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Global Integration Method (Metódo de Integração Global—MIG): A Pilot Mixed-Methods RCT on the Effects of a Motor Training Program Integrated with Cognitive, Behavioral, and Narrative Strategies in Autistic Children

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Abstract

Motor impairments and limitations in functional performance are common in children with autism spectrum disorder, restricting participation in daily activities. This study aimed to compare the effectiveness of the MIG Program with conventional physical therapy in the development of socio-communicative motor skills and the achievement of functional goals. A mixed-methods randomized clinical trial was conducted with children with autism spectrum disorder aged 6 to 12 years (mean 8.73 ± 1.95; support levels 1 and 2), recruited from rehabilitation clinics in southeastern Brazil. Participants were randomly assigned to the MIG Program, which integrates contextualized functional motor training with narrative grammar strategies and the use of a therapeutic vest, or to conventional physical therapy based on traditional motor approaches. Primary outcomes included fundamental motor skills and functional goal attainment, while secondary outcomes were balance, gross and fine motor skills, and socio-communicative abilities. The RCT protocol was registered in the Brazilian Clinical Trials Registry (RBR-76pk39r), in 21 October 2025. The MIG Program was associated with greater improvements in fundamental motor skills and functional goal attainment compared to conventional physical therapy, with effects maintained at follow-up, as well as with more favorable trends in balance and communication outcomes; however, no clear differences were observed in gross and fine motor skills. Qualitative findings suggested increased engagement, autonomy, and participation in the MIG group. Overall, these preliminary findings indicate that the MIG Program may be a promising approach for supporting functional outcomes in children with autism spectrum disorder, although the results should be interpreted with caution given the small sample size and the number of outcomes assessed.

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1. Introduction

Autism Spectrum Disorder is traditionally defined by impairments in social communication and the presence of restricted/repetitive behaviors. However, evidence shows that children with autism spectrum disorder also present deficits across multiple domains of the International Classification of Functioning, Disability, and Health (ICF), including motor limitations, which represent a highly prevalent and clinically relevant aspect of the phenotype [1]. Large-scale studies indicate that up to 88% of children with autism spectrum disorder are at increased risk for motor difficulties, although only a small proportion receive assessment or targeted intervention in this domain [2]. These deficits, often associated with alterations in postural control, motor planning, and sensory processing, can substantially compromise participation in daily, school, and community activities, reducing opportunities for social interaction, active environmental exploration, and social development [3]. Moreover, evidence indicates associations between motor difficulties and greater severity of socio-communicative symptoms, suggesting bidirectional interactions between motor competence, social engagement, and learning [4–6]. Collectively, these findings reinforce that motor alterations are not peripheral components but central and consistent features of the autism spectrum disorder clinical profile, emphasizing the need for structured, individualized interventions that promote more qualified and broadly sustained participation in daily life contexts.

The Global Integration Method (Método de Integração Global—MIG) is an intensive, interdisciplinary intervention designed for children and adolescents with autism spectrum disorder, based on the premise that motor skills, proprioception, and body organization form the foundation for socio-communicative development. Structured as intensive programs, MIG utilizes ecologically valid environments, such as the "City of Tomorrow," which simulates real-life daily scenarios to facilitate immediate generalization of trained skills [7–9]. This approach is grounded in contemporary theoretical models, particularly predictive coding and embodied cognition, which explain how difficulties in sensory-motor integration and event anticipation affect the social and communicative functioning of autistic individuals [10,11]. By promoting greater postural stability, proprioceptive control, and body organization, enhanced by the use of the MIG Flex therapeutic vest, the MIG program reduces prediction errors, decreases the cognitive load associated with body self-regulation, and increases the availability of attentional resources for higher-order processes such as social interaction, functional communication, and participation in meaningful activities [7].

In addition to the bottom-up reorganization afforded by the body-based intervention, MIG systematically integrates cognitive, behavioral, and structured teaching strategies mediated by narrative grammar, a tool that enhances predictability, temporal coherence, and understanding of complex social events [7]. These strategies are embedded in functional activities conducted within the simulated environments of the "City of Tomorrow," enabling social, communicative, and adaptive skills to be acquired in the context of real-life tasks relevant to daily routines. Furthermore, family-centered therapeutic planning ensures that goals and practices reflect everyday needs, strengthening adherence and maximizing the transfer of skills to the child's natural environments [8,12]. Thus, MIG represents an integrative approach that combines contemporary neurocognitive foundations, intensive motor intervention, structured teaching, and ecological participation, offering a coherent and comprehensive model to promote the global development of children and adolescents with autism spectrum disorder [7].

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Recent evidence consistently demonstrates that MIG promotes significant improvements in functional, motor, and communicative performance in children and adolescents with autism spectrum disorder, confirming the alignment between its theoretical foundations and observed outcomes. Studies indicate that approximately 60% of functional goals achieve clinically meaningful progress in performance and satisfaction, with moderate to large effect sizes, as well as high levels of family satisfaction and strengthened perceptions of partnership between therapists and caregivers [8,12]. These findings are supported by a pilot study involving 15 participants, which reported substantial improvements in occupational performance, systematically observed communicative skills, and fundamental motor skills [9].

Although these findings provide promising preliminary evidence and suggest that MIG is a potentially effective, ecologically valid approach aligned with current family-centered care guidelines, the absence of randomized clinical trials limits the robustness of the available conclusions. In this context, the present study proposes a mixed-methods RCT to rigorously and comprehensively evaluate the impact of MIG in children with autism spectrum disorder. This investigation not only allows testing the program's effectiveness compared to conventional physical therapy but also enables understanding, through qualitative and quantitative approaches, the mechanisms through which clinical effects emerge in the daily lives of children and their families. The primary aim of this study was to assess the effectiveness of the MIG Program for children with autism spectrum disorder compared to conventional physical therapy in terms of fundamental motor skills and functional goal attainment. Secondary outcomes included functional balance, gross and fine motor skills, cognitive/communicative abilities, and functional communication skills.

2. Materials and Methods

2.1. Study Design Ethics

This study employed a mixed-methods design [13]. The quantitative component consisted of a two-arm randomized controlled trial (RCT) comparing the MIG Program with conventional physical therapy, using concealed allocation, assessor blinding, and three assessment time points (baseline, immediately post-intervention, and 12 weeks post-intervention). The RCT protocol was developed and reported in accordance with the Standard Protocol Items: Recommendations for Interventional Trials (SPIRIT) guidelines [14], and the reporting of trial results followed the Consolidated Standards of Reporting Trials (CONSORT) statement. Concurrently, a descriptive-interpretive qualitative study was conducted [15]. The RCT protocol was prospectively registered in the Brazilian Clinical Trials Registry (RBR-76pk39r) before enrollment of the first participant. No amendments were made to the primary or secondary outcomes, eligibility criteria, intervention procedures, or prespecified statistical analysis plan after trial registration. The study was approved by the Research Ethics Committee of the Faculty of Medical Sciences of Minas Gerais, Brazil (CAAE 89887325.2.0000.5134). Written informed consent was obtained from all parents or legal guardians, and assent was obtained from participating children before the initiation of study procedures. Methods related to the quantitative and qualitative components are presented separately. The informed consent form signed by parents or legal guardians included authorization for participation in the study, as approved by the Research Ethics Committee.

2.2. RCT Design

This study was conducted in the "City of Tomorrow" space at the Reabilitar clinic, located in Ribeirão das Neves, Minas Gerais, Brazil.

