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REVIEW ARTICLE

The Effect of Schroth Exercises and Orthotic Bracing on Changes in Sagittal Balance and Sagittal Index in Patients with Adolescent Idiopathic Scoliosis

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Abstract

Adolescent idiopathic scoliosis (AIS) is a three-dimensional spinal deformity characterized by lateral curvature, vertebral rotation, and sagittal imbalance. It affects 2–4% of adolescents, predominantly females (7:1 ratio). Progressive deformity can cause respiratory dysfunction, chronic pain, and psychosocial distress. Developing effective conservative treatments remains a major challenge in orthopedic rehabilitation. This study aimed to evaluate the effectiveness of combined Schroth therapy and 3D-Chêneau bracing in managing AIS, focusing on sagittal alignment, postural control, and functional improvement. A prospective quasi-experimental study was conducted with 60 adolescents (mean age 13.3 ± 1.6 years) diagnosed with AIS (Cobb angle 20°–47°). The intervention consisted of two phases: an intensive 3-week supervised Schroth exercise program (21 sessions) followed by continued home exercises combined with a custom 3D-modified Chêneau brace. Assessments were performed at baseline, 4 weeks, 3 months, and 6 months. Primary outcomes included sagittal balance (mm) and sagittal index (mm), evaluated by standardized plumb-line analysis. Results: After six months, significant improvements were observed in sagittal alignment ($p < 0.001$). Sagittal balance increased toward the physiological reference (~20 mm), indicating improved postural symmetry and trunk stability. Sagittal index values reflected curve-specific and localization-dependent adaptations, particularly in thoracic deformities. Combined Schroth therapy and 3D-modified Chêneau bracing effectively enhanced sagittal spinal alignment in adolescents with AIS. This integrated conservative approach demonstrated measurable improvements in physiological balance and postural organization, supporting its role as a functional, noninvasive intervention for AIS management.

Keywords: Adolescent idiopathic scoliosis · Schroth exercises · Chêneau brace · sagittal balance · sagittal index · rehabilitation

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Introduction

Scoliosis is a three-dimensional deformity of the spine characterized by the loss of sagittal curves, deviation in the frontal plane, and vertebral body rotation, which may worsen rapidly during growth spurts (Weiss & Moramarco, 2013). The majority of scoliosis cases encountered in clinical practice are idiopathic, with the etiology remaining largely unknown, unlike secondary forms such as congenital, neurological, or syndromic scoliosis (Janicki & Alman, 2007). Although scoliosis can be associated with neuromuscular disorders, syndromes, or tumors, 80–90% of cases are classified as idiopathic due to the absence of an identifiable cause (Weiss & Moramarco, 2013).

Adolescent idiopathic scoliosis (AIS) is diagnosed when a spinal curvature greater than 10° Cobb is observed in otherwise healthy adolescents (Yaman & Dalbayrak, 2014). The prevalence of AIS in the general population is estimated at 2–3%, with approximately 10% of patients requiring some form of treatment and 0.1% eventually undergoing surgery (Weiss & Moramarco, 2013). AIS is more common in females, with a female-to-male ratio of approximately 7:1 (Weiss & Moramarco, 2013). Early detection is critical, as timely intervention allows for simpler, non-invasive treatments and reduces the need for surgical correction (Daruwalla & Balasubramaniam, 1985).

AIS is typically classified by age of onset into infantile, juvenile, and adolescent forms, with the adolescent type being the most prevalent (Trobisch et al., 2010). Despite extensive research, the etiology of AIS remains unclear, though genetic factors appear to play an important role, as suggested by family aggregation and twin studies (Kesling & Reinker, 1997; Burwell, 2003).

Given the potential for curve progression during growth, the primary goal of treatment is to prevent worsening of deformity and to preserve quality of life (Weiss & Moramarco, 2013). Conservative approaches such as physiotherapy, bracing, and specific exercise methods, particularly the Schroth method, have demonstrated positive effects on curve reduction, function, and patient well-being (Laita et al., 2018; Berdishevsky et al., 2016).

