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Effectiveness of the Gyrotonic and Mézières Methods in Improving Coronal Imbalance

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Abstract

Coronal imbalance and mild scoliosis are associated with postural asymmetry, reduced movement efficiency, and altered spinal mechanics. Conservative rehabilitation approaches that focus on postural correction and multidimensional movement have gained increasing attention in the management of these conditions. The aim of this study was to compare the effects of the Mézières Method and the Gyrotonic Method on coronal imbalance and Cobb angle in young people with postural asymmetry. Thirty third-year bachelor students (male and female) with a mean age of 21.62±1.58 years recruited from the University of Sports of Tirana were included in the study. The intervention protocol was carried out over a 12-week period with 45-60 minute exercise sessions performed three times a week. Participants were divided into two groups: the Gyrotonic Group (GG) and the Mézières Group (GM). Coronal imbalance (mm) and Cobb angle were assessed pre- and post-intervention using the DIERS Formetric 4D system and radiographic assessment. The groups demonstrated reductions in coronal imbalance and Cobb angle after the intervention period. However, no statistically significant differences were identified between the groups (p>0.05). The findings suggest that the Gyrotonic method may provide improvements in spinal alignment and postural symmetry comparable to the Mézières method in individuals with mild scoliosis and coronal postural deviations. Further research with larger sample sizes, more diverse participant populations, and longer follow-up periods is recommended to better assess the long-term effectiveness and clinical applicability of these rehabilitation approaches in the management of scoliosis and coronal postural deviations.

Keywords: *rehabilitation, scoliosis, Diers 4D, back pain, postural deviation, Cobb angle*

Introduction

Spinal alignment plays a fundamental role in biomechanical efficiency, postural stability, and functional movement. Although much of the literature has historically focused on sagittal imbalance, increasing attention is now being directed toward coronal imbalance, defined as a lateral deviation of the trunk relative to the pelvis in the frontal plane (Obeid et al., 2018). Coronal imbalance is closely associated with scoliosis and contributes to asymmetrical loading patterns, impaired neuromuscular control, and reduced functional performance (Li et al., 2025). Low back pain and spinal musculoskeletal disorders remain among the leading causes of disability worldwide and are strongly associated with altered spinal mechanics and sedentary lifestyles (Hartvigsen et al., 2018; Hoy et al., 2014; Van Dieën et al., 2003).

Scoliosis is a three-dimensional spinal deformity characterized by lateral curvature, vertebral rotation, and alterations in postural alignment (Negrini et al., 2018). Individuals with scoliosis frequently demonstrate asymmetrical muscle activation, reduced spinal mobility, impaired proprioceptive input, and deficits in postural control, all of which negatively affect movement efficiency and functional stability (Mahaudens et al., 2005). Even subtle deviations in the coronal plane may disrupt force distribution across the spine, increase stress on passive structures such as ligaments and intervertebral discs, and contribute to chronic musculoskeletal dysfunction (Panjabi, 2003). These biomechanical changes are commonly associated with pain, reduced mobility, and decreased participation in daily activities (Foster et al., 2018).

From a physiotherapeutic perspective, the management of coronal imbalance and scoliosis requires interventions that address both structural alignment and the neuromuscular mechanisms underlying posture and movement control (Hodges &

Tucker, 2010). Traditional rehabilitation strategies have included corrective exercises, manual therapy, and postural education; however, recent evidence highlights the importance of three-dimensional movement approaches that promote symmetry, active control, and functional integration across multiple planes of motion (Dimitrijević et al., 2024; Ma et al., 2023; Negrini et al., 2018; X. Wang et al., 2026). Within this framework, the Mézières Method represents an important global postural rehabilitation approach. Developed by Françoise Mézières, the method is based on the concept of interconnected muscular chains and proposes that muscular shortening, particularly within the posterior chain, contributes to postural asymmetries and spinal deformities. Treatment focuses on global stretching, breathing control, alignment correction, and restoration of muscular balance through sustained active postures (Rosario, 2017). The Mézières Method emphasizes treating the body as an integrated system rather than focusing on isolated segments, making it particularly relevant in the rehabilitation of scoliosis and coronal imbalance (Todri et al., 2025).