2.3. Participants

Participants were recruited by convenience from public institutions, philanthropic organizations, and private physical therapy clinics in Ribeirão das Neves, Minas Gerais, Brazil. Children and pre-adolescents aged 6 to 12 years at the start of the intervention were eligible if they had a previous clinical diagnosis of autism spectrum disorder documented through a medical report provided by their parents or legal guardians. Participants were required to be classified as autism spectrum disorder support level 1 or 2 according to the diagnostic documentation, with support level information confirmed by parental report.

To ensure participation in the intervention and assessment procedures, participants were required to demonstrate sufficient receptive communication abilities to understand simple verbal instructions and engage in the proposed activities. Exclusion criteria included cognitive, behavioral, or medical conditions that could compromise understanding of instructions, compliance with assessment procedures, or safe participation in the intervention. In addition, participants were not receiving any other rehabilitation interventions, including physical therapy, occupational therapy, psychomotor therapy, or structured motor intervention programs, during the study period.

2.4. Sample Size

The sample consisted of 18 participants, divided into two groups of 9 participants each. The sample size was determined based on the results of a previous study investigating the effects of the MIG Program in children with autism spectrum disorder [8]. The calculation was based on an effect size of 0.87 derived from the Canadian Occupational Performance Measure (COPM) results. Additionally, a statistical power of 80%, a significance level of α = 5%, and an estimated attrition rate of 20% over time were considered, using G*Power 3.1 software [16].

2.5. Randomization and Blinding

Participants were recruited and enrolled by an independent researcher (GC). Recruitment commenced on 25 October 2025, following prospective registration of the trial in the ReBEC, and the first participant was randomized thereafter. Eligible participants were individually allocated to one of two groups: (I) the MIG Program or (II) Conventional Physical Therapy. The randomization sequence was generated using a computer-based simple randomization procedure by a study investigator (IC) who was not involved in participant recruitment, assessment, treatment delivery, or outcome evaluation. Allocation concealment was ensured through the use of sequentially numbered, opaque, sealed envelopes. Following confirmation of eligibility and completion of all baseline assessments, a researcher not involved in outcome assessment opened the next envelope in sequence immediately before the participant's first treatment session to determine group allocation. Outcome assessors remained blinded to treatment allocation throughout the study. Owing to the nature of the interventions, blinding of participants and treating therapists was not feasible.

2.6. Interventions

2.6.1. MIG Program

Participants in this group received a motor protocol corresponding to a segment of the MIG Program. The intervention was delivered by physical therapists with prior experience in MIG and specific training alongside an interdisciplinary team (comprising psychologists, speech-language pathologists, and occupational therapists) to ensure standardized application of the research protocol. The motor component of the MIG Program was implemented in three weekly sessions, each lasting 50 min, following a pre-structured organization.

The MIG Flex therapeutic vest, designed based on myofascial lines, provides proprioceptive input and postural support. This tool serves a dual function: on one hand, it stabilizes the body and enhances motor organization; on the other, it reduces the cognitive load typically required for the child to maintain posture or coordinate movements, thereby freeing attentional and cognitive resources that can be directed toward interaction, play, and communication.

Upon arrival at the session, the participant wore the MIG Flex vest, which was adjusted by the physical therapist, and the day's narrative was immediately presented. This narrative introduced the main character, the setting, and the temporal context (initial situation), as well as the problem, triggering event, or central challenge to be addressed (initial event). The character's feelings or emotions and the plan for problem resolution were also explicitly described; this plan directly corresponded to the motor activities the child was expected to perform to "help" the character. The narratives used in sessions 1 and 15 are provided in Supplementary Materials S1 and S2.

The entire structure of the motor protocol was therefore contextualized and guided by narrative grammar, which organized the session stages: movement preparation with active myofascial mobilization; core strengthening; motor skills circuit, including balance, coordination, strength, motor planning, and power; and a contextualized target activity. Motor circuit equipment, such as cones, balls, and unstable surfaces, was used to support these activities. The motor skills intervention program involved functional training of motor abilities, integrating multiple physical capacities (such as strength, endurance, balance, flexibility, agility, power, and conditioning) through activities including running, jumping, hopping, galloping, throwing, and kicking. The program followed a gradual progression in activity difficulty, consistently providing positive feedback and encouragement to participants. Details of the MIG Program motor protocol are provided in Supplementary Material S3. At the end of each session, participants received a small home-based task designed to review and consolidate the narrative elements addressed during that day's session (Supplementary Material S4).

In addition to the procedures outlined in the MIG Program motor protocol, cognitive and behavioral strategies recommended in the literature were incorporated to optimize motor learning in children with autism spectrum disorder [17]. These included the use of visual supports, modeling, prompting, task modification, immediate feedback, tailored instructions, and varied practice schedules, aimed at facilitating the execution of motor activities, enhancing engagement, and promoting retention and generalization of learning [17]. A full description of the MIG Program, according to the TIDieR framework for describing and replicating interventions [18], can be found in Table 1.

Table 1. MIG Program.

TIDieR Criteria	MIG Program
Intervention name	Global Integration Method (integrated motor training program combined with cognitive, behavioral, and social narrative strategies).
Why	To improve motor skills, balance, and communication.
What (material)	Motor-based program grounded in the principles of the MIG program.
What (Procedures):	The MIG Flex approach was integrated with narrative grammar to contextualize and guide functional activities that progressively and playfully trained multiple physical capacities, combined with the systematic use of evidence-based cognitive and behavioral strategies to optimize engagement, task execution, and motor learning retention.

Table 1. *Cont.*

TIDieR Criteria	MIG Program
Who provided	The intervention was delivered by three physiotherapists with more than five years of experience working with children with autism, all trained and experienced in the application of the MIG and specifically trained to ensure standardized implementation of the research protocol.
How	Individually, in person, with one physiotherapist per child.
Where	Conducted in a naturalistic environment known as "Cidade do Amanhã", primarily in the Fitness Unit.
When and how much	Training duration: 5 weeks; Training frequency: 3 times per week; Session duration: 60 min; Total number of sessions: 15 sessions; Intensity and volume: individualized according to each child's abilities.
Tailoring	Detailed descriptions of the narratives and the motor protocol used to contextualize the intervention are provided in Supplementary Materials S1, S2 and S3, respectively. The protocol was individualized according to each child's capacities, and progression of activities was implemented based on individual performance and ability.
Modifications	The intervention was not modified during the study.
How well	An independent physiotherapist monitored the intervention weekly to ensure fidelity to the planned protocol. Daily records were maintained to document the total number of sessions, reasons for absences, occurrence of adverse events, and the treatment protocol delivered in each session.

2.6.2. Control Group

Participants in this group received conventional physical therapy. This included three motor physiotherapy sessions per week, each lasting 50 min, organized into four parts: 5 min of warm-up, 20 min of general motor skills training (e.g., jump rope, hopscotch), 20 min of manual skills training (e.g., hitting a ball, aiming and throwing the ball into a basket), and finally, 5 min of cool-down. The control group's physiotherapy protocol did not include the use of the MIG Flex therapeutic vest, narrative grammar strategies, or cognitive strategies. Participants in this group received the intervention program in conventional treatment rooms available for physiotherapy at the Reabilitar Clinic, Ribeirão das Neves, Minas Gerais, Brazil. After completion of the 12-week follow-up assessment, children in the control group were invited to participate in the MIG Program intervention, following the conclusion of the study.

2.7. Outcome Measures

2.7.1. Primary Outcome

The Test of Gross Motor Development-2 (TGMD-2) was used to assess fundamental motor skills [19,20]. It is a standardized assessment tool that quantitatively and qualitatively evaluates 12 fundamental motor skills, subdivided into two categories: six locomotor skills and six object control skills. The scoring methodology involves summing the raw scores of each subtest, which are then converted into motor quotients, allowing for normative analysis of performance [19]. The validation and reliability of the TGMD-2 for Brazilian children with typical development were established by Valentini et al. (2012) [21]. Subsequently, the instrument has been applied in studies involving children with autism spectrum disorder [22], demonstrating its versatility in neurodiverse populations.