Schroth therapy is a conservative treatment method for scoliosis based on sensorimotor and kinesthetic principles, combining corrective exercises, postural self-correction, and specific breathing techniques to prevent curve progression and improve function (Bezalel et al., 2019). It is an individualized, therapist-guided approach that relies on intensive training and structured home practice, with proven benefits in spinal alignment, respiratory function, and overall quality of life (Monticone et al., 2014; Weinstein et al., 2013).

Spinal orthoses represent another key conservative method, most often prescribed for curves between 25–40° during growth phases at risk of progression (Negrini et al., 2012). Among various types, the 3D-Chêneau brace is widely recommended, with treatment effectiveness strongly linked to daily wear time and quality of in-brace correction. Successful outcomes require careful brace fitting, regular monitoring, and multidisciplinary team involvement (Kotwicki, 2008; Kwiatkowski et al., 2015).

Previous research highlights the effectiveness of Schroth exercises in reducing Cobb angle, trunk rotation, and improving quality of life compared with standard exercise or no treatment (Kuru et al., 2016; Dimitrijević et al., 2022a; Dimitrijević et al., 2022b). Moreover, combining physiotherapeutic scoliosis-specific exercises with bracing has shown superior outcomes in controlling curve progression and maintaining long-term function (Wibmer et al., 2019; Grivas et al., 2022).

Given that correcting sagittal balance is a crucial long-term goal in Adolescent Idiopathic Scoliosis treatment, and that the impact of combined methods (Schroth and Chêneau) on this specific parameter is often overlooked, the primary aim of this study is to evaluate the efficacy of a combined protocol involving Schroth Exercises and 3D-Chêneau bracing on changes in spinal sagittal balance. A particular focus is placed on measuring the change in the Sagittal Index as an objective radiological parameter, aiming to prove the effectiveness of this multimodal approach in achieving sustained and functional postural correction.

Combined therapy, integrating an intensive Schroth program and the use of a 3D-Chêneau brace, yields a statistically significant and clinically relevant improvement in the Sagittal Index and overall sagittal balance in patients with Adolescent Idiopathic Scoliosis.

Method

2.1. Study Design

This research was conducted as an empirical, longitudinal, prospective quasi-experimental study with a single-group pretest–posttest design. Theoretical analysis was applied to define the conceptual framework, while statistical methods were used for data processing. The study also had characteristics of action research, providing both quantitative and qualitative insights. Assessments were performed at three major time points: baseline (prior to the intervention), after 3 months, and at 6 months (final follow-up), to evaluate short-term outcomes. In addition, early effects were assessed: the clinical impact of the Schroth method was evaluated after 4 weeks.

2.2. Participants and Measures

The study included 60 adolescents (45 females, 15 males) aged 10–16 years (mean age 13.3 ± 1.6), recruited from the Institute of Physical Medicine, Rehabilitation, and Orthopedic Surgery "Dr. Miroslav Zotović" in Banja Luka. Mean body height was 164.1 ± 10.5 cm (range 134–189 cm), and mean body mass was 52.8 ± 12.9 kg (range 26.5–99 kg). Among female participants, 37 had reached menarche, with an average age of onset of 12.6 ± 0.9 years (range 11–15 years).

Inclusion criteria were: adolescent idiopathic scoliosis (AIS) diagnosed by a physician, Cobb angle ≥ 20°, and radiographic confirmation (AP and sagittal full-spine imaging). Participants were stratified into subgroups based on curve magnitude (< 30° vs. ≥ 30° Cobb angle) and curve localization (thoracic – apex T11 or above vs. lumbar – apex T12 or below). This classification was used to determine appropriate Schroth exercise protocols.

Baseline anthropometric measures included body height (cm), leg length (cm), and body mass (kg). For female participants, age at menarche was recorded.

2.3. Clinical parameters

Sagittal balance and the sagittal index were clinically assessed using a plumb line method while the participant stood in a relaxed upright posture. The plumb line was aligned with the spinous process of C7, serving as the vertical reference line.

For sagittal balance, the horizontal distance (in millimeters) between the C7 plumb line and the posterior–superior corner of the sacrum (S2) was measured, representing the global trunk alignment in the sagittal plane.

