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Side Plank Pose Exercises for Adolescent Idiopathic Scoliosis Patients

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Abstract

Background: Fishman et al. reported that side plank poses asymmetrically strengthened the convex side of the curve and decreased primary Cobb angle by 49% among compliant patients with adolescent idiopathic scoliosis (AIS).

Methods: AIS patients with curves of 10° to 45° were randomized into the front plank (control) or side plank group. The side plank was performed with their curve convex down. A weekly survey monitored compliance, defined by completing poses 4 or more times a week.

Results: A total of 64 patients were enrolled; 34% (22 of 64) of patients (mean age = 13 years) were compliant. In the control group, there were 11 compliant patients with 6 undergoing brace treatment. At enrollment, they had a mean Cobb angle of 30° (range: 14°–40°) and mean scoliometer reading of 13°. At 6 months, they had a mean Cobb angle of 30° (range: 14°–42°) and mean scoliometer of 12°. In the side plank group, there were 11 compliant patients with 5 undergoing brace treatment. At enrollment, they had a mean Cobb angle of 32° (range: 21°–44°) and mean scoliometer reading of 12°. At 6 months, they had a mean Cobb angle of 31° (range: 17°–48°) and a mean scoliometer reading of 13°. There were no significant changes in either the control or side plank group in regards to primary Cobb angle (control: $P = .53$, side plank: $P = .67$) or scoliometer (control: $P = .22$, side plank: $P = .45$).

Conclusion: There were no significant changes in primary Cobb angle or scoliometer after 6 months of side plank exercises. In contrast to a prior study, there was no improvement in curve magnitude in AIS patients performing side plank exercises.

Keywords

randomized trial, young adults, intervention

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Introduction

The most common conservative treatment modalities for adolescent idiopathic scoliosis (AIS) include observation, bracing, and exercise.[1–3] Previous studies have reported that bracing helps decrease curve progression in AIS patients.[3–7] Scoliosis-specific exercises (SSE) have also gained acclaim with goals of core strengthening, symptom relief, and preventing curve progression.[8] However, recent literature has shown inconsistencies on the effectiveness of SSE in treating scoliosis.[9]

In 2014, Fishman et al. reported that side plank poses asymmetrically strengthened the convex side of the curve's quadratus lumborum, iliopsoas, transverses abdominus, oblique, intercostal, and paraspinal muscles. By strengthening these muscles, the spine will theoretically bend away from the stronger side and straighten the spine. The authors found a primary curve improvement of 49% in AIS patients who performed the pose for approximately 6 months.[10] With such an impressive improvement, the goal of this study was to replicate this study of exercises in the conservative treatment of

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AIS in a prospectively randomized manner. The purpose of this study is to determine if side plank pose exercises decrease curve magnitude in patients with AIS.

Materials and Methods

After institutional review board approval was obtained, a randomized controlled prospective study was conducted at our institution. AIS patients, who were seen by our pediatric orthopedic spine surgeons, between the ages of 10 to 17 with Cobb angles measuring 10° to 45° on standing anteroposterior radiographs were prospectively enrolled. Each patient provided informed written consent. Patients who reported back pain, had additional injuries to upper and lower extremities, or were unable to perform the exercise due to another injury/diagnosis were excluded. At their initial visit, patients were randomized into the front plank (control) or side plank (experimental) treatment group (Figure 1(A) and (B)). A physical therapist affiliated with our institution demonstrated the proper technique on these planking poses to the research team. After assigning patients their pose, study personnel demonstrated how to correctly carry out the pose to the patient and family. The patient was then asked to demonstrate the pose for the study personnel to ensure accuracy and consistency. Study subjects were then instructed to perform the poses daily and to hold the pose for as long as possible (following the protocol as described by the previous Fishman et al. study). A weekly survey was administered to monitor compliance, completion of poses, and frequency of exercises (Online Appendix 1). Subjects who performed the exercises more than 4 times per week were defined as compliant.

