

## Effective treatment of adolescent idiopathic scoliosis with the PosturalSpine® D'Amanti method and Chêneau brace. A pediatric patient case report demonstrating postural and orthotic synergy

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### Abstract

Adolescent Idiopathic Scoliosis (AIS) is a three-dimensional spinal deformity that, if untreated, can impair posture, biomechanics, and quality of life. This case report aims to present the clinical outcomes of an innovative conservative treatment approach that combines the PosturalSpine® D'Amanti Method with the Chêneau brace, in an 8-year-old patient with thoracolumbar rotoscoliosis. This integrative method may represent a novel alternative to conventional bracing or physiotherapy-only protocols. An 8-year-old girl diagnosed with a 32° thoracolumbar rotoscoliosis likely of hereditary origin underwent a 36-month treatment program at Studio Kinesis in Ragusa. The intervention combined a Chêneau brace with the PosturalSpine® D'Amanti Method, which includes proprioceptive and biomechanical exercises. The protocol involved eight 30-minute sessions per month, focusing on spinal alignment, posture, breathing, and body awareness. Radiographic evaluations were conducted at baseline and 10<sup>th</sup>, 24<sup>th</sup>, and 35<sup>th</sup> months. The Cobb angle improved from 32° to 12°, with the most notable reduction occurring within the first 12 months. A slight increase was observed, which may correspond with a 12.5 cm growth spurt, suggesting the influence of rapid growth on treatment outcomes. The integration of PosturalSpine® D'Amanti Method with the Chêneau brace showed encouraging results in reducing spinal curvature and enhancing postural alignment with a noticeable reduction of rib hump in a pediatric patient. This case highlights the potential of combining kinesiotherapy and bracing in scoliosis management. However, broader studies are necessary to validate these findings and optimize protocols for long-term care, particularly during growth phases.

**Key Words:** PosturalSpine®, adolescent idiopathic scoliosis, posturology.

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Scoliosis is a complex, three-dimensional deformity of the spine, characterized by a lateral curvature and vertebral rotation that affect all three anatomical planes: frontal, coronal, and sagittal.<sup>1</sup> The most prevalent form is Adolescent Idiopathic Scoliosis (AIS), which occurs in approximately 0.47% to 5.20% of the population. It is diagnosed when the Cobb angle, measured on spinal radiographs, exceeds 10° – the standard threshold for clinical significance.<sup>2,3</sup> According to the Italian Society of Scoliosis, periodic radiographic monitoring is essential to assess progression and to guide therapeutic decisions.<sup>4</sup>

AIS shows a substantial gender disparity, with a female-to-male ratio ranging from 3:1 to 5:1, and it often worsens during growth spurts.<sup>5</sup> The condition's etiology is multifactorial, involving both genetic predisposition and environmental influences, which may contribute to its progression and impact on patients' quality of life.<sup>6</sup> Clinically, patients may present with visible postural asymmetries, such as shoulder elevation, chest wall deformities, and trunk shifts, although milder curves can remain asymptomatic.<sup>7,8</sup> Skeletal maturity, a critical parameter for treatment plan-

ning, is commonly assessed using the Risser index, in conjunction with physiological markers such as menarche onset.<sup>9,10</sup>

Treatment options are stratified based on curve severity and skeletal maturity: i) Observation for curves  $<10^\circ$ , regardless of maturity; ii) Orthopedic-Kinesiological Management — combining bracing and physiotherapy — for curves between  $10^\circ$  and  $45^\circ$  in skeletally immature individuals (Risser  $<3$ ); iii) Surgical intervention for curves  $>45^\circ$  in immature skeletons, or slightly larger curves if maturity (Risser  $\geq 3$ ) has been reached.<sup>11,12</sup>