Similarly, the Gyrotonic Method has emerged as a contemporary movement-based intervention that aligns with modern rehabilitation principles. The method incorporates continuous circular and spiral spinal movements, emphasizing elongation, lateral flexion, rotation, and coordinated breathing patterns. Through its multidirectional movement approach, Gyrotonic training may improve spinal mobility, proprioceptive awareness, neuromuscular coordination, and symmetrical movement patterns (Seo & Kim, 2019). These characteristics suggest potential benefits in the rehabilitation of three-dimensional spinal deformities and postural asymmetries (Brown & McGill, 2007).

Despite its growing use in clinical and therapeutic settings, scientific evidence regarding the effectiveness of the Gyrotonic Method in the rehabilitation of scoliosis and coronal imbalance remains limited. Reliable assessment tools are therefore essential for objectively evaluating treatment outcomes. Evidence from systematic reviews indicates that raster stereographic measurements demonstrate good reliability and validity, particularly for frontal plane asymmetry and postural assessment (Tabard-Fougère et al., 2016).

The Mézières Method has been investigated as a global postural rehabilitation approach aimed at restoring muscular balance and improving body alignment. Previous studies have reported that Mézières-based interventions can improve postural control, trunk symmetry, flexibility, and balance through the correction of muscular chain shortening and compensatory postural patterns (Paolucci et al., 2017; Todri et al., 2025b). Paolucci et al. (2017) demonstrated significant improvements in postural stability and functional balance following a Mézières rehabilitation program, supporting the method's potential role in conditions characterized by postural asymmetries. Given that coronal imbalance is closely associated with asymmetrical muscle tension and altered postural organization, the global corrective principles of the Mézières Method may contribute to improvements in spinal alignment and postural equilibrium (Paolucci et al., 2017).

The Gyrotonic Method has emerged as a movement-based intervention that emphasizes spinal elongation, multidirectional mobility, trunk stabilization, and neuromuscular coordination. Research has shown that Gyrotonic exercises can improve spinal mobility, core muscle activation, postural control, and functional movement patterns. Seo and Kim (2019) reported significant improvements in lumbar stability and trunk muscle function following a Gyrotonic exercise program, suggesting its potential to enhance dynamic postural control and spinal stability. Through its integration of rotational, lateral flexion, and elongation movements, the Gyrotonic Method may help address postural asymmetries and movement dysfunctions commonly observed in individuals with scoliosis and coronal imbalance.

Therefore, this study aims to compare the effectiveness of the Mézières Method and the Gyrotonic Method in improving coronal imbalance and scoliosis in a sample of student recruited from the University of Sports of Tirana.

Methods

Participants

Participants (n=30) will be divided into two intervention groups, with outcomes assessed through DIERS Formetric 4D analysis and radiographic evaluation in order to determine the impact of both rehabilitation approaches on spinal alignment and postural symmetry. The participants included both male and female third-year bachelor students, with a mean age of 21.62±1.58 years, mean height of 166.62±8.24 cm, and mean body mass of 57.15±9.25 kg (Table 1).

Table 1. Anthropometric measurements of participants

Category	Details
Sample size	30 adults
Mean age	21.62±1.58 years
Mean body height	166.62±8.24 cm
Mean body mass	57.15±9.25 kg

Procedure

All participants agreed to take part in the study after being informed about the assessment procedures. In accordance with the ethical principles of the Declaration of Helsinki, this study was approved by the Ethics Council of University of Sports of Tirana in Albania (Protocol No. 2988, dated 22/10/2024).

All participants voluntarily signed a written informed consent form prior to participation. The participant selection procedure was based on the following criteria: Individuals who had experienced low back pain for at least three months and were not undergoing any other treatment for back pain; Individuals capable of performing physical exercises despite the presence of back pain; Individuals without previous orthopedic or neurosurgical operations in the lumbar region; Individuals without sensory abnormalities or muscular paralysis resulting from neurological disorders; Individuals without diagnosed motor performance limitations or other mental disorders.