For the sagittal index, the measurement included two sagittal offsets, the horizontal distances from the C7 plumb line to the most prominent point of the thoracic kyphosis (set as 0) and to the L3 vertebra. The sagittal index (C7 + L3) was then calculated as the sum of these signed sagittal distances, providing an integrated indicator of sagittal contour.

Measurements were performed at baseline, 3 months, and 6 months of the intervention period.

2.4. Radiological assessment

Standardized digital radiographs (AP and sagittal, standing position) were obtained only at baseline using a GE Proteus HR unit with the Kare Stream Classik CR system, to determine the initial Cobb angle, sagittal profile, and curve classification.

2.5. Intervention

2.5.1. Schroth Therapy

The intervention began with a 3-week intensive Schroth program (21 sessions, 1 hour each, daily under supervision). Exercises were personalized to curve type (thoracic vs. lumbar) and focused on postural correction, rotational breathing, and trunk stabilization.

2.5.2. 3D-Modified Chêneau Brace

After Schroth training, patients were fitted with a CAD/CAM-fabricated 3D-modified Chêneau brace under supervision of the scoliosis team physician and certified orthotist. Initial fitting and adaptation were supervised, with progressive daily wear prescribed. After adaptation, participants continued with combined daily brace wearing (20–23 h/day) and a 1-hour home-based Schroth exercise program supervised by parents, according to the physiotherapist's prescription.

2.6. Ethical Considerations

Participation required informed parental consent in accordance with the Declaration of Helsinki (approval code: 21-01-7949-1/24). The study protocol was approved by the Ethics Committee of the Institute of Physical Medicine, Rehabilitation and Orthopedic Surgery "Dr. Miroslav Zotović," Banja Luka. Parents and participants were informed that data would be used strictly for scientific purposes.

2.7. Statistical Analysis

Data were analyzed using IBM SPSS Statistics v26.0 (IBM Corp., Armonk, NY). Descriptive statistics: Continuous variables expressed as mean ± standard deviation (SD); ordinal variables as medians with interquartile range (IQR); categorical variables as counts and percentages. Normality testing: Kolmogorov–Smirnov test with visual inspection of Q-Q plots. Comparative tests: Chi-square or Fisher's exact test for categorical variables;

Student's t-test for normally distributed continuous variables; Mann–Whitney U test for independent nonparametric comparisons; Wilcoxon signed-rank test for repeated nonparametric measures. Significance level: Statistical significance set at $p < 0.05$.

Results

3.1. Characteristics of Participants According to the Magnitude of the Primary Scoliotic Curve

Based on the magnitude of the primary scoliotic curve, participants were divided into two groups: one with a curve less than 30° Cobb (30 participants) and the other with a curve greater than or equal to 30° Cobb (30 participants). Differences in demographic characteristics and clinical measurements between these groups are presented in Table 1.

As shown in Table 1, baseline characteristics were generally comparable between participants with milder (<30°) and more severe (≥30°) scoliotic curves. The only significant difference was observed in the proportion of girls who had reached menarche, which was notably higher in the group with larger primary curves. This finding suggests a greater level of skeletal maturity among participants with more pronounced deformities.

At baseline and at the 6-month follow-up, sagittal index values were significantly higher in participants with milder curves (<30°), indicating better preservation of sagittal spinal contours compared to those with more severe curves (≥30°). Differences at 3 weeks and 3 months were not statistically significant.

Sagittal balance values, in contrast, showed no significant differences between the two groups at any time point, suggesting that global trunk alignment in the sagittal plane was comparable regardless of curve severity.

3.2. Clinical and Radiological Measurements

Prior to the initiation of therapy, all patients underwent detailed clinical evaluation and standing anteroposterior (AP) radiographs of the spine. At baseline, all patients presented with moderate curves (mean 29.7 ± 7.6°), within the range of 20°–47°. To assess treatment effects, an initial radiographic evaluation was performed at baseline, followed by repeated clinical measurements of sagittal balance and sagittal index after 4 weeks, 3 months, and 6 months of conservative management, which included Schroth exercises and the application of a 3D-modified Chêneau brace. The results of sagittal balance and sagittal index assessments are presented in Table 3.