The Canadian Occupational Performance Measure (COPM) was used to assess the achievement of functional goals [23]. It is a semi-structured interview that allows parents to identify, describe, and prioritize treatment objectives relevant to their child's occupational performance. Each goal is scored on a 1-to-10 scale across three dimensions: importance, patient performance, and parent satisfaction with the execution of the activity. Recognized as a valid, reliable, and clinically responsive tool [23–25], the COPM can detect significant

changes in occupational performance over time and following interventions, functioning as a client-centered, outcome-oriented assessment instrument. In this study, three functional goals were defined for each participant.

2.7.2. Secondary Outcomes

The Pediatric Balance Scale (PBS) was used to assess functional balance. The PBS examines both static and dynamic balance and consists of 14 items evaluating functional activities that a child may perform in daily life. The PBS was adapted for the Brazilian population, and its measurement properties have been evaluated, demonstrating good responsiveness [26,27].

The motor subscale of the Vineland Adaptive Behavior Scales (VABS) was used to assess adaptive motor skills, including gross and fine motor abilities [28]. It is a standardized parent-report questionnaire that evaluates adaptive functioning and overall development in individuals aged 0 to 90 years and is widely used in individuals with autism spectrum disorder. The motor subscale assesses both gross and fine motor skills. The version used in this study was the VABS-II. VABS domains demonstrate high validity and reliability (>0.80), and the motor domain shows a concurrent validity of 0.77 with the Peabody Developmental Motor Scales [29].

The Behavioral Observation Protocol (BOP) was used to assess communicative and cognitive skills [30]. The BOP is a structured tool that allows detailed analysis of children's interactions and responses in naturalistic or controlled settings. It is designed to create a structured situation in which the child's interaction with an examiner can be observed and video-recorded over 30 to 40 min, using pre-selected toys. This method enables analysis of the typical progression of language and symbolic development, as well as the interrelationship between these aspects of child development. Furthermore, it is particularly useful for identifying and characterizing levels of development and patterns of cognitive and communicative functioning in children presenting developmental delays or disorders. In the present study, three variables contributing to the BOP total score were considered: expression, referring to the child's ability to produce spoken language and use different communicative forms; verbal comprehension, assessing the ability to understand commands, statements, and communicative situations; and cognitive development, related to the use of symbolic skills, problem-solving, and joint attention during interaction [31].

The Pragmatics subtest of the ABFW Child Language Test was used to assess functional communicative skills [32]. Its administration is based on systematic observation and detailed recording of a session lasting approximately 30 min, during which the child interacts spontaneously with a familiar adult, usually a parent. This procedure allows analysis of both quantitative and qualitative aspects of communication, including the number and type of communicative acts, the means used (verbal, vocal, or gestural), and the predominant communicative functions. Widely used in research and clinical practice, the ABFW has proven to be a sensitive and reliable instrument for evaluating children's pragmatic performance and monitoring therapeutic progress in various conditions affecting language development. Two variables derived from the ABFW pragmatic assessment were considered: total communicative acts, corresponding to the number of communicative initiatives produced by the child during the interaction; and interaction, a variable reflecting the quality and dynamics of the child's participation in communicative exchanges, including responsiveness, initiative, and engagement in social interaction [33,34].

2.8. Procedures

Outcome measures were administered by three independent, blinded assessors: a physiotherapist, a speech-language pathologist, and an occupational therapist, according

to their technical expertise and the specificity of each instrument. The PBS and TGMD-2 were administered by the physiotherapist. During the motor testing of the children, the COPM was conducted simultaneously by the occupational therapist in a separate environment through a parent or caregiver interview. The assessor guided participants in defining functional goals, providing examples and assisting in structuring the reported priorities. Finally, the BOP and the Pragmatics subtest of the ABFW were administered by a speech-language pathologist, following standardized administration procedures. Due to the nature of the intervention, blinding of the therapists was not possible. All assessments were conducted at three distinct time points: baseline, immediately post-intervention, and 12 weeks post-intervention. All baseline assessments were completed prior to randomization. Study preparation activities, including protocol development, therapist training, and administrative procedures, were conducted throughout 2025. Participant recruitment began on 25 October 2025, after trial registration, and data collection was completed in 2026.

2.9. Statistical Analysis

Statistical analyses were conducted using IBM SPSS Statistics, version 24 (IBM Corp., Armonk, NY, USA). Initially, descriptive analyses were performed to characterize the sample in terms of age, sex, and support level, with results presented as means and standard deviations. The normality of outcome distributions was assessed using the Shapiro–Wilk test. Before conducting repeated-measures ANOVA, the assumptions of normality, homogeneity of variances, and sphericity were evaluated. No substantial violations of these assumptions were identified, supporting the use of parametric analyses. Baseline differences between the MIG and control groups were examined using independent-samples *t*-tests. To preserve sample integrity and minimize bias due to attrition, an intention-to-treat (ITT) approach was adopted. Missing data were handled using the last observation carried forward (LOCF) method. This approach was adopted to preserve sample size and maintain consistency with the intention-to-treat (ITT) principle, minimizing the impact of attrition in this small sample. However, LOCF assumes stability of outcomes over time and may introduce bias by underestimating variability and potentially over- or underestimating treatment effects.

To evaluate changes in dependent variables over time and differences between intervention groups, a two-way repeated-measures ANOVA was conducted with one within-subjects factor (time: pre, post, and follow-up) and one between-subjects factor (group: MIG vs. conventional physiotherapy). Sphericity was tested using Mauchly's test; when violated, degrees of freedom were adjusted using the Greenhouse–Geisser correction. When significant effects were identified, paired post hoc comparisons were performed with Bonferroni correction to control for type I error. Additionally, effect sizes (partial η^2) were calculated to estimate the magnitude of observed differences. The significance level was set at $p \leq 0.05$, and all tests were two-tailed.

2.10. Interpretative Description (Qualitative Component)

Although RCTs are widely recognized as the gold standard for investigating causal relationships between interventions and clinical outcomes [35], there is growing recognition of the importance of more comprehensive and integrative methodological approaches. This perspective arises from the understanding that, despite the experimental rigor and bias control provided by RCTs, these designs do not adequately capture the complexity of human experiences [36]. Therefore, the integration of qualitative methods becomes essential to deepen the understanding of perceived effects, contextualize changes observed in quantitative outcomes, and reveal aspects of intervention impact that cannot be accessed solely through objective measures. The objectives of the qualitative research were: (1) To

explore the experiences of parents and caregivers of children who participated in the MIG program; (2) To identify the outcomes they perceived across different domains of functionality according to the International Classification of Functioning, Disability, and Health (ICF).

2.11. Participants, Procedures, and Data Collection

Parents of children and pre-adolescents who participated in the Phase 1 intervention programs, belonging to the MIG group, diagnosed with autism spectrum disorder at support levels 1 and 2, and aged between 6 and 12 years, were recruited by convenience for this stage of the study. Upon completion of the five-week MIG program, an in-person focus group was conducted exclusively with these parents, aiming to explore their perceptions regarding the intervention.

The focus group was facilitated by an interviewer experienced in qualitative research (P.A.N.S.) and lasted approximately 60 min. Prior to the session, participants were thoroughly informed about the objectives, procedures, and ethical implications of the study and, upon agreement, provided written informed consent. Data collection took place at the Institute of Neurodevelopment, Cognition, and Inclusive Education, located in Ribeirão das Neves, Minas Gerais, Brazil. During the focus group, only the participants and the interviewer were present in the room, ensuring privacy and confidentiality of the information shared.