Instruments and test protocol

DIERS Formetric 4D system has shown value in monitoring postural deformities and spinal alignment changes over time (Degenhardt et al., 2017), while radiographic evaluation (X-ray) remains the reference standard for structural scoliosis assessment. The DIERS Formetric 4D method (DIERS International GmbH, Schlangenbad, Germany; Figure 1) is an advanced, non-invasive raster stereographic technology used for the analysis of posture and spinal alignment, with particular importance in the assessment of coronal imbalance (Drerup & Hierholzer, 1994; Hackenberg et al., 2003). By projecting structured light onto the surface of the back, the system creates an accurate three-dimensional model of the spine and pelvis, allowing quantitative evaluation of parameters such as trunk imbalance, lateral deviation, and pelvic asymmetry (Degenhardt et al., 2020; Drerup & Hierholzer, 1994). Unlike conventional radiographic methods, the Formetric 4D system is radiation-free, making it especially suitable for repeated assessments in conditions such as scoliosis (Mohokum et al., 2015). The system is located at the University of Sports of Tirana. Participants were evaluated for the following parameters before and after the 12-week intervention period: coronal imbalance (mm) and Cobb angle.

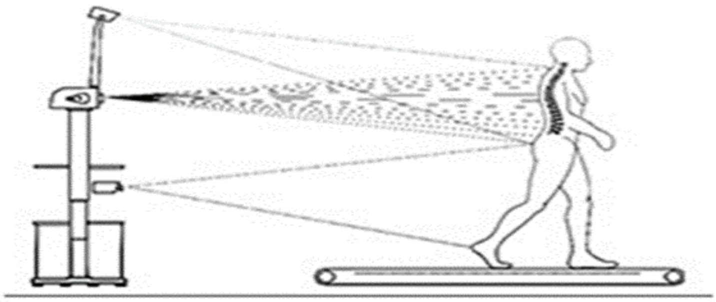

Figure 1. DIERS Formetric 4D

Intervention

The intervention protocol for our participants was conducted three times per week, with sessions lasting 45–60 minutes over a period of 12 weeks. In the G1 group, the Gyrotonic exercise method was applied using the Gyrotonic Pulley Tower Combination Unit ULTIMA (Gyrotonic Inc., New York, NY, USA) under the supervision of a certified instructor. In the M1 group, the Mézières Method was applied two times per week, under the supervision of a physiotherapist (Horvath, 2023; Seo & Kim, 2019).

Table 2 presents a structured comparison between the two exercise intervention protocols—the Gyrotonic Method (G1) and the Mézières Method (M1)—organized according to program phases, exercise content, muscular activation, and time parameters. This organization allows a clear analysis of the conceptual and practical differences between the two approaches in postural rehabilitation and re-education. Exercise intensity was progressively increased according to the participants' tolerance and was monitored using the Rating of Perceived Exertion (RPE) scale.

Table 2. Description of the intervention and exercises

Component	Gyrotonic group (GG, n=15)	Mézières group (MG, n=15)
Intervention goal	Improve spinal mobility, postural symmetry, neuromuscular coordination, and three-dimensional spinal alignment through multidirectional movements.	Improve postural alignment, muscular balance, and correction of asymmetries through global stretching of muscular chains.
Warm-up (10–15 min)	General mobility exercises and dynamic movements to prepare the musculoskeletal system for exercise.	Gentle spinal mobilization and breathing exercises to increase awareness of spinal elongation and postural alignment.

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Table 2. Description of the intervention and exercises

Component	Gyrotonic group (GG, n=15)	Mézières group (MG, n=15)
Main exercises	1. Lateral Spinal Elongation (asymmetry correction) 2. Spiral Rotation (three-dimensional spinal reorganization) 3. Posterior Chain Integration	1. Supine Global Posterior Chain Stretch 2. Seated Axial Elongation with Forward Projection 3. Standing Wall Alignment (anti-coronal correction) 4. Asymmetrical Correction Posture (scoliosis-specific)
Primary muscles activated	Quadratus lumborum, multifidus, deep spinal rotators, intercostals, internal and external obliques, erector spinae, gluteus maximus, thoracolumbar fascia.	Posterior muscular chain, erector spinae, internal and external obliques, gluteus maximus, thoracolumbar fascia, and postural stabilizing muscles.
Movement characteristics	Continuous circular and spiral movements combined with synchronized breathing and axial elongation.	Sustained corrective postures combined with controlled breathing and global muscular chain stretching.
Cool-down (5–10 min)	Relaxation and breathing exercises to reduce muscle tension and facilitate recovery.	Relaxation and breathing exercises to promote postural integration and muscle relaxation.
Session duration	40–60 min	40–60 min
Frequency	3 sessions/week	2 sessions/week
Intervention period	12 weeks	12 weeks
Total sessions	36 sessions	24 sessions

