appropriate to the child's skills. Additionally, they appropriately regulate the environment in which the child is located to present a play activity and to support his visual abilities, for instance, by keeping the environment dimmed and positioning a light to backlight the toy.

3.2.3. Behavior, social interaction and communication

The child's competencies remain heavily influenced by his general clinical status and his sleep-wake rhythm difficulties; however, during moments when he is well and in a state of calm wakefulness, several improvements can be observed. Indeed, the child alternates between periods of active wakefulness, during which he appears responsive to the proposed stimuli (albeit with a latency period), and moments of somnolence. The face presents with good mimicry, through which he makes himself understood regarding pleasure or distress, primarily through a smile or crying. The child is non-verbal and communicates his state of well-being or distress through vocalizations, smiles, or crying. During periods of wakefulness, and particularly during states of distress, he allows himself to be easily consoled by his parents, the nanny, and the therapists, and he accepts, without showing particular signs of discomfort, the interactions of the family dog.



Currently, the moments in which he appears engaged in a relationship with the interlocutor have increased, and he seems to experience greater enjoyment during interaction within play activities. He is beginning to utilize his gaze for communicative purposes, for instance, by fixing his gaze on an acoustic toy to request its activation or by making small choices when two highly preferred and motivating toys are presented, orienting his gaze toward the preferred toy. Furthermore, the child smiles in the presence of his parents and upon the perception of an auditory or visual stimulus to his liking. In fact, a coded communication regarding “yes” and “no” is beginning to emerge through a smile or an expressionless (amimic) face. The parents demonstrate greater awareness regarding how to stimulate the child to support these skills and how to decode his communication.

3.2.4. Cognitive area and play skills

The child demonstrates an evident global delay in line with the diagnosis. Attention spans regarding the various stimuli last approximately ten seconds, which can be extended if the activity is to his liking. Currently, with facilitations and during moments when the child is well and highly motivated from a relational standpoint and by the type of play, he is able to perform several activities for a few seconds. For example, he repeatedly activates a pressure-based cause-effect toy or activates an acoustic toy by executing movements of the upper limb, when facilitated in grasping via the assistive device. The child is unable to structure a play activity autonomously, but he expresses which stimuli are of interest to him by slightly increasing his attention span or visual tracking attempts.

In light of the findings recorded by the TNPEE through the initial e final assessment, the results achieved, in terms of skills acquired by the child and persisting weaknesses, are summarized in Table 1.

4. DISCUSSION

After six months of treatment within the Home Care service (C-Dom), significant improvements are observed in the child in terms of motor skills, visual tracking, communication, and interaction competencies, despite the overall clinical complexity. Furthermore, the parents demonstrate greater awareness regarding the child’s resources and fragilities, becoming more proficient in supporting and stimulating him.

The comparison between the obtained results and the literature review highlighted important convergences regarding the efficacy of home-based treatments; however, the lack of articles more specifically pertinent to the pathology treated and the interventions provided by the TNPEE figure makes a comprehensive comparison of results difficult. Having considered only a single clinical case limits the representativeness of the results, also in the absence of a long-term re-evaluation. Additionally, the assessment was conducted through qualitative observations, as the severity of the clinical case precluded the administration of quantitative tests and standardized scales, rendering the results less objective and repeatable.

Therefore, while noting the need for further studies to clarify the efficacy of home therapy in the treatment of children with neuromotor disorders and to further define the role of the TNPEE within the home care service, the presented case represents a useful first step in highlighting the characteristics of this type of treatment. Further developments could be achieved by adding more treated cases, which might eventually allow for the application of objectifiable assessment scales. Moreover, it would be of interest to investigate the effect on the family members of the children under treatment in terms of stress related to daily caregiving.

Table 1: Post-intervention results in terms of acquired skills and persisting weaknesses.

INITIAL ASSESSMENT	POST-INTERVENTION ASSESSMENT
Relationship with parents	
He communicates his state of well-being or distress through vocalizations or crying and allows himself to be consoled by his parents; he smiles and appears particularly interested in their voices.	He exhibits greater motor activation when encouraged by parents and therapists.
Pleasure from auditory and visual stimuli	
He manifests activation during exposure to auditory and visual stimuli, such as the human voice, music, or luminous objects.	He is able to perform moderate visual tracking, with some latency, if the stimulus is of interest to him and is placed against a high-contrast background.



Copyright: © 2026 by the authors. Submitted for possible open access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).