2.12. Focus Group

A semi-structured interview was employed to guide the focus groups, developed based on the study objectives and central dimensions of interest. To encourage more detailed responses and enhance the depth of discussions, the interviewer used to prompt questions related to the topics addressed.

The focus groups were conducted immediately after the completion of the intervention and were audio-recorded for subsequent transcription and qualitative data analysis. Following transcription, participants were given access to the full content of their statements to verify the accuracy and fidelity of the information before analysis by the researchers. During the sessions, the interviewer also made additional notes to capture contextual and non-verbal impressions relevant for the interpretation of the data.

2.13. Data Analysis

The analysis was based on content analysis, following classical frameworks in qualitative research [37]. Initially, participants' narratives were transcribed verbatim and subsequently coded and organized into thematic categories using NVivo software (version 12). The coding process was conducted independently by two researchers (A.F.B.L. and I.C.), ensuring the reliability of the results; any discrepancies were resolved by consensus, with mediation from a third reviewer (T.K.F.C.).

3. Results

A total of 20 participants were initially recruited for the study (Figure 1). Of these, one participant withdrew due to relocation, and one child was excluded due to scheduling conflicts, resulting in a final sample of 18 participants who completed the experimental protocol. No additional dropouts occurred after randomization or during the intervention period in either group. However, two children from the control group and one child from the MIG group did not attend the follow-up assessment. Missing outcome data at follow-up were handled using the LOCF approach, ensuring that all randomized participants were included in the analyses in accordance with the intention-to-treat principle. The extent and pattern of missing data were limited and balanced across groups, supporting consistency

between the sample flow and the analyses performed. All randomized participants were included in the analyses according to the intention-to-treat principle.

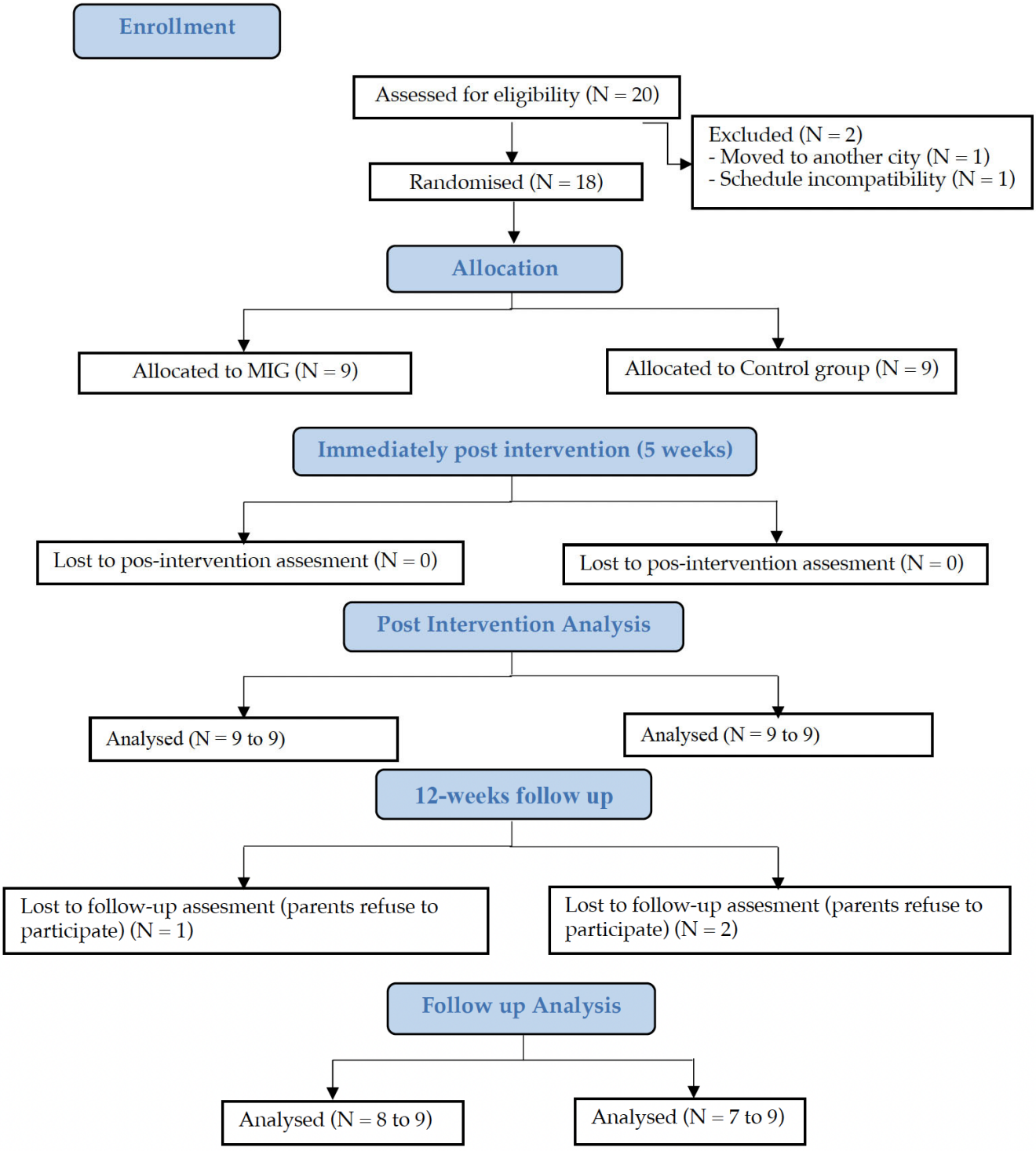

Figure 1. CONSORT flow diagram.

The groups were demographically and clinically similar with respect to age, sex, and support level. The MIG group included nine participants (mean age 8.44 ± 1.94 years; eight males; seven classified as support level 1), while the control group included nine participants (mean age 9.22 ± 1.98 years; six males; six classified as support level 1). No statistically significant differences were observed between groups at baseline ($p > 0.05$).

Medication use at baseline was reported by 3 of 9 participants (33.3%) in the MIG group and 4 of 9 participants (44.4%) in the control group. Risperidone was the most frequently used medication, reported by four participants across both groups. Other medications included methylphenidate, Ritalin, Neuleptil, Depakene, Atensina, Paporim, and aripiprazole.

Participants in the MIG group demonstrated high adherence, with 86.67% attendance across the 15 planned sessions. Two participants reported mild adverse events, characterized by transient discomfort associated with the initial use of the MIG Flex suit. This discomfort decreased progressively during the first session and did not recur in subsequent sessions. In the control group, attendance was 80%, and no adverse events were reported during the intervention period.

3.1. Primary Outcomes

Table 2 presents the primary outcome results comparing the MIG and control groups. For the overall TGMD-2 score, a significant time effect was observed ($p = 0.006$; $\eta^2 = 0.323$) as well as a significant time × group interaction ($p = 0.018$; $\eta^2 = 0.268$). Post hoc analyses showed a significant improvement from T0 to T1 only in the MIG group ($p < 0.05$), with no significant changes in the control group ($p > 0.05$). Regarding the object control subscale, significant effects of time ($p = 0.037$; $\eta^2 = 0.229$) and time × group interaction ($p = 0.035$; $\eta^2 = 0.232$) were found. For the locomotor subscale, a significant group effect ($p = 0.009$; $\eta^2 = 0.290$) and group × time interaction ($p = 0.026$; $\eta^2 = 0.232$) were identified. Post hoc analyses revealed significant improvements in the MIG group between T0 and T1 and between T0 and T3 ($p < 0.05$), with no significant changes in the control group.

Table 2. Comparisons between MIG (N = 9) and Control (N = 9) groups for primary outcomes.