Data analysis

Data analysis was performed using IBM SPSS Statistics Version 26. Initially, descriptive statistics were conducted to summarize the main characteristics of the data, including the mean (M), standard deviation (SD), and the minimum and maximum values for each variable. To verify the fulfilment of statistical assumptions, the normality of data distribution for each group was assessed using the Kolmogorov–Smirnov test with Lilliefors correction and the Shapiro–Wilk test. Given the small sample size in each group (n=15), the results of the Shapiro–Wilk test were considered the primary reference for evaluating normality. To compare differences between groups, a 2×2 mixed-model analysis of variance (ANOVA) was employed. For each analysis, the F statistic, degrees of freedom (df), and significance level (p) were reported. The level of statistical significance was set at $\alpha=0.05$ for all statistical tests.

Results

Table 3 presents the obtained data for Coronal imbalance (mm) and Cobb angle (°). In the Gyrotonic group, Coronal Imbalance decreased from 8.60±3.14 mm before the intervention to 5.93±2.15 mm after the intervention. In the Mézières group, the values decreased from 9.27±3.41 mm pre-intervention to 6.40±2.47 mm post-intervention. The total sample (n = 30) showed a reduction from 8.93±3.24 mm before the intervention to 6.17±2.29 mm after the intervention.

Regarding Cobb angle (°), the Gyrotonic group demonstrated a decrease from 16.00±2.65° before the intervention to 13.47±1.89° after the intervention. In the Mézières group, the values decreased from 15.40±2.77° pre-intervention to 13.00±2.36° post-intervention. The total sample (n=30) showed a reduction from 15.70±2.68° before the intervention to 13.23±2.11° after the intervention.

Table 3. Summary statistics for the Variables

Method		Coronal Imbalance before (mm)	Coronal Imbalance after (mm)	Cobb angle before	Cobb angle after
Gyrotronic	N	15	15	15	15
	Mean	avg.60	maj.93	16.00	13.47
	Median	8.00	5.00	15.00	13.00
	Std. Deviation	3.135	2.154	2.646	1.885
	Std. Error of Mean	0.809	0.556	0.683	0.487

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Table 3. Summary statistics for the Variables

Gyrotronic	Minimum	5	3	14	12
	Maximum	16	11	24	19
	Range	11	8	10	7
	Kurtosis	0.541	0.763	5.681	4.735
	Std. Error of Kurtosis	1.121	1.121	1.121	1.121
	Skewness	0.926	0.990	2.216	1.943
	Std. Error of Skewness	0.580	0.580	0.580	0.580
Mezeires	N	15	15	15	15
	Mean	sept.27	jun.40	15.40	13.00
	Median	8.00	6.00	14.00	12.00
	Std. Deviation	3.411	2.473	2.772	2.360
	Std. Error of Mean	0.881	0.638	0.716	0.609
	Minimum	5	2	12	10
	Maximum	16	10	21	18
	Range	11	8	9	8
	Kurtosis	-0.527	-1.057	-0.330	-0.392
	Std. Error of Kurtosis	1.121	1.121	1.121	1.121
	Skewness	0.696	0.024	0.797	0.639
	Std. Error of Skewness	0.580	0.580	0.580	0.580

Regarding the change in coronal imbalance, the data were found to be non-normally distributed in both groups. The Shapiro–Wilk test was statistically significant for both the Mézières group ($W=0.72$, $p<0.001$) and the Gyrotonic group ($W=0.88$, $p=0.050$). Likewise, for the change in Cobb angle, the Shapiro–Wilk test results indicated that the data distribution deviated from normality in both groups (Mézières: $W=0.85$, $p=0.015$; Gyrotonic: $W=0.83$, $p=0.010$) as shown in table 4.

Table 4. Tests of Normality

Variable	Group	n	Kolmogorov–Smirnov D	p	Shapiro–Wilk W	p
Coronal Imbalance Difference	Mézières	15	0.322	<0.001	0.715	<0.001
	Gyrotonic	15	0.239	0.021	0.881	0.050
Cobb Angle Difference	Mézières	15	0.306	0.001	0.846	0.015
	Gyrotonic	15	0.305	0.001	0.833	0.01

Note. Lilliefors Significance Correction.