Reaching attempts	
With postural containment and facilitation, the child engages an object placed at a distance of a few centi-meters and makes reaching attempts, keeping the hand closed and preferably using the right up-per limb.	He performs more goal-directed reaching attempts, opening and closing the right hand, while the left remains mostly closed.
Posturo-motor control and dynamic locomotor competencies	
A severe deficit in axial and postural control is ob-served in all postures. The child does not achie-ve any postural transitions or autonomous move-ments and performs some postural transitions only if facilitated.	Postural transitions are not achieved but, if motiva-ted by the presentation of stimuli and facilitated, he performs rolling with greater active participation. In the prone position, he exhibits initial head con-trol for approximately twenty sec-onds.
Cognitive level	
The child shows global delay and attention levels are poor. He does not perform play activities au-tono-mously but shows interest in various stimuli.	Global delay persists, although attention spans toward vari-ous stimuli have increased to about ten seconds, which can be further extended if the activity is to his liking. He does not perform play activities autonomously but shows interest in more differentiated stimuli. He repeatedly activates cau-se-effect games using residual motor resources.
Communication	
He communicates his state of well-being or distress through vocalizations or crying, and the face appe-ars moderately expressive.	The face presents with good mimicry. Gaze is used for com-municative purposes, making small choices when two highly preferred and motivating games are proposed. Furthermore, an initial coded com-munication regarding "yes" and "no" is detected through a smile or an expressionless (amimic) face.

REFERENCES

1. Brooks Rehabilitation. (n.d.). Brooks Rehabilitation. Retrieved July 2024 from <https://brooksrehab.org/glossary/neuromotor-disorders/>

2. Fedrizzi, E. (2009). *I disordini dello sviluppo motorio. Fisiopatologia. Valutazione diagnostica. Quadri clinici. Riabilitazione* [Disorders of motor development. Pathophysiology. Diagnostic evaluation. Clinical frameworks. Rehabilitation]. PICCIN.

3. GIPCI, G. I. (2000, September). *Manifesto per la riabilitazione del bambino* [Manifesto for child rehabilitation]. Retrieved from https://sinpia.eu/wp-content/uploads/doc/MANIFESTO_PER_LA_RIABILITAZIONE_DEL_BAMBINO-2000.pdf

4. DPCM 12 gennaio 2017. (2017). *Definizione e aggiornamento dei livelli essenziali di assistenza* [Definition and updating of essential levels of assistance]. GU Serie Generale n.65 del 18-03-2017, suppl. n.15.

5. Schnackers, M., Beckers, L., Janssen-Potten, Y., Aarts, P., Rameckers, E., van der Burg, J., . . . Steenbergen, B. (2018, Apr). *Home-based bimanual training based on motor learning principles in children with unilateral ce-rebral palsy and their parents (the COAD-study): rationale and protocols. BMC Pediatr*, p. 139; doi: 10.1186/s12887-018-1110-2.

6. Mattern-Baxter, K., McNeil, S., & Mansoor, J. (2013, Nov). *Effects of Home-Based Locomotor Treadmill Trai-ning on Gross Motor Function in Young Children With Cerebral Palsy: A Quasi-Randomized Controlled Trial. Arch Phys Med Rehabil*, p. 2061-7; doi: 10.1016/j.apmr.2013.05.012.

7. Chen, C.-l., Kang, L.-j., Hong, W.-H., Chen, F.-C., Chen, H.-C., & Wu, C.-y. (2013, Mar). *Effect of therapist-ba-sed constraint-induced therapy at home on motor control, motor performance and daily function in children with cerebral palsy: a randomized controlled study. Clin Rehabil*, p. 236-45; doi: 10.1177/0269215512455652.

8. Schranz, C., Kruse, A., Belohlavek, T., Steinwender, G., Tilp, M., Pieber, T., & Svehlik, M. (2018, Dec). *Does Home-Based Progressive Resistance or High-Intensity Circuit Training Improve Strength, Function, Activity or Participation in Children With Cerebral Palsy? Arch Phys Med Rehabil*, p. 2457-2464; doi: 10.1016/j.apmr.2018.06.010.

9. Fauzi, A. A., Khayat, M. M., Sabirin, S., Haron, N., Azmi Mohamed, M., & Davis, G. M. (2019, 12(2)).

Structured home-based exercise program for improving walking ability in ambulant children with cerebral palsy. *J Pediatr Rehabil Med*, p. 161-169; doi: 10.3233/PRM-180538.