Outcomes	Baseline (T0)	Post-Intervention (T1)	Follow-Up (T2)	Time Effect			Time-Group Interaction		
	M (SD)	M (SD)	M (SD)	f	*p*	η^2	f	*p*	η^2
TGMD2—Total Score				6.676	0.006 *	0.323	2.358	0.018 *	0.268
MIG group	61.13 (14.50)	74.75 (10.48)	72.38 (8.74)		T0 ≠ T1				
Control group	68.13 (11.24)	69.02 (12.18)	71.01 (9.64)		T0 = T1, T2				
TGMD2—Object Control				4.162	0.037 *	0.229	4.238	0.035 *	0.232
MIG group	31.00 (8.01)	38.00 (5.20)	35.88 (4.48)		T0 ≠ T1				
Control group	32.50 (5.90)	32.64 (5.34)	35.25 (6.06)		T0 = T1, T2				
TGMD2—Locomotion				5.705	0.009 *	0.290	4.161	0.026 *	0.229
MIG group	30.13 (7.71)	36.75 (6.49)	36.50 (4.87)		T0 ≠ T1, T2				
Control group	35.63 (6.78)	36.38 (5.50)	35.68 (4.48)		T0 = T1, T2				
COPM—Performance				43.792	<0.001 **	0.803	7.625	0.003 *	0.401
MIG group	2.83 (1.48)	6.45 (1.19)	7.72 (1.06)		T0 ≠ T1, T2				
Control group	3.16 (1.28)	4.45 (2.31)	4.38 (1.53)		T0 = T1, T2				
COPM—Satisfaction				36.146	<0.001 *	0.767	4.712	0.002 *	0.300
MIG group	2.38 (1.63)	7.32 (1.63)	7.94 (1.04)		T0 ≠ T1, T2				
Control group	3.04 (1.70)	5.14 (3.53)	5.12 (2.43)		T0 = T1, T2				

Legend: TGMD-2: Gross Motor Development Test, 2nd Edition; COPM: Canadian Occupational Performance Measure; MIG: Global Integration Method. * = $p < 0.05$; ** = $p < 0.001$.

For the COPM Performance domain, a significant main effect of time was observed ($p < 0.001$; $\eta^2 = 0.803$), along with a significant time × group interaction ($p = 0.003$; $\eta^2 = 0.401$). Post hoc comparisons indicated a significant increase in scores in the MIG group between T0 and T1 and between T0 and T3 ($p < 0.05$), whereas no significant changes were detected in the control group. Concerning the COPM Satisfaction domain, significant time ($p < 0.001$; $\eta^2 = 0.767$) and time × group interaction ($p = 0.002$; $\eta^2 = 0.300$) effects were found. Post hoc analyses demonstrated significant improvements in the MIG group between T0 and T1 and between T0 and T3, while the control group showed no statistically significant changes over time.

3.2. Secondary Outcomes

Table 3 presents the results of the secondary outcomes. For the total PBS score, a significant effect of time was identified (F = 5.592; $p = 0.008$; $\eta^2 = 0.259$), as well as a significant time × group interaction (F = 4.288; $p = 0.004$; $\eta^2 = 0.259$). The MIG group showed a significant increase in scores from baseline to post-intervention (T0 ≠ T1), whereas the control group maintained stable scores over time (T0 = T1 = T2). Regarding the Vineland scale, no significant effects of time or time × group interaction were observed, indicating stability of adaptive scores in both groups across assessments, with no relevant differences between baseline, post-intervention, and follow-up.

Table 3. Comparisons between MIG (N = 9) and Control (N = 9) groups for secondary outcomes.

Outcomes	Baseline (T0)	Post-Intervention (T1)	Follow-Up (T2)	Time Effect			Time—Group Interaction		
	M (SD)	M (SD)	M (SD)	f	*p*	η^2	f	*p*	η^2
PBS				5.592	0.008 *	0.259	4.288	0.004 *	0.259
MIG group	49.67 (3.93)	52.56 (2.35)	49.78 (3.31)		T0 ≠ T1, T2				
Control group	52.33 (2.95)	52.51 (3.32)	52.44 (3.39)		T0 = T1, T2				
VABS-II				0.390	0.680	0.472	0.598	0.945	0.007
MIG group	19.80 (5.93)	20.60 (1.67)	21.00 (2.82)		T0 = T1, T2				
Control group	20.00 (4.74)	20.00 (2.12)	21.20 (3.19)		T0 = T1, T2				
BOP—Expressive language				7.586	0.002 *	0.322	4.077	0.026 *	0.203
MIG group	51.89 (10.17)	64.89 (6.60)	64.22 (9.77)		T0 ≠ T1, T2				
Control group	58.44 (11.70)	58. 22 (9.18)	56.56 (14.01)		T0 = T1, T2				
BOP—Verbal Comprehension				6.483	0.014 *	0.288	2.371	0.134	0.129
MIG group	49.11 (11.08)	49.67 (4.67)	58.50 (3.05)		T0 ≠ T2				
Control group	54.44 (8.81)	57.56 (6.61)	56.67 (7.71)		T0 = T1, T2				
BOP—Cognitive development				11.865	0.001 **	0.426	2.828	0.089	0.150
MIG group	46.01 (16.54)	56.56 (12.54)	61.33 (7.09)		T0 ≠ T1, T2				
Control group	54.44 (18.12)	59.11 (13.51)	60.89 (14.31)		T0 = T1, T2				
ABFW—Number of more interpersonal acts				4.321	0.022 *	0.213	7.973	0.002 *	0.333
MIG group	24.32 (5.19)	35.22 (5.47)	31.11 (4.98)		T0 ≠ T1				
Control group	29.56 (6.06)	27.89 (3.79)	27.36 (5.19)		T0 = T1, T2				
ABFW—Total number of communicative acts				7.770	0.002 *	0.327	3.745	0.035 *	0.190
MIG group	36.67 (10.55)	51.44 (4.48)	47.44 (4.98)		T0 ≠ T1				
Control group	34.56 (12.28)	35.89 (9.36)	46.33 (13.79)		T0 ≠ T2				

Legend: PBS: Pediatric Balance Scale; BOP: Behavioral Observation Protocol; VABS-II—Vineland Adaptive Behavior Scales—Second Edition; ABFW: Child Language Test; MIG: Global Integration Method. * = $p < 0.05$; ** = $p < 0.001$.

For expressive language, assessed by the BOP, a significant effect of time was observed (F = 7.586; $p = 0.002$; $\eta^2 = 0.322$), along with a significant time × group interaction (F = 4.077; $p = 0.026$; $\eta^2 = 0.203$). Bonferroni post hoc analyses showed that the MIG group presented

a significant increase in scores from baseline to post-intervention, with maintenance at follow-up (T0 ≠ T1 and T2), whereas the control group did not show significant changes over time. For verbal comprehension, a significant effect of time was identified (F = 6.483; p = 0.014; η^2 = 0.288), with no significant time × group interaction. In the MIG group, improvement occurred only at follow-up compared with baseline (T0 ≠ T2), suggesting a delayed effect of the intervention, while the control group maintained stable scores. Regarding cognitive development, a significant effect of time was found (F = 11.865; p = 0.001; η^2 = 0.426), with a non-significant trend toward a time × group interaction. The MIG group showed improvement from baseline to post-intervention and follow-up (T0 ≠ T1 and T2), whereas the control group showed no significant differences across the assessed time points.