Before performing the inferential analyses, the distribution of the data was assessed for each variable and group using the Kolmogorov–Smirnov test with Lilliefors correction and the Shapiro–Wilk test. Given the relatively small sample size in each group ($n=15$), the Shapiro–Wilk test was considered the primary indicator of normality. Descriptive statistics are presented as mean ± standard deviation.

To evaluate the effects of the intervention methods over time, a 2×2 mixed-model analysis of variance (ANOVA) was conducted for each dependent variable (Table 5). Time (pre-intervention and post-intervention) was treated as the within-subject factor, while intervention method (Gyrotonic and Mézières) was treated as the between-subject factor. The analyses examined the main effects of time and group, as well as the interaction effect between time and group. Statistical significance was established at $p<0.05$.

For coronal imbalance, the mixed ANOVA revealed a significant main effect of time, $F(1,28)=24.37$, $p<0.001$, $\eta p^2=0.465$, indicating a significant reduction in coronal imbalance following the 12-week intervention period. However, neither the main effect of group, $F(1,28)=0.29$, $p=0.594$, $\eta p=0.010$, nor the time × group interaction, $F(1,28)=0.21$, $p=0.655$, $\eta p^2=0.007$, reached statistical significance.

Similarly, for Cobb angle, a significant main effect of time was observed, $F(1,28)=19.84$, $p<0.001$, $\eta p^2=0.415$, demonstrating an overall improvement from pre- to post-intervention across both groups. No statistically significant main effect of group, $F(1,28)=0.17$, $p=0.683$, $\eta p^2=0.006$, or time × group interaction, $F(1,28)=0.18$, $p=0.679$, $\eta p^2=0.006$, was identified.

Overall, the findings indicate that both the Gyrotonic and Mézières methods were associated with significant improvements in coronal imbalance and Cobb angle after 12 weeks of intervention. Nevertheless, no statistically significant differences were found between the two intervention methods.

Table 5. Analysis of variance ANOVA

Outcome Variable	Effect	df	F	p	Partial η²
Coronal Imbalance (mm)	Time	1, 28	24.37	<0.001	0.465
	Group	1, 28	0.29	0.594	0.010
	Time × Group	1, 28	0.21	0.655	0.007
Cobb Angle (°)	Time	1, 28	19.84	<0.001	0.415
	Group	1, 28	0.17	0.683	0.006
	Time × Group	1, 28	0.18	0.679	0.006

Discussion

The present study compared the effects of the Gyrotonic Method and the Mézières Method on coronal imbalance and Cobb angle in young adults presenting with postural asymmetries and mild scoliosis-related deviations. The principal finding was that both intervention approaches produced significant improvements in coronal imbalance and Cobb angle following the 12-week rehabilitation program. However, no significant interaction effect between intervention type and time was identified, indicating that neither method demonstrated superiority over the other in improving the measured postural parameters. The significant main effect of time observed for both coronal imbalance and Cobb angle suggests that participation in a structured rehabilitation program, regardless of the specific method employed, may positively influence spinal alignment and postural organization. Importantly, the effect sizes associated with the time factor were large ($\eta p^2=0.465$ for coronal imbalance and $\eta p^2=0.415$ for Cobb angle), indicating that the magnitude of change was clinically meaningful despite the absence of significant between-group differences. These findings support the growing body of evidence indicating that conservative exercise-based interventions can contribute to improvements in postural symmetry and spinal alignment in individuals with mild scoliosis and postural dysfunction (Kocaman et al., 2021; Negrini et al., 2018; Romano et al., 2009; Zhu et al., 2025).

The improvements observed in the Gyrotonic group may be explained by the multidimensional nature of the method. Gyrotonic exercises emphasize coordinated spinal rotation, lateral flexion, axial elongation, and synchronized breathing. Such movement patterns may enhance neuromuscular coordination, trunk stabilization, proprioceptive awareness, and dynamic postural control (Hodges & Tucker, 2010; Seo & Kim, 2019; Wang et al., 2024). Previous studies have suggested that movement-based interventions incorporating multi-planar spinal motion may improve spinal mobility and functional alignment by promoting more efficient motor control strategies and reducing asymmetrical loading patterns (Hodges & Tucker, 2010; Seo & Kim, 2019). The reductions in coronal imbalance and Cobb angle observed in the present study are consistent with these proposed mechanisms. Similarly, the positive outcomes observed in the Mézières group may be related to the method's emphasis on global muscular chain stretching, postural correction, and breathing control. The Mézières approach aims to restore muscular balance through sustained corrective postures that address asymmetrical tension within interconnected muscular chains. Previous research has reported that global postural rehabilitation approaches can improve postural stability, trunk alignment, flexibility, and functional movement patterns (Bonetti et al., 2010; Paolucci et al., 2017). These mechanisms may contribute to a more symmetrical distribution of mechanical forces across the trunk and pelvis, thereby supporting improvements in coronal alignment.

