

# Literature Review of Studies on the Diagnosis and Treatment of Adolescent Idiopathic Scoliosis (AIS)

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**Abstract:** *This comprehensive review explores Adolescent Idiopathic Scoliosis AIS, a condition prevalent in 2-4 of adolescents aged 10-18, characterized by an abnormal spinal curvature. It delves into the pathogenesis, clinical features, and treatment options of AIS, highlighting genetic influences, sex hormone roles, and bone density factors. The review discusses the relative anterior spinal overgrowth concept, supported by anatomical and MRI studies. It also covers the physical manifestations of AIS, such as uneven shoulders and waistlines, and the right-sided spine curvature bias. Treatment perspectives include the effectiveness of consistent brace wearing and surgical interventions like spinal fusion and vertebral body tethering. Additionally, the review examines conservative treatments like the Schroth Method and core stabilization exercises, their impact on spinal curvature and quality of life, and the role of manual therapies. It concludes with an analysis of curve progression predictors, emphasizing the importance of Cobb angle, curve flexibility, and other morphological factors in AIS management.*

**Keywords:** Adolescent Idiopathic Scoliosis, Pathogenesis, Conservative Treatment, Spinal Curvature, Curve Progression

Adolescent Idiopathic Scoliosis (AIS) is a common type of scoliosis that occurs in adolescents during their growth spurt, typically between the ages of 10 and 18. It affects about 2-4% of adolescents. "Idiopathic" means that the cause of the condition is unknown. AIS is characterized by an abnormal sideways curvature of the spine, in an "S" or "C" shape and is substantiated with a Cobb Angle of 10 degrees.

Addai et.al, (2020) conducted a comprehensive review literature surrounding the possible pathogenesis of AIS, its clinical features, investigations, surgical management options, in the treatment of AIS. Their research shows that genetics plays a significant role in the increased risk of developing AIS in people who have first degree relatives affected by AIS, higher prevalence in women than men during puberty, suggesting a role of sex hormones in the disease, calmodulin, melatonin, vitamin D and low bone mineral density. The authors emphasize that the recognition of the anterior lengthening of the thoracic spine compared to its posterior counterpart in patients with Adolescent Idiopathic Scoliosis (AIS), referred to as relative anterior spinal overgrowth (RASO) or uncoupled neuro-osseous growth, has been substantiated by numerous anatomical and MRI studies, they cite. One of them investigated the origins of the anterior-posterior length discrepancy, revealing that it results from both anterior and posterior column shortening. While the vertebrae contribute to this length disparity, the primary factor is the heightened height of the anterior intervertebral discs. Similarly, they provide literature evidence that AIS patients show a curved back, shoulders at different heights, uneven waistline, and a noticeable bump on the ribs, typically not accompanied by pain. Most cases of AIS involve the spine curving more to the right side. So, if someone has an unusual scoliosis curve, a curve that's getting worse quickly, or signs of neurological problems, it's a good reason to check for a potential underlying issue. Regarding surgical choices, positive outcomes are observed in patients who consistently wear braces for at least 18 hours daily. Surgery becomes a consideration for those with curves

exceeding 40°. While spinal fusion remains the conventional and widely employed approach, there is potential in vertebral body tethering, an innovative technique that enables adolescents to preserve their range of motion (Addai, 2020).

A randomized controlled trial from Turkey (Kocaman et al., 2021) studied 28 subjects with adolescent idiopathic scoliosis and mild curve magnitudes (10°-26°) were randomly assigned to two groups: the Schroth group and core group.

The Schroth Method is a conservative, exercise-based approach to managing and treating scoliosis. It was developed by Katharina Schroth in the 1920s and further developed by her daughter, Christa Lehnert-Schroth. The method aims to improve posture, reduce spinal curvature, and enhance overall function in individuals with scoliosis.

The Schroth group received supervised Schroth exercises, while the core group underwent supervised core stabilization exercises. Both groups performed exercises three days a week for 10 weeks, along with additional traditional exercises. Evaluation parameters included Cobb angle, trunk rotation, cosmetic trunk deformity, spinal mobility, peripheral muscle strength, and quality of life, assessed through various methods such as radiography and Adam's test. They found that patients in the Schroth group showed greater improvement in Cobb angles, thoracic trunk rotation angle, cosmetic trunk deformity, spinal mobility, and quality of life than those in the core group except for in lumbar trunk rotation angle. Peripheral muscle strength improvement was greater in the core group than in the Schroth group.

Another study by Weinstein et al., (2013) examined the effect of bracing in patients with adolescent idiopathic scoliosis, 10 to 15 years old, who are at risk for curve progression with current Cobb angle of 20 to 40 degrees. Participants were assigned into control and bracing group

where patients were instructed to wear the brace, rigid thoracolumbosacral orthosis, at least 18 hours per day. The results showed that bracing significantly decreases the progression of AIS and high-risk curves, with the benefits increasing with longer hours of brace wear (Weinstein et, al., 2013).

Lotan and Kalichman (2019) conducted a literature review of manual therapy treatment for adolescents with idiopathic scoliosis. In the review of fourteen papers focusing on manual therapy treatments for Adolescent Idiopathic Scoliosis (AIS), including manipulation, mobilization, and soft tissue techniques, all case studies demonstrated significant post-treatment improvement in various parameters. However, case reports and small-scale clinical trials yielded mixed results, and a sole randomized controlled trial (RCT) suggested ineffectiveness in improving trunk morphology and spine flexibility in AIS patients. They suggest a potential efficacy of techniques like myofascial release and spinal manipulation when combined with other conservative treatments.

Another review by Wong, et, al, (2022) aimed to assess the evidence regarding the influence of curve type and morphology on the risk of progression in AIS. A thorough search of various databases yielded 26 publications (25 datasets) for review. Strong evidence was found for Cobb angle, curve type, flexibility, and correction rate as predictors of progression. Notably, Cobb angle  $> 25^\circ$  and flexibility  $< 28\%$  were identified as crucial thresholds for clinical prognostication in unbraced patients, while factors such as thoracic curves, apical vertebral rotation, rib morphology, and pelvic tilt showed varying degrees of evidence as predictors.

In conclusion, this review provides a holistic understanding of Adolescent Idiopathic Scoliosis AIS, emphasizing its multifactorial nature encompassing genetic, hormonal, and morphological aspects. The findings from various studies underline the significance of early detection and a tailored approach to treatment, ranging from bracing and surgical options to conservative methods like the Schroth exercises and core stabilization. The role of manual therapies, although promising, requires further research to establish efficacy. Understanding curve progression through parameters like the Cobb angle and curve flexibility is crucial for effective AIS management. Future research should focus on refining treatment protocols and developing predictive models for curve progression, enhancing the quality of life for adolescents affected by AIS

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