Analysis of data related to the number of interpersonal acts in the ABFW test revealed a significant effect of time (F = 4.321; p = 0.022; η^2 = 0.213) and a highly significant time × group interaction (F = 7.973; p = 0.002; η^2 = 0.333). The MIG group showed a marked increase at post-intervention compared with baseline (T0 ≠ T1), while the control group remained stable over time. Similar results were observed for the total number of communicative acts (ABFW), with a significant effect of time (F = 7.770; p = 0.002; η^2 = 0.327) and a significant time × group interaction (F = 3.745; p = 0.035; η^2 = 0.190). The MIG group showed a significant increase at post-intervention (T0 ≠ T1), whereas the control group demonstrated improvement only at follow-up (T0 ≠ T2), suggesting distinct trajectories of communicative development between the groups.

3.2.1. Parents' Perspectives on the MIG Program

All nine caregivers of children participating in the MIG group took part in a focus group lasting approximately 60 min. Qualitative data analysis allowed the identification of four central themes, which summarize the main benefits of the intervention as perceived by the parents. These findings were organized according to the ICF domains of functioning, namely Body Structure and Function and Activity and Participation, as well as an additional category related to Parents' Overall Perception of the MIG Program, created to encompass broader aspects of the families' experiences.

3.2.2. Parents' Overall Perception of the MIG Program

Parents reported that the way activities were planned and implemented—using functional, playful, progressive, and adapted tasks—facilitated children's participation and enhanced the impact of the intervention. The structure based on meaningful activities, graded goals, and intensive practice was perceived as responsible for changes in communication, behavior, posture, body control, and autonomy. According to parents, the program's methodology promoted gains that exceeded initial expectations, reinforcing the perception that this intervention model has the potential to produce lasting effects throughout development.

"For me, it exceeded my expectations, because I never imagined he would achieve even half of what he did. And it wasn't only in relation to my goals, but in everything—especially interaction. In less than two months, my son before and my son today seem like different people. His behavior is different; his posture is different—and that was my main goal. It improved a lot, really a lot."

Mother #7, caregiver of a 12-year-old male child, support level 1.

3.2.3. Body Structures and Functions

Parents' reports highlighted perceptible changes in body structure and function components following the children's participation in the MIG program. According to parents, the MIG program influenced aspects related to balance, postural control, coordination,

muscle tone, agility, and strength. Many observed that the children became more stable, steady, and confident when handling objects and maintaining posture, as expressed by one mother:

> *"I did notice improvement in muscle strength. I also noticed more confidence when handling objects: he holds things better and doesn't drop them as easily as before. And in posture as well—his posture has improved."*
>
> Mother #2, caregiver of a 11-year-old male child, support level 2.

Progress was also reported in cognitive functions, particularly in the domains of sustained attention and concentration capacity, with participants demonstrating greater ability to maintain focus on tasks and to respond more systematically to environmental demands. Improvements were also observed in expressive communication functions, evidenced by an expanded verbal repertoire, greater clarity in formulating requests, and an increasing ability to identify and name everyday information, such as schedules and routines.

> *"Before, she didn't say anything—she would arrive and wouldn't ask for anything. Nowadays, she knows how to ask, she knows how to speak, even about schedules. Things she didn't even know how to look at before; now she can say the times."*
>
> Mother #4, caregiver of a 09-year-old female child, support level 1.
>
> *"He is now starting to concentrate more"*
>
> Mother #6, caregiver of a 10-year-old male child, support level 1.

3.3. Activity

Parental reports indicate significant advances in gross motor activities after participation in the program, especially in tasks involving mobility. Parents mentioned that their children began to run more efficiently, with less fatigue and greater initiative to engage in this activity, which had previously been avoided or performed with great effort. Improvements were also observed in the ability to go up and down stairs, a task previously limited by fear, insecurity, or lack of coordination. In some cases, children began to perform this movement independently, without adult support, demonstrating a qualitative leap in functional autonomy. Other caregivers reported gains in jumping, pedaling, and walking with greater stability, including abandonment of toe-walking patterns and increased confidence when climbing onto surfaces or negotiating obstacles.

> *"He still has some limitations, but he can already run; he gets a little less tired, which represents an important improvement, considering that before he didn't even try to run. When it comes to climbing stairs, he's no longer as afraid, and the same goes for getting into the elevator—things that seem small, but were huge for us, because he couldn't really climb stairs properly and didn't use the elevator either. Running was impossible, and even walking made him very tired. So these small achievements are actually very big. He had a significant improvement."*
>
> Mother #1, caregiver of an 11-year-old male child, support level 2.
>
> *"At home there's a staircase that she now goes down and up by herself; before, we had to hold her to go down. Now she goes down and up on her own."*
>
> Mother #9, caregiver of a 10-year-old female child, support level 2.

In addition to gross motor skills, marked progress was also observed in activities of daily living, evidenced by greater initiative and independence in tasks such as dressing, handling cutlery, carrying objects, putting away groceries, and organizing personal belongings. Many caregivers reported that their children began trying to eat using a fork and knife, to dress themselves—even if with adjustments or not fully appropriately—and to

brush their teeth with less need for direct assistance. Independence was also evident in everyday contexts, such as helping carry grocery bags, putting items away at home, and choosing clothes autonomously—behaviors that were not previously part of the child's repertoire. In play activities, parents noted increased independent play, interest in drawing, coloring, and manipulating toys without constant assistance. These improvements indicate that the intervention promoted not only motor performance, but also the child's ability to carry out meaningful activities in a more functional way in daily life.

> *"He is trying now; before, he didn't even try. Today he tries to hold the fork to eat, and he can already run a bit more than before, so I consider that he improved by about 50%. But for me, it's as if it were 100%, just because he is trying to do things. Getting dressed is still a challenge, because he puts his clothes on backwards; brushing his teeth and combing his hair also require us to always be there saying, 'Let's do this.' But he tries, and just the fact that he tries is already great. Then we just go over and check."*
>
> Mother #1, caregiver of an 11-year-old male child, support level 2.

3.4. Participation

Family members also reported important changes in the children's participation across different life contexts, highlighting greater involvement in social, school, and household activities. Many noted that their children began to play more and in more varied ways, showing initiative to invite other children, remain engaged in play for longer periods, and explore environments that had previously been avoided. There was also an increase in participation in family routine tasks, such as helping with small household activities, interacting more during shared moments, and spontaneously seeking the company of siblings and caregivers. In community and school settings, some parents observed that their children were more willing to participate in group activities, approach peers, and initiate simple conversations, facilitating relationship building and the expansion of their social networks.

> *"He didn't have any little friends. He had only one, who was his only reference. Now, however, he already has more friends and is interacting with other children, participating."*
>
> Mother #2, caregiver of an 11-year-old male child, support level 2.
>
> *"He is also more participative. Today, for example, we went to the supermarket and, as soon as we passed the checkout, he started putting the groceries into the bags. He left the store carrying the bags in both hands, without me needing to ask. I even said, 'Let's split the bags,' but he was already carrying everything by himself. He is more independent. When we got home, he helped put the groceries away."*
>
> Mother #3, caregiver of a 12-year-old male child, support level 1.
>
> *"At school, the teacher praised her a lot, saying that she has changed a great deal. Now she interacts in the classroom, asks questions, and when someone asks her something, she already answers. She is participating and interacting much more."*
>
> Mother #9, caregiver of a 10-year-old female child, support level 2.