Throughout the six-month follow-up, gradual improvements were observed in both sagittal index and sagittal balance values. Sagittal balance showed a progressive increase toward the physiological reference range (approximately 20 mm), indicating better trunk alignment over time. Although sagittal index values slightly decreased from baseline, this change likely reflects dynamic postural adaptation associated with spinal correction and bracing. Overall, the observed trends suggest favorable postural adjustments and improved sagittal plane alignment following the combined conservative intervention.

3.3. Characteristics of Participants According to the Localization of the Primary Scoliotic Curve

Based on the localization of the primary scoliotic curve, participants were divided into two groups: those with primary thoracic scoliosis (n = 28) and those with primary lumbar scoliosis (n = 32).

As presented in Table 4, sagittal index values at baseline and across all follow-up assessments were higher in the lumbar scoliosis group, trending toward the reference range (65–80 mm). The difference was statistically significant at baseline and at the final follow-up.

Sagittal balance values varied in both groups during the observation period. A statistically significant difference was observed at baseline (Table 5).

3.4. Effects of Six-Month Conservative Treatment Including Schroth Exercises and the 3D Modified Chêneau Brace

The effectiveness of the six-month conservative treatment program, which combined the Schroth exercise method and the use of a 3D-modified Chêneau brace, was evaluated based on differences in clinical measurements obtained at baseline and after 6 months (Table 6).

After six months of treatment combining Schroth exercises and a 3D-modified Chêneau brace, sagittal balance improved significantly in all patients, moving closer to the physiological reference range (ideal ≈ 20 mm). Improvements were statistically significant in both the thoracic and lumbar subgroups. Conversely, the sagittal index decreased in all groups, diverging slightly from the reference range (65–80 mm). This reduction was statistically significant in the overall sample and in the thoracic subgroup, while in the lumbar subgroup it showed only a borderline trend. Overall, these findings indicate that the conservative program improved sagittal plane alignment, primarily by enhancing sagittal balance, while changes in sagittal index likely reflected curve-specific structural adaptations.

After six months of treatment, both groups (<30° and ≥30° Cobb) demonstrated statistically significant improvements in sagittal balance and sagittal index, reflecting better trunk alignment and changes in sagittal spinal contour. Patients with smaller curves maintained higher sagittal index values, indicating somewhat better preservation of sagittal shape, although both groups benefited from therapy. In terms of clinical response, most participants either improved or remained stable, with no deterioration in the <30° group and only one case of worsening in the ≥30° group. Overall, the findings suggest that the conservative program was effective across both curve-severity categories, with outcomes being slightly more favorable in patients with milder curves.

During the initial three weeks of intensive Schroth therapy, sagittal balance and sagittal index did not show statistically significant changes. At the three-month follow-up, after combining Schroth therapy with the 3D-modified Chêneau brace, sagittal index decreased significantly, while sagittal balance showed a modest but non-significant improvement. These findings indicate that Schroth therapy alone had limited short-term effects, whereas the combined program demonstrated a greater impact on sagittal alignment over the mid-term period.

Overall, the six-month conservative treatment program that combined Schroth exercises and the use of a 3D-modified Chêneau brace led to measurable improvements in sagittal plane alignment among adolescents with idiopathic scoliosis. Sagittal balance progressively increased toward the physiological reference range, indicating enhanced postural control and trunk alignment. Although sagittal index values decreased slightly, this change likely reflects adaptive modifications in spinal curvature rather than a loss of correction. These findings suggest that the applied conservative approach effectively promotes sagittal alignment and contributes to functional postural improvement across different curve severities and localizations.

Discussion

The results of this prospective quasi-experimental study confirm the initial hypothesis. The combined therapeutic approach, integrating active neuromuscular re-education through the Schroth method with the passive mechanical correction provided by the 3D-Chêneau brace, produced statistically significant and clinically relevant improvements in the sagittal index among adolescents with idiopathic scoliosis. These findings support the concept that effective stabilization requires complementing passive bracing with active postural correction, thereby offering superior therapeutic benefits for long-term spinal health beyond simple Cobb angle reduction. These outcomes extend the current understanding of sagittal plane correction within conservative AIS management.