Kinesitherapy, particularly Physiotherapy Scoliosis-Specific Exercises (PSSE), plays a central role in conservative treatment. These protocols involve active mobilization (derotation), targeted breathing techniques, and neuromuscular re-education to stabilize the corrected posture and potentially reduce curve progression with an improvement of cosmetic appearance.<sup>13,14</sup>

PosturalSpine® D'Amanti Method is an innovative approach that integrates three-dimensional self-correction, self-awareness, reinforcement, and maintenance under proprioceptive stimulation, and anti-gravity techniques using a specialized therapeutic bench.<sup>15</sup> The system is designed to optimize patient engagement and therapeutic efficiency by allowing precise, individualized postural adjustments. Preliminary studies conducted at the Biomechanics Laboratory of the University of Palermo suggest its potential for improved outcomes in both alignment and functional recovery.

This case report aims to detail the clinical presentation, management, and outcomes of an 8-year-old patient with idiopathic scoliosis treated with a combined and innovative approach integrating PosturalSpine® D'Amanti Method and full-time Chêneau bracing. The purpose is to explore the potential benefits of merging biomechanical bracing with proprioceptive-based kinesitherapy as a non-surgical alternative.

### Case Report

#### Initial diagnosis and family history

In November 2021, an 8-year-old female (W 24 kg, H 131 cm, Risser index 0) with a pertinent family history of idiopathic scoliosis underwent an orthopedic evaluation, which exhibited a right rib hump of 20 mm. At radiographic evaluation, she had a  $32^\circ$  thoracolumbar rotoscoliosis (T5-L3). The patient did not complain of pain, and she had a sedentary lifestyle.

The research involving human participants complied with all relevant national regulations and institutional policies, and was in accordance with the tenets of the Helsinki Declaration. It has been approved by the authors' institutional review boards or equivalent committees. The study design was approved by the Departmental Research Committee (approval no. UKE-IRBPSY-12.11.23).

#### Corrective treatment and rehabilitation

In March 2022, the child began corrective treatment at Studio Kinesis in Ragusa, Italy. The rehabilitation program included specific exercises for the correction of scoliosis, wearing the Chêneau brace, on an innovative device called PosturalSpine® (Figure 1). This device, which Prof. Carmelo D'Amanti patented, is designed to facilitate the targeted correction of scoliosis through specialized movements, adapted to individual needs (Figure 2).

#### Procedure

PosturalSpine® was the only tool used. It is defined as a "Portable multisensory postural gym" and was created to accelerate postural recovery. The principles of kinesiological work with PosturalSpine® are body awareness, breathing, self-stretching, stretching of muscle chains, proprioception, translation, decompression, correction, strengthening, maintenance, and verticalization. PosturalSpine® allows the user to take advantage of its multisensory,



**Figure 1.** PosturalSpine® bench. a) Anti-gravity pillow; b) PosturalSpine® bench: Using the arms with the button, one can adjust the oscillations to personal preferences; c) Full PosturalSpine® bench.

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biomechanical, and proprioceptive features (Figure 1). The carefully calibrated angular oscillation, the central loop, the anti-gravity cushion, and the double mirror structure induce the correction of scoliosis.<sup>16</sup>

The child wore a full-time Chêneau brace throughout the treatment and during daily life activities.

The work protocol lasted 36 months (31 months of actual work and 5 months of summer break) with 8 sessions per month lasting 30 minutes. During the session, the patient worked alone with the physiotherapist or at most in a small group of four patients. Each exercise lasted from 5 to 10 minutes.

The rehabilitation protocol was divided into five phases, each consisting of approximately 16 sessions. In the first phase, the focus was primarily on raising awareness of the disharmony in both static and dynamic postures. During the second, third, and fourth phases, correction exercises were introduced, incorporating more challenging angular oscillations to promote derotation and translation. In the last phase, the focus was on stabilization exercises, which were performed in the corrected posture, emphasizing isometric contractions. The exercise protocols were adapted every 12 sessions to maintain motivation, ensure adherence, and monitor the progression of the treatment.