4. Discussion

This pilot mixed-methods randomized controlled trial (RCT) involving 18 participants aimed to preliminarily explore the effects of the MIG Program for children with autism spectrum disorder compared with conventional physiotherapy, focusing on fundamental motor skills, achievement of functional goals, functional balance, and motor and communicative skills. Quantitative results indicated significantly greater improvements in the MIG group in both fundamental motor skills and the achievement of measured functional

goals, with relevant gains in performance and parental satisfaction. In addition, consistent progress was observed in functional balance and communicative competencies, suggesting broad effects that extend beyond the motor component. No significant improvement was observed in adaptive motor skills in either group. The qualitative findings contextualized the quantitative changes by illustrating how MIG caregivers perceived changes in daily life; however, because only MIG caregivers participated, these data cannot establish comparative effectiveness. The quantitative and qualitative findings should be interpreted in parallel, suggesting potential functionally meaningful improvements, potentially translating into greater participation and performance in children's daily lives. However, these findings should be interpreted as preliminary given the small sample size and pilot nature of the study.

The greater improvements observed in the MIG group regarding fundamental motor skills, compared with conventional physiotherapy, may be interpreted in relation to its integrated and multifaceted structure. The program combines functional motor training, proprioceptive modulation, and cognitive-behavioral strategies within meaningful and structured activities, which together may favor greater engagement, attentional involvement, and active participation, factors widely recognized as important for motor learning and generalization in children with autism spectrum disorder [38–40]. The effect sizes observed in this study, ranging from moderate to large, suggest that the gains are not limited to statistical significance but may reflect clinically meaningful changes in motor performance. However, given that these elements are inherently intertwined within the intervention, the present design does not allow determination of the relative contribution of each component. Therefore, the observed effects should be interpreted as arising from the combined characteristics of the MIG program as a whole.

With regard to the achievement of functional goals, COPM results demonstrated that the improvements observed in the MIG group were significantly greater than those obtained with conventional physiotherapy, with large effect sizes for both performance and satisfaction, and with maintenance of gains at follow-up. These findings suggest that the intervention may have contributed to immediate changes and the maintenance of gains over time, although confirmation in larger trials is required. Unlike conventional approaches predominantly centered on motor repetition, the MIG emphasizes understanding the task goal, sequential organization of action, and the attribution of meaning to activities, which may explain the greater magnitude and sustainability of the functional effects observed. The specificity of the intervention, combined with its intensity and focus on goals that are relevant to the child's and family's daily life, appears to have been decisive in ensuring that gains translated into perceived improvements that were maintained after the end of the program, reinforcing the importance of functionally oriented, participation-centered interventions.

The results indicate that the group submitted to the MIG program showed greater improvement in functional balance compared with the control group. This finding is particularly relevant, given that children with autism spectrum disorder frequently present deficits in postural control, hypotonia, and balance instability [41,42]. Within the integrated structure of the MIG program, which combines functional motor training, proprioceptive inputs, and structured task engagement, the observed gains may be related to the interaction among these elements. In this context, the MIG Flex therapeutic garment can be understood as one of the components embedded within this multicomponent approach, potentially contributing to postural organization and body awareness, as suggested by previous literature on proprioceptive resources and compressive garments [7,8,43,44]. However, since these elements were delivered simultaneously, the present study does not allow

the isolation of their individual effects, and the improvements are more appropriately interpreted as reflecting the combined influence of the intervention as a whole.

Another relevant finding concerns the advances observed in the communicative skills of children who participated in the MIG program. These results may be interpreted in light of the integrated characteristics of the intervention, which combines motor, cognitive, and narrative elements within functional activities. In particular, structured narrative strategies, as supported by previous studies, have been associated with improvements in verbal comprehension and oral expression in children with autism spectrum disorder [45,46]. Additionally, evidence from studies on linguistic microstructures indicates gains in core language domains such as morphosyntax and cohesion [47]. Within the context of the MIG program, the integration of narrative grammar into functional motor tasks may have created opportunities for sequencing actions, anticipating outcomes, and organizing experiences, factors recognized as relevant for communicative development [48]. However, as these components were implemented in an integrated manner, it is not possible to attribute the observed effects to any single element, and the findings should be understood as resulting from the combined characteristics of the intervention.

The results of the Vineland Motor Scale did not indicate significant effects of time or group × time interaction, suggesting stability of adaptive motor skills, both gross and fine motor, over the intervention period in both the MIG and conventional physiotherapy groups. These findings may be partially explained by the instrument's low sensitivity to change, as the Vineland-II shows reduced responsiveness, with values ranging from 0.27 to 0.34 according to a European consortium review, which requires longer intervention periods to detect clinically meaningful changes [49]. Thus, it is plausible that the five-week intervention period was insufficient to produce variations measurable by this scale [50]. Additionally, the Vineland assesses adaptive behaviors consolidated in daily life, whose progression tends to be slow in children with autism spectrum disorder due to developmental variability, limited spontaneous generalization of skills, and difficulties transferring gains to natural contexts [51,52]. Consequently, even interventions that positively impact motor performance may not be immediately reflected in adaptive gains, which depend on the consistent incorporation of skills into functional routines. The stability observed in the Vineland Motor Scale, therefore, does not contradict the other study findings but rather indicates that adaptive motor changes require longer longitudinal follow-up and specific generalization strategies to be detected by instruments of this nature.

The qualitative analysis deepened the findings of this study by revealing functionally relevant changes perceived by parents across the three ICF domains, thereby broadening the understanding of the effectiveness of the MIG Program. The reports indicated consistent advances in postural control, coordination, attention, and expressive communication, core aspects of everyday functioning. In addition, concrete progress was described at the activity level, such as running, climbing stairs, manipulating objects, and performing activities of daily living with greater autonomy. A critical point highlighted was the effective transfer of clinical gains to real-life contexts, overcoming a recurrent limitation of conventional interventions, whose generalization tends to be restricted [53,54]. Within the participation domain, parents reported greater engagement in play, more spontaneous social interactions, and positive reorganization of family routines, indicating that the improvements extended beyond the therapeutic setting. The qualitative and quantitative findings are presented as complementary but independent sources of evidence, with qualitative data providing contextual understanding of caregiver perceptions within the MIG group. These reports document not only the magnitude of the changes but also their direct impact on autonomy, participation, and the meaning attributed to these transformations in everyday family life.

The mixed-methods design adopted in this study allowed for a more comprehensive understanding of the effects of the MIG program by combining quantitative outcomes with qualitative insights from caregivers. However, it is important to clarify that the qualitative component was conducted exclusively with participants from the intervention group and, therefore, does not allow for direct comparison with the control condition. In this context, the qualitative findings should be interpreted as complementary to the quantitative results, providing contextualized perspectives on perceived changes in functioning, participation, and daily life, rather than serving as evidence of comparative effectiveness between groups. Furthermore, caregiver reports may have been influenced by expectancy effects, confirmation bias, or a desire to report positive changes associated with participation in the intervention. Therefore, these findings should be understood as subjective accounts of experience rather than objective indicators of treatment efficacy. Accordingly, the integration of findings in this study is intended to enrich the interpretation of the observed outcomes by incorporating family experiences and meanings attributed to change, while remaining bounded by the methodological scope of the qualitative data.

An additional aspect that should be considered when interpreting the findings relates to the characteristics of the comparator condition. Although the control group received conventional physiotherapy with a similar frequency and session duration, the interventions differed in terms of complexity, structure, and theoretical orientation. While the MIG program is inherently multicomponent and integrates motor, cognitive, behavioral, and narrative elements within ecologically valid and structured contexts, the comparator condition was based on more traditional motor approaches, with less emphasis on contextualization, task meaning, and integration across domains. These differences may have influenced participant engagement, attentional demands, and opportunities for skill generalization, which are factors known to impact intervention outcomes in children with autism spectrum disorder. Therefore, the observed differences between groups should be interpreted not only as reflecting the potential effectiveness of the MIG program, but also in light of the broader distinction between an integrated, multicomponent approach and a more conventional, less complex intervention. This limitation highlights the importance of future studies employing comparators with matched levels of complexity and structure, in order to more precisely isolate the effects attributable to different therapeutic approaches.