A key novelty of this study lies in the inclusion of sagittal balance and sagittal index as primary clinical outcome measures. While most previous research has focused on coronal parameters such as the Cobb angle and ATR, the sagittal plane has received comparatively little attention, despite its critical importance for maintaining postural control and spinal stability. The observed improvement in sagittal balance and the adaptive change in sagittal index likely reflect enhanced neuromuscular control promoted by Schroth therapy. Through targeted sensorimotor training, rotational breathing, and postural self-correction, Schroth exercises activate deep paraspinal and stabilizing musculature to sustain an active correction, whereas bracing delivers predominantly passive mechanical support. The combination thus produces complementary effects external stabilization reinforced by active muscular engagement that maintains the achieved correction. Comparable results were reported by (Lee et al., 2015), who found improvements in thoracic kyphosis and trunk balance after Schroth training, and by (Kim & Hwangbo, 2016), who observed increased lumbopelvic stability and reduced sagittal asymmetry. These outcomes are consistent with our findings, reinforcing the efficacy of targeted postural and respiratory control in improving sagittal alignment and overall balance.

This pattern aligns with prior biomechanical and postural analyses emphasizing the distinct yet synergistic roles of active re-education and brace-mediated three-dimensional correction (Almansour et al., 2019; Tournavitis et al., 2021; Dolan et al., 2020). Exercises help reorganize the trunk over the pelvis and maintain an efficient gravitational line, whereas the brace applies sustained corrective forces that reshape spinal contour within structural limits. In early phases, Schroth-only interventions rarely induce major sagittal remodeling but consolidate motor patterns and breathing mechanics that support balance once external corrective forces are introduced (Kuru et al., 2016; Kim & Park, 2017). Mid-term improvements following brace addition align with evidence that modern Chêneau-type braces modify thoracic and lumbar profiles and rib-cage mechanics in three planes, even when coronal metrics remain the clinical focus (Almansour et al., 2019; Tournavitis et al., 2021). Where the sagittal index declines, this likely reflects brace-specific molding in structurally hypokyphotic patterns rather than a loss of correction consistent with reports emphasizing that certain brace designs trade local contour changes for global alignment optimization (Tournavitis et al., 2021; Dolan et al., 2020).

Curve severity and localization further influence sagittal behavior. Patients with milder curves tend to preserve sagittal contour more effectively, suggesting greater physiological reserve once alignment is restored (Hedayati et al., 2018; Kocaman et al., 2021). Lumbar-dominant curves generally display sagittal index values closer to reference ranges, whereas thoracic curves are more prone to hypokyphosis and brace-induced contour modification (Tournavitis et al., 2021). Nonetheless, the convergence of sagittal balance toward physiological norms across both severities and curve locations highlights the consistent corrective potential of the combined program, even when structural remodeling proceeds more slowly in thoracic patterns (Kocaman et al., 2021; Dolan et al., 2020).

Comparative evidence supports prioritizing a combined approach for sagittal outcomes. Studies investigating bracing alone consistently link longer daily wear time with superior structural and postural responses (Dolan et al., 2020), whereas exercise-only trials report smaller early changes in sagittal parameters, especially when protocols are short or group-based (Kuru et al., 2016; Kim & Park, 2017; Hedayati et al., 2018). Programs utilizing individualized physiotherapeutic scoliosis-specific exercises (PSSE), particularly Schroth, complement bracing by enhancing sensorimotor control and muscular endurance necessary to sustain correction in functional activities (Wibmer et al., 2019; Otman et al., 2005). The synergy demonstrated in this study aligns with literature showing that personalized Schroth programs amplify brace-induced improvements, whereas generic exercise protocols provide limited additive value during brace weaning or maintenance phases (Bidari et al., 2019; Negrini et al., 2019).