### Measurements

Four erect anteroposterior spine X-rays were taken at baseline and 10<sup>th</sup>, 24<sup>th</sup>, and 35<sup>th</sup> months to measure the thoracolumbar Cobb angle (Figure 3).

### Results

At the 35-month follow-up, the patient exhibited a 15 mm reduction in the rib hump. The radiography control showed a significant improvement in the right thoracolumbar Cobb angle, which improved from 32° to 12° (Figure 4).

In particular, at the 12<sup>th</sup> month, the thoracolumbar Cobb angle was even lower (7°). These findings should be correlated with changes in the patient's anthropometric measurements (Table 1).

### Discussion

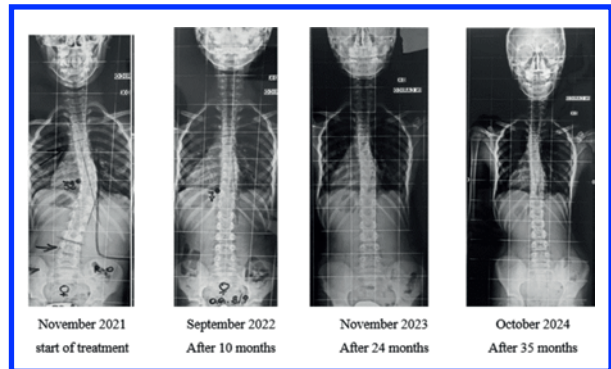
The results obtained with the PosturalSpine® D'Amanti method combined with the Chêneau brace demonstrated a significant improvement in the correction of scoliosis in a pediatric patient. Over a 35-month treatment period, the Cobb angle decreased from 32° to 12°, indicating substantial spinal realignment and enhanced postural control. The most notable radiographic progress occurred during the first 12 months, showing a decrease of Cobb angle from 32° to 7°. However, during the following 24 months, a mild increase in the Cobb angle was noticed. It coincided with a 12.5 cm growth spurt.

As suggested by Duval-Baupèere's law, the evolution of the scoliotic curve is the greatest during puberty. Therefore, the onset of puberty is known to amplify the risk of curve progression, reinforcing the need for close monitoring and individualized therapeutic strategies.<sup>17,18</sup> This

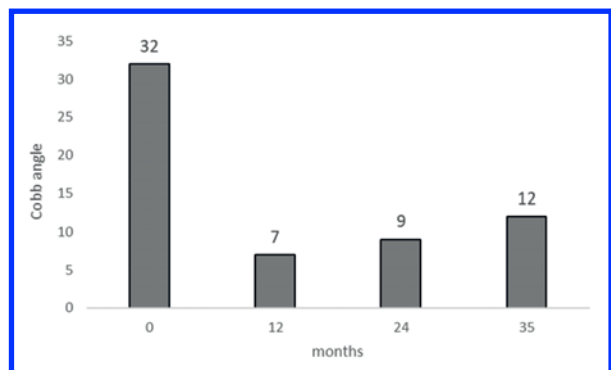
highlights the need for flexible treatment protocols, especially during pubertal growth, when scoliosis progression tends to accelerate.<sup>19</sup>



**Figure 2.** Case study while performing exercises on PosturalSpine®.



**Figure 3.** Periodic radiographic evaluations.



**Figure 4.** Cobb angle progression at 12, 24, and 35 months.

**Table 1.** Anthropometric values during the control x-rays.

X-rays	Age (years/months)	Risser index	Weight (kg)	Height (cm)
1 <sup>st</sup> (November 2021)	8	0	24	128
2 <sup>nd</sup> (September 2022)	8.6	0	24.9	131
3 <sup>rd</sup> (November 2023)	8.10	0	25.7	133.5
4 <sup>th</sup> (October 2024)	10	0	30	143