One of the most noteworthy findings of the present study is the absence of statistically significant differences between the two intervention methods. Although Gyrotonic and Mézières differ considerably in their theoretical foundations and exercise execution, both approaches share several fundamental rehabilitation principles. These include spinal elongation, postural awareness, breathing integration, neuromuscular activation, and correction of asymmetrical movement patterns. It is therefore plausible that these common therapeutic mechanisms represent the primary drivers of the observed improvements. From a clinical perspective, the findings suggest that the achievement of spinal realignment may depend more on the implementation of consistent, structured postural rehabilitation than on the selection of a specific exercise method. An additional consideration is the relatively small sample size of the present study. Although significant improvements over time were detected, the study may have lacked sufficient statistical power to identify small differences between intervention methods. Furthermore, participants presented with relatively mild postural deviations and Cobb angles at baseline, which may have limited the potential magnitude of improvement and reduced the likelihood of detecting intervention-specific effects. Previous studies have suggested that longer intervention durations and larger participant cohorts may be necessary to observe substantial structural adaptations in spinal alignment (Negrini et al., 2015).

The use of the DIERS Formetric 4D system represents a methodological strength of the study. Raster stereography provides reliable and radiation-free assessment of postural asymmetries and spinal alignment, making it particularly suitable for repeated monitoring of rehabilitation outcomes. Combined with radiographic assessment of Cobb angle, the methodology allowed both functional and structural aspects of spinal alignment to be evaluated. From a clinical standpoint, the findings suggest that both Gyrotonic and Mézières rehabilitation programs may represent viable conservative treatment options for individuals with mild scoliosis and coronal postural deviations. Given the comparable outcomes observed between methods, clinicians may consider patient preference, therapist expertise, equipment availability, and treatment accessibility when selecting an intervention strategy. Such flexibility may improve adherence and facilitate long-term participation in rehabilitation programs.

Limitations and future directions

Several methodological limitations should be considered when interpreting the findings of the present study. First, the sample consisted of university students with relatively mild postural deviations and Cobb angles, which may limit the generalizability of the results to individuals with more severe scoliosis or different age groups. Second, participants were assigned to active intervention groups only, and the absence of a non-intervention control group makes it difficult to determine the extent to which the observed improvements were attributable solely to the rehabilitation programs. Third, although significant improvements were observed in spinal alignment parameters, additional outcomes such as pain intensity, functional capacity, quality of life, and muscle activation patterns were not assessed. Finally, the relatively small sample size may have reduced the statistical power to detect subtle differences between the Gyrotonic and Mézières methods. In addition, the 12-week intervention period may not have been sufficient to observe substantial long-term structural spinal changes. Future studies should include larger samples, longer intervention periods, and follow-up assessments to better evaluate the long-term effectiveness of the Gyrotonic and Mézières methods in scoliosis rehabilitation.

Conclusion

Both the Gyrotonic method and the Mézières method demonstrated positive effects on coronal imbalance and Cobb angle after 12 weeks of intervention. Although no statistically significant differences were identified between the two methods, both approaches contributed to improvements in spinal alignment and postural symmetry.

These findings support the potential value of movement-based rehabilitation programs in the management of mild scoliosis and coronal postural deviations. Further research with larger samples, control groups, and longer follow-up periods is necessary to confirm these results and better understand the long-term effects of these interventions.

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Conflict of Interest

The authors declare that there are no financial, commercial, or personal relationships that could be considered a potential conflict of interest regarding the publication of this study. No external funding was received for this research, and the authors have no affiliation with Gyrotonic® organizations, equipment manufacturers, or commercial rehabilitation providers that could influence the interpretation or reporting of the results. All assessments, analyses, and interpretations were conducted independently in accordance with academic and ethical research standards.

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