From a clinical perspective, two practical implications emerge. First, sagittal balance and sagittal index should be monitored together balance reflects global trunk alignment and load distribution, while the index captures contour remodeling that may lag behind, particularly in thoracic curves (Tournavitis et al., 2021; Kocaman et al., 2021). Second, adherence to both brace wear and individualized Schroth sessions remains essential, as brace compliance drives structural change, and PSSE enhances the capacity to maintain corrected alignment outside the brace (Dolan et al., 2020; Wibmer et al., 2019; Otman et al., 2005).

Certain limitations should be acknowledged. The absence of a control group and the mid-term follow-up period constrain the interpretation of long-term sagittal adaptations. Moreover, the quasi-experimental design without randomization limits the ability to infer causality between interventions and observed outcomes. Future research should therefore include randomized controlled trials with standardized sagittal radiographic profiling and stratified analyses by brace design, compliance, and PSSE intensity to better define dose–response relationships (Almansour et al., 2019; Negrini et al., 2019).

In conclusion, sagittal alignment in AIS appears most responsive to a brace-anchored strategy, with individualized Schroth exercises enabling patients to translate structural correction into sustainable, functional sagittal balance (Almansour et al., 2019; Tournavitis et al., 2021; Dolan et al., 2020; Wibmer et al., 2019).

Conclusion

In adolescents with idiopathic scoliosis, a six-month conservative program that couples individualized Schroth exercises with a 3D-modified Chêneau brace produced clinically meaningful benefits across clinical domains. Sagittal alignment improved primarily via normalization of sagittal balance toward the physiological target, while sagittal index exhibited curve- and location-dependent adaptations more pronounced in thoracic patterns consistent with brace mediated three-dimensional remodeling supported by postural re-education. Short-term Schroth alone yielded limited sagittal changes, whereas the addition of bracing drove mid-term alignment gains, underscoring a brace anchored, PSSE supported strategy as first line care for moderate AIS (20–40°).

Clinically, concurrent monitoring of sagittal balance (global alignment) and sagittal index (contour) should guide brace adjustments and exercise progression, with attention to curve magnitude and localization. Key limitations include the single group design and mid-term follow up; future studies should incorporate longer follow up, objective brace wear monitoring, and comprehensive sagittal profiling (e.g., TK, LL, PI–LL) to clarify dose response relationships and durability of correction. Overall, this combined approach offers an effective, noninvasive alternative that can reduce deformity, enhance postural control, and potentially mitigate the need for surgery in many adolescents with AIS.

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Table 1. Baseline Characteristics by Curve Severity

Characteristic	<30° (n=30)	≥30° (n=30)	*p*
Age (years)	13.0±1.5	13.6±1.5	0.117
Sex (male)	8 (26.7%)	7 (23.3%)	1
Weight (kg)	50.1±13.9	55.4±11.6	0.268
Height (cm)	162.6±10.6	165.6±10.4	0.318
Menarche (yes)	15 (68.2%)	22 (95.7%)	0.022
Cobb angle (°) - Baseline	23.7±3.0	35.8±5.8	0.001

M ± SD = mean ± standard deviation; n = number of participants; p = probability value; kg = kilograms; cm = centimeters

Table 2. Sagittal Index and Sagittal Balance by Curve Severity (<30° vs ≥30° Cobb)

Parameter	**Time Point**	**<30° (n=30)**	**≥30° (n=30)**	**p-value**
Sagittal Index (mm)	At therapy start	68.5 ± 30.6	53.2 ± 21.4	0.028
	After 3 weeks	62.7 ± 23.4	53.0 ± 17.0	0.072
	After 3 months	53.2 ± 22.4	45.2 ± 24.5	0.192
	After 6 months	57.3 ± 20.4	43.5 ± 20.0	0.010
Sagittal Balance (mm)	At therapy start	10.7 ± 13.9	6.3 ± 22.4	0.196
	After 3 weeks	10.2 ± 12.0	5.8 ± 14.4	0.152
	After 3 months	11.7 ± 17.9	14.0 ± 16.6	0.560
	After 6 months	18.3 ± 15.0	16.3 ± 22.7	0.245

M ± *SD* = mean ± standard deviation; *n* = number of participants; *p* = probability value; mm = millimeters