This study's main strength lies in the adoption of a mixed-methods design, integrating an RCT with a complementary qualitative analysis, which allowed for a more comprehensive understanding of the effects associated with participation in the MIG Program. The quantitative component was conducted in accordance with CONSORT guidelines and characterized as a single-blind trial, with assessors blinded to participant allocation. In addition, the intervention programs showed excellent adherence, with no dropouts occurring during the intervention period, ensuring high data quality. Although a small number of participants had missing data at follow-up, all randomized participants were retained in the analyses.

Despite these merits, some limitations should be acknowledged. First, although the sample size was determined a priori based on previous effect estimates, the relatively small number of participants may have reduced statistical power for some outcomes and increased uncertainty regarding the magnitude and precision of treatment effect estimates. This limitation is particularly relevant given the number of primary and secondary outcomes assessed and may restrict the generalizability of the findings. Accordingly, the results should be considered preliminary and require confirmation in larger, adequately powered trials.

Second, the results reflect the effects of a short-duration program, which prevents determining whether longer interventions would yield additional gains or whether the ob-

served benefits would be maintained after treatment cessation. Third, although adherence and attendance were high among participants, the generalizability of the findings to other sociocultural contexts remains uncertain.

Another methodological consideration concerns the handling of missing data. The last observation carried forward (LOCF) approach, although useful for preserving sample size and maintaining intention-to-treat analyses, assumes stability of outcomes over time and may introduce bias in treatment effect estimates. Future studies should consider more robust approaches, such as mixed-effects models or multiple imputation, particularly in larger samples with longer follow-up periods.

An additional limitation relates to the qualitative component. Only caregivers of children allocated to the MIG group participated in the interviews, which may have limited the range of perspectives captured and precluded direct comparison of family experiences across intervention groups. Furthermore, parental reports may be influenced by subjectivity and differences in sensitivity to detecting behavioral and functional changes.

Another important limitation relates to the multicomponent nature of the MIG intervention package. The program integrated motor training with narrative strategies, cognitive-behavioral supports, ecological activities, home assignments, therapist-specific training, and the use of a therapeutic garment. Consequently, the present study does not allow the isolated evaluation of the contribution of individual intervention components. In addition, the comparator was intentionally designed to reflect conventional physiotherapy services commonly available in the Brazilian rehabilitation context and was not matched to the MIG program in terms of complexity or contextual features. Therefore, the findings should be interpreted as reflecting the overall effects associated with participation in the MIG intervention package under the conditions of this study rather than the effectiveness of any specific element. Future studies using component-specific, dismantling, or factorial designs are needed to determine the relative contribution of individual intervention components and identify the mechanisms most strongly associated with clinical outcomes.

Finally, although the study followed rigorous methodological standards and used standardized protocols, implementation of the MIG Program requires a high level of professional expertise and specific material resources, such as the therapeutic garment and narrative framework, which may limit its replicability in services with lower operational capacity. In addition, comorbid conditions were not systematically assessed, preventing analysis of their potential influence on treatment response.

5. Conclusions

The findings of this pilot study suggest that the MIG program may be associated with greater improvements than conventional physiotherapy in fundamental motor skills, achievement of functional goals, functional balance, and communicative skills in children with autism spectrum disorder. These improvements were associated with moderate to large effect sizes and were observed at post-intervention, with indications that some gains may have been maintained at follow-up. The integration of motor, narrative, and psychological components may have contributed to enhanced engagement, organization of actions, and the application of acquired skills in daily life contexts. However, no changes were observed in adaptive motor skills.

Given the small sample size, the pilot nature of the trial, and the number of outcomes assessed, these findings should be interpreted with caution. Therefore, while these preliminary findings suggest that the MIG program may represent a promising and potentially clinically relevant approach aligned with contemporary rehabilitation models focused on functionality and participation, larger and adequately powered randomized controlled trials are needed before firm conclusions regarding effectiveness can be drawn.

Future research should also explore dose–response relationships, cost-effectiveness, and the applicability of the MIG program across different clinical contexts.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/disabilities6040059/s1, Supplementary Material S1: Narrative used in session 1; Supplementary Material S2: Narrative used in session 15; Supplementary Material S3: MIG Program motor protocol; Supplementary Material S4: Home Practice Activities.

Author Contributions: D.O.S. and T.K.F.C. conceived and designed the study. R.d.C.P.N., A.F.B.d.L., A.A.A.C.N., A.C.D.C.S., S.R.B., I.C.R., G.C.R. and P.A.N.S. conducted data collection. D.O.S. performed the statistical analysis. D.O.S. and T.K.F.C. interpreted the data. D.O.S. and T.K.F.C. drafted the manuscript. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement: This study was approved by the Research Ethics Committee of the Faculdade de Ciências Médicas de Minas Gerais under the Certificate of Presentation for Ethical Appraisal (CAAE: 89887325.2.0000.5134; date of approval: 19 August 2025). All procedures were conducted in accordance with the ethical principles of the Declaration of Helsinki.

Informed Consent Statement: Written informed consent was obtained from the parents or legal guardians of all participating children, and assent was obtained from the children when appropriate.

Data Availability Statement: The data supporting the study results are available upon request to the authors.

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Conflicts of Interest: The intervention evaluated in this study (Global Integration Method—MIG) was developed by TREINITEC Ltda. The authors declare no ownership stakes or intellectual property rights related to the evaluated intervention. All authors are affiliated with the Institute of Neurodevelopment, Cognition and Inclusive Education (INCEI), the institution contracted to conduct the technical and scientific evaluation of the intervention. INCEI was responsible for all scientific and operational stages of the study, including protocol implementation, participant recruitment, data collection and management, outcome assessment, statistical analysis, interpretation of results, and manuscript preparation. The contractual agreement explicitly established that methodological, analytical, interpretative, and editorial decisions remained under the exclusive responsibility of the research team. TREINITEC Ltda. did not participate in participant recruitment, data collection, outcome assessment, statistical analysis, interpretation of results, manuscript writing, or the decision to submit the study for publication. TREINITEC Ltda. had no control over the scientific content of the study and had no authority to approve, modify, delay, or prevent the dissemination of results. The research team maintained unrestricted access to the complete database and assumed final responsibility for analysis, interpretation, and communication of the results.

Disability Language/Terminology Positionality Statement: In this study, the authors adopt person-first language, such as "children with autism spectrum disorder" because they understand that this approach aligns with contemporary guidelines in the scientific literature and international recommendations, valuing the individual beyond their condition. The terminological choice is consistent with the scientific and cultural context of the health and rehabilitation field in which this study is situated.

Abbreviations

The following abbreviations are used in this manuscript:

ABFW	ABFW Child Language Test
ANOVA	Analysis of Variance
ASD	Autism Spectrum Disorder
CAAE	Certificate of Presentation for Ethical Appraisal
CNPq	National Council for Scientific and Technological Development
CONSORT	Consolidated Standards of Reporting Trials
COPM	Canadian Occupational Performance Measure
G*Power	Statistical power analysis software
ICF	International Classification of Functioning, Disability and Health
IBM SPSS	Statistical Package for the Social Sciences
ITT	Intention-to-Treat
LOCF	Last Observation Carried Forward
MIG	Global Integration Method
PBS	Pediatric Balance Scale
BOP	Behavioral Observation Protocol
RCT	Randomized Clinical Trial
RBR	Brazilian Clinical Trials Registry
SPIRIT	Standard Protocol Items for Randomized Trials
TGMD-2	Test of Gross Motor Development – Second Edition
TIDieR	Template for Intervention Description and Replication
VABS-II	Vineland Adaptive Behavior Scales – Second Edition
η^2	Eta squared (effect size measure)

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