10. Mahmood, Q., Habibullah, S., & Aurakzai, H. (2024, Mar). Effectiveness of simple and basic home-based exercise programs including pediatric massage executed by caregivers at their homes in the management of children with spastic cerebral palsy: A randomized controlled trial. *J Pediatr Rehabil Med*, p. 97-106; doi: 10.3233/PRM-220135.
11. Orton, J., Doyle, L., Tripathi, T., Boyd, R., Anderson, P., & Spittle, A. (2024). Early developmental intervention programmes provided post hospital discharge to prevent motor and cognitive impairment in preterm infants (Review). *Cochrane Database of Systematic Reviews*. <https://doi.org/10.1002/14651858.CD005495.pub5>
12. Liu, Y., Chang, T., Liang, K., Shieh, J., Chen, H., & Wang, T. (2017). The effect of the home-based family-friendly bilateral intensive training on motor and psychosocial outcomes in children with hemiplegic cerebral palsy. *Journal of the Neurological Sciences*, p. 927.
13. Valentini, N., de Almeida, C., & Smith, B. (2020, December). Effectiveness of a home-based early cognitive-motor intervention provided in daycare, home care, and foster care settings: Changes in motor development and context affordances. *Early Human Development*, Article 105223; <https://doi.org/10.1016/j.earlhumdev.2020.105223>.
14. Kim, M., Park, C., Jeon, H., Choi, W., & Hyun You, S. (2021, 49(4)). Comparative effects of community-based family-child-centered care and conventional pediatric rehabilitation for cerebral palsy. *NeuroRehabilitation*, p. 533-546; DOI: 10.3233/NRE-210219.
15. Spittle, A. J., Anderson, P. J., Lee, K. J., Ferretti, C., Eeles, A., Orton, J., . . . Doyle, L. W. (2010). Preventive Care at Home for Very Preterm Infants Improves Infant and Caregiver Outcomes at 2 Years. *Pediatrics*, DOI: 10.1542/peds.2009-3137.
16. Spencer-Smith, M., Spittle, A., Doyle, L., Lee, K., Lorefice, L., Suetin, A., . . . Anderson, P. (2012, Dec). Long-term Benefits of Home-based Preventive Care for Preterm Infants: A Randomized Trial. *Pediatrics*, p. 1094-101; doi: 10.1542/peds.2012-0426.
17. Hernández-Sánchez, A., Parra-Sánchez, L., Montolio, M., Rueda-Ruzafa, L., Ortiz-Comino, L., & Sánchez-Joya, M. (2023, Mar). Family Involvement and at-Home Physical Therapy on Duchenne Muscular Dystrophy: A Randomized Controlled Trial. *Pediatr Neurol*, p. 34-40; DOI: 10.1016/j.pediatrneurol.2023.12.015.
18. Wingrat, J., Price, C., & Wright, T. (2024, Sep). Facilitators of and Barriers to Caregiver Adherence to Home Therapy Recommendations for Infants and Children With Neuromotor and Neuromuscular Diagnoses: A Scoping Review. *Am J Occup Ther*, 78(5); DOI: 10.5014/ajot.2024.050567.
19. Başaran, A., Karadavut, K., Üneri, Ş., Balbaloglu, Ö., & Atasoy, N. (2014). Adherence to Home Exercise Program among Caregivers of Children with Cerebral Palsy. *Turk J Phys Med Rehab*, 85-91; DOI: 10.5152/tftrd.2014.60973.
20. Gmmash, A., Effgen, S., Skubik-Peplaski, C., & Lane, J. (2021, Apr). Parental Adherence to Home Activities in Early Intervention for Young Children With Delayed Motor Development. *Phys Ther*, 101(4); DOI: 10.1093/ptj/pzab023.
21. Novak, I., Cusick, A., & Lannin, N. (2009, Oct). Occupational Therapy Home Programs for Cerebral Palsy: Double-Blind, Randomized, Controlled Trial. *Pediatrics*, p. 606-14; DOI: 10.1542/peds.2009-0288.
22. Jasmin, E., Têtreault, S., Larivière, N., & Joly, J. (2018, Feb). Participation and needs of children with developmental coordination disorder at home and in the community: Perceptions of children and parents. *Res Dev Disabil*, p. 1-13; DOI: 10.1016/j.ridd.2017.12.011.
23. Wille, A.-M., & Ambrosini, C. (2012). *Manuale di terapia psicomotoria dell'età evolutiva [Manual of psychomotor therapy of the developmental age]*. Ed. Cuzzolin.
24. Massenz, M., & Simonetta, E. (2002). *La valutazione psicomotoria [Psychomotor assessment]*. Ed. Franco Angeli.
25. Pilz, P. D. (2005). Orphanet. Retrieved September 19, 2024 from <https://www.orpha.net/it/disease/detail/531>

Author Contributions: Conceptualization, Colombo and Abrate and Borsani; methodology, Colombo and Abrate; formal analysis, Pucinotti and Abrate; writing—original draft preparation, Pucinotti and Abrate and Borsani; writing—review and editing, Pucinotti and Abrate and Colombo; supervision, Colombo. All authors have read and agreed to the published version of the manuscript.

Data Availability Statement: Research data can be found at the Maddalena Grassi Foundation.

Conflicts of Interest: The authors declare no conflict of interest.



Copyright: © 2026 by the authors. Submitted for possible open access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).