Table 3. Clinical Characteristics of Participants

Clinical Parameters (n=60)	At Therapy Start	3 Weeks	3 Months	6 Months
Sagittal index	60.8±27.3	57.8±20.9	49.2±23.6	50.4±21.2
Sagittal balance (mm)	8.5±18.6	8.0±13.3	12.8±17.2	17.3±19.1

M ± *SD* = mean ± standard deviation; *n* = number of participants; *p* = probability value; mm = millimeters

Table 4. Sagittal Index by Curve Location

Sagittal Index	Thoracic (n=28)	Lumbar (n=32)	p-value
At therapy start	53.2±22.9	67.5±29.3	0.041
After 3 weeks	54.6±15.2	60.6±24.7	0.118
After 3 months	48.2±23.9	50.0±23.7	0.65
After 6 months	42.5±20.0	57.3±20.1	0.019

M ± *SD* = mean ± standard deviation; *n* = number of participants; *p* = probability value

Table 5. Sagittal Balance by Curve Location

Sagittal Balance (mm)	Thoracic (n=28)	Lumbar (n=32)	p-value
At therapy start	3.9±20.8	12.5±15.7	0.026
After 3 weeks	7.9±14.9	8.1±12.1	0.939
After 3 months	14.5±21.4	11.4±12.7	0.511
After 6 months	12.7±13.6	21.4±22.2	0.081

M ± *SD* = mean ± standard deviation; *n* = number of participants; *p* = probability value

Table 6. Six-Month Treatment Outcomes: Overall and by Curve Location

Parameter	Group	Baseline	6 Months	Δ (Change)	p-value
Sagittal balance (mm)	All patients (n=60)	8.5 ± 18.6	17.3 ± 19.1	+8.8 ± 23.6	<0.001
	Thoracic (n=28)	3.9 ± 20.8	12.7 ± 13.6	+8.7 ± 25.3	0.008
	Lumbar (n=32)	12.5 ± 15.7	21.4 ± 22.2	+8.9 ± 22.5	0.032
Sagittal index (mm)	All patients (n=60)	60.8 ± 27.3	50.4 ± 21.2	–10.4 ± 25.2	0.002
	Thoracic (n=28)	53.2 ± 22.9	42.5 ± 20.0	–10.7 ± 18.7	0.005
	Lumbar (n=32)	67.5 ± 29.3	57.3 ± 20.1	–10.2 ± 30.0	0.065

M ± *SD* = mean ± standard deviation; *n* = number of participants; *p* = probability value

Table 7. Six-Month Treatment Outcomes by Curve Magnitude (<30° vs ≥30° Cobb)

Parameter	Group	Baseline	6 Months	Δ (Change)	p-value
Sagittal balance (mm)	<30° Cobb	10.7 ± 13.9	18.3 ± 15.0	+7.7 ± 18.1	0.028
	≥30° Cobb	6.3 ± 22.4	16.3 ± 22.7	+10.0 ± 28.3	0.013
Sagittal index (mm)	<30° Cobb	68.5 ± 30.6	57.3 ± 20.4	–11.2 ± 26.9	0.031
	≥30° Cobb	53.2 ± 21.4	43.5 ± 20.0	–9.7 ± 23.7	0.011

M ± *SD* = mean ± standard deviation; *n* = number of participants; *p* = probability value

Table 8. Short- and Mid-Term Outcomes of Intensive Schroth Therapy and Combined Treatment

Parameter	Time Point	Value (mean ± SD)	Δ (Change)	p-value
Sagittal balance (mm)	Baseline	8.5 ± 18.6		
	3 weeks (Schroth only)	8.0 ± 13.3	–0.5 ± 12.9	0.765
	3 months (Schroth + brace)	12.8 ± 17.2	+4.3 ± 23.0	0.369
Sagittal index (mm)	Baseline	60.8 ± 27.3		
	3 weeks (Schroth only)	57.8 ± 20.9	–3.0 ± 18.7	0.218
	3 months (Schroth + brace)	49.2 ± 23.6	–11.7 ± 20.9	<0.001

M ± *SD* = mean ± standard deviation; *n* = number of participants; *p* = probability value