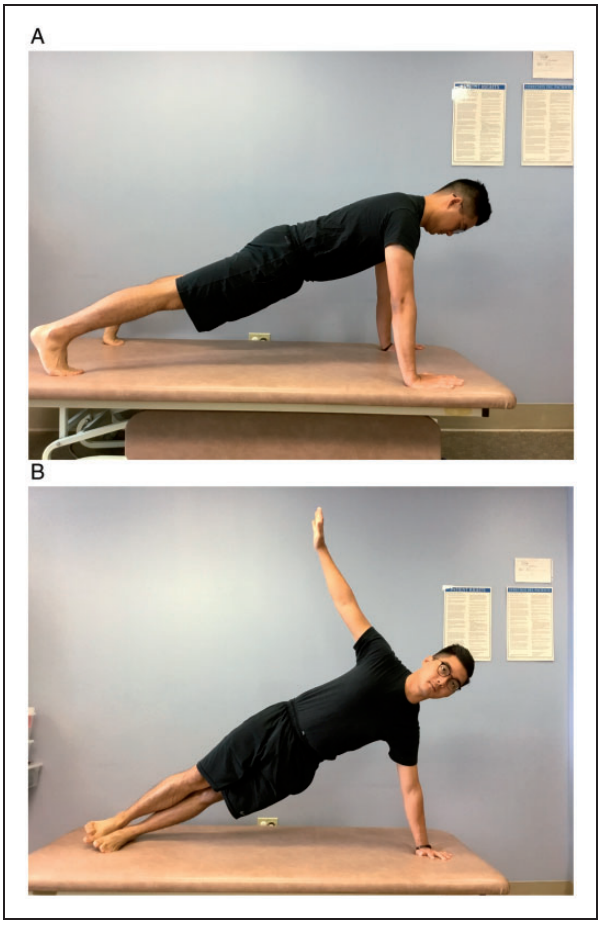

Figure 1. A, The Front Plank Pose Performed for Patients in the Control Group. B, The Side Plank Pose Performed for Patients in the Experimental Group. Reproduced with permission from Children's Orthopaedic Center, Los Angeles.

Primary Cobb angle and scoliometer reading were measured at initial enrollment and at 6-±2-month follow-up. Treatment type (observation or bracing) was recorded at each visit including patients who progressed to surgery. Patient demographics including age, weight, height, and sex were also collected. Two-sample *t* tests were used to determine whether there was a significant difference between Cobb angle and scoliometer measurements at initial and approximate 6-month follow-up. Level of significance was defined as $P < .05$.

Results

A total of 64 patients were enrolled (Figure 2): 53 patients were female and 11 were male. Mean age of participants was 13 years (range: 10–17 years). Moreover, 34% (22 of 64) of patients were compliant and completed the poses on average 6 times per week for 1 to 1.5 minutes a day for 6 months.

Compliant Patients

In the control group, there were 11 patients with 5 (45.5%) undergoing observation and 6 (54.5%) patients undergoing brace treatment. At enrollment, the control group had a mean Cobb angle of 30° (range: 14°–40°; n = 11) and a mean scoliometer reading of 13° (n = 8). At the 6-month follow-up, the mean Cobb angle was 30° (range: 14°–42°; n = 11) and a mean scoliometer of 12° (n = 8).

In the side plank group, there were 11 patients with 6 (54.55%) undergoing observation and 5 (45.5%) patients undergoing brace treatment. At the time of enrollment, the mean Cobb angle was 32° (range: 21°–44°; n = 11) and a mean scoliometer reading of 12° (n = 10). At the 6-month follow-up, the mean Cobb angle was 31° (range: 17°–48°; n = 11) and mean scoliometer reading of 13 (n = 10).

There were no significant changes in either the control or side plank group in regards to primary Cobb angle

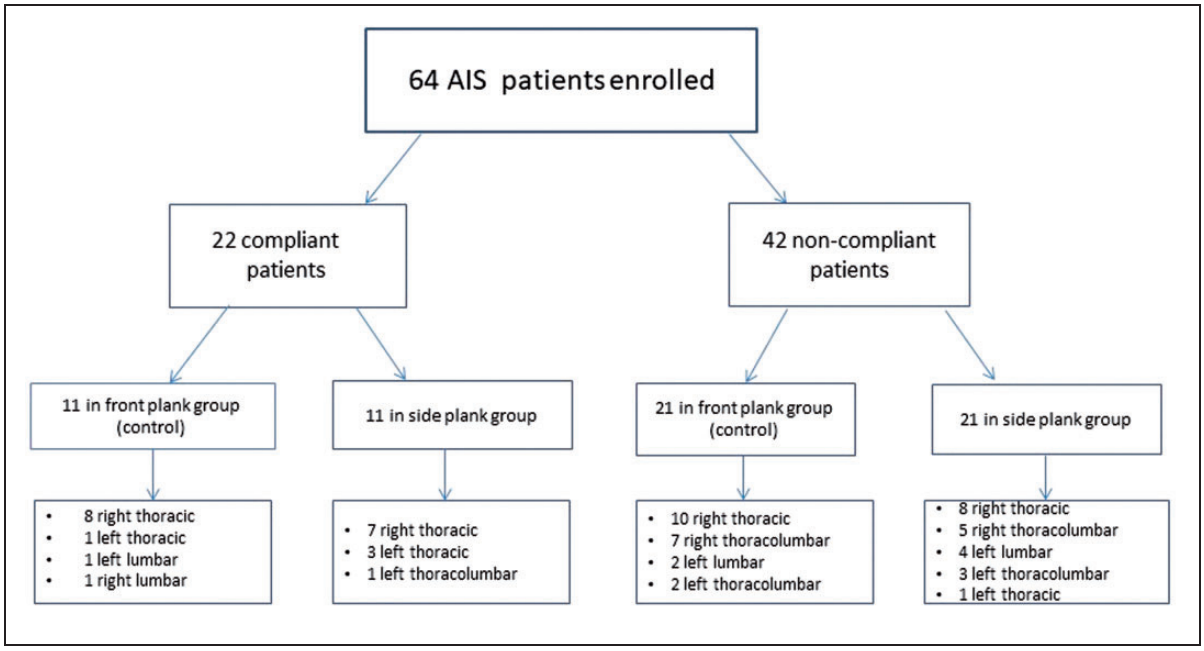

Figure 2. Flowchart of patient's compliance and exercise group. Note that *compliancy* is defined as completing poses more than 4 times per week. AIS, adolescent idiopathic scoliosis.