In this context, recent evidence also emphasizes the importance of maintaining adequate nutritional status and balanced physical activity to support bone metabolism and overall musculoskeletal health, particularly during periods of rapid growth and physiological stress such as puberty.<sup>20</sup> As defined by the Scoliosis Research Society (SRS), therapeutic success in bracing is achieved when a reduction of 5 or more degrees in the Cobb angle is observed at the end of treatment, compared to the initial value. Comparing our results with SRS criteria, it is evident that this interesting case demonstrates a significant improvement, with a reduction of 20 degrees. However, it should be noted that the treatment cannot yet be considered complete, as the latest radiograph indicates a Risser sign of 0.<sup>16</sup>

The integration of the Chêneau brace with the innovative PosturalSpine<sup>®</sup> device adheres to the principles of Physiotherapeutic Scoliosis-Specific Exercises (PSSE), including three-dimensional autocorrection, active stabilization through intensive symmetrical activation of all stabilizing muscles, neuromotor control, proprioceptive training, balance reactions, and corrective breathing techniques. According to the 2016 SOSORT guidelines, the combined approach of PSSE and bracing is supported by Level II evidence and a Grade B strength of recommendation.<sup>14</sup>

Thus, PosturalSpine<sup>®</sup> was central to the intervention, enabling the integration of multisensory inputs, proprioceptive training, and biomechanical corrections. Its anti-gravity cushion, adjustable support system, and double-structure design encouraged adherence and conscious postural adjustments, promoting effective spinal alignment.

The active involvement of the entire rehabilitation team, including the physician (orthopedist or physiatrist), orthotist, physiotherapist, and, importantly, the patient and their family, is crucial for achieving significant improvements in outcomes for idiopathic scoliosis.

Compared to the other conventional approaches, this method appears to yield quicker outcomes.<sup>21</sup> The combination of dynamic, targeted exercises with structured bracing support offers a promising alternative in non-surgical scoliosis care.

Nonetheless, as this is a single-case observation, broader clinical research is needed to confirm the overall effectiveness and reproducibility of the method. Continuous monitoring during adolescence remains crucial to prevent relapse and maintain postural improvements over time.<sup>22</sup>

### Conclusions

The present case report revealed that combining exercises on PosturalSpine<sup>®</sup> with the use of the Chêneau brace offers a promising and innovative approach to scoliosis treatment in children. Full adherence was achieved through an appropriate adaptation of the exercise protocol and the employment of PosturalSpine<sup>®</sup>. However, further follow-up evaluations must be carried out, especially 1-2 years after the completion of skeletal maturity, to assess the sustained correction.

Integrating advanced biomechanical technologies with traditional rehabilitation methods provides a robust strategy to achieve significant improvements in idiopathic scoliosis outcomes.

### Limitations

This case report has several limitations that should be acknowledged. First, it describes a single patient, which limits the generalizability of the findings. Second, no control group was used to compare outcomes against standard physiotherapy or bracing alone. Third, compliance with the home-based aspects of treatment, including full-time brace use, may vary and was not objectively measured. Future studies, preferably prospective and randomized, are needed to validate these preliminary findings and determine the reproducibility of the results in a broader population.

### Contributions

ADA, CDA, conceptualization; , DKN, CDA, and GM, methodology; FC and RN, formal analysis; FC and LC, data curation; FC and ADA, writing—original draft preparation; ADA and FC, writing—review and editing; EP and GM, supervision. All authors have read and agreed to the published version of the manuscript.

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## Conflicts of interest

The authors declare no conflicts of interest.

## Ethics approval

The study was conducted in accordance with the Declaration of Helsinki and the recommendations of the Ethical Code of the University of Palermo. The Code of Ethics was approved by the General Assembly of the Italian Association of Psychology on 27 March 2015. The study design obtained ethical permission from the University Enna Kore Internal Committee for research (approval no. UKE-IRBPSY-12.11.23).

## Informed consent

Informed consent was obtained from all subjects involved in the study.

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