Table 1. Cobb Angle and Scoliometer Measurements at Enrollment and 6-Month Follow-up for the Compliant Group and Noncompliant Group.

	Enrollment	~6 Month Follow-up	Δ	Significance ($P < .05$)
Compliant Side Plank (n = 11)				
Cobb angle	32°	31°	−1°	.67
Scoliometer	12°	13°	1°	.45
Compliant control (n = 11)				
Cobb angle	30°	30°	0°	.53
Scoliometer	13°	12°	1°	.22
Noncompliant Side Plank (n = 21)				
Cobb angle	29°	30°	1°	.26
Scoliometer	10°	11°	1°	.81
Noncompliant control (n = 21)				
Cobb angle	29°	30°	1°	.93
Scoliometer	11°	11°	0°	.82

(control: $P = .53$, side plank: $P = .67$) or scoliometer (control: $P = .22$, side plank: $P = .45$) (Table 1).

Noncompliant Patients

Sixty-seven percent (42 of 64) of patients were noncompliant and completed poses less than 4 times a week. There were 21 patients in the front plank group with 10 (48%) undergoing observation and 11 (52%) patients undergoing brace treatment. The mean Cobb angle at the time of enrollment was 29° (range: 12°–39°; n = 21) and mean scoliometer reading of 11° (n = 13). At the 6-month follow-up, mean Cobb angle was 30° (range: 13°–40°; n = 21) and mean scoliometer reading was 11° (n = 13).

In the side plank group, there were 21 patients with 14 (67%) undergoing observation and 7 (33%) patients undergoing brace treatment. The mean Cobb angle at the time of enrollment was 29° (range: 15°–46°) (n = 21) and mean scoliometer reading of 11° (n = 21). At the 6-month follow-up, the mean Cobb angle was 30° (range: 13°–46°; n = 21) and mean scoliometer reading was 11° (n = 13). There was no significant change in Cobb angle in either the control group ($P = .93$) or

side plank group ($P = .26$) for the noncompliant patients. Similarly, there was no significant change in scoliometer measurement in either the control group ($P = .82$) or the side plank group ($P = .81$) (Table 1). In addition, there was no significant change in Cobb angle when patients were further stratified by treatment: observation (control group: $P = .81$, side plank group: $P = .17$) and bracing (control group: $P = .91$, side plank group: $P = .68$).

Discussion

Our objective was to determine if completing side plank poses would lead to a decrease in Cobb angle. In this randomized, prospective study, side plank poses were not effective in decreasing curve magnitude in AIS patients. It was speculated that the side plank pose was useful for strengthening the convex side of the curve's abdominal and spinal muscles which will theoretically bend the spine away from the stronger side and strengthen the spine.[10] However, contrary to prior reports, our cohort showed no significant changes during a 6-month study period.

Fishman et al. reported 7 compliant patients performing side plank poses and no control group. In their study, the patients were instructed to perform the pose daily for as long as possible and compliant patients were those who completed the pose 4 or more times a week for 6 months. Although Fishman et al. found that side planks improved Cobb angle from a mean 23° to 11° in their 7 compliant AIS patients after completing the pose for 1.5 minutes, we saw no improvement in Cobb angle in our cohort of compliant patients who completed the pose between 1 and 1.5 minutes. Our study followed the exact same protocol with patients receiving the same instructions regarding pose and duration with the only modification being the addition of a control group. Nevertheless, the success of Fishman et al. could not be replicated, and the use of this specific pose may not be warranted as an option for conservative treatment.

Currently, there is no agreement on the effectiveness of SSE in treating scoliosis. SSE methods include Schroth, yoga, and pilates. One previous study found that core stabilization was effective in the correction of vertebral rotation and reduction of pain in AIS patients.[11] However, a 2013 systematic review found insufficient high-quality evidence that corrective exercises decreased curve magnitude in patients with AIS.[12] The results of our study present no significance between completing a side plank or front plank for 6 months on Cobb angle. The patients who were also undergoing conservative treatment such as bracing, while performing the side plank poses had no improvement in their curve magnitude. The purpose in this study was to see if we could replicate the findings reported by Fishman et al. Unfortunately, we did not see the same improvement observed in that study. It is worth noting, however, that lack of progression is in and of itself an accomplishment. One could argue that perhaps the regular plank exercises in the control group were equally beneficial as the side plank pose and that was why we did not see a difference between the control and side plank groups in compliant patients (though we certainly did not see the mean improvement of 49% reported by the previous study). However, the lack of difference between the compliant and noncompliant groups would argue that this is not the case.

One limitation of this study was compliance. Although a majority of the patients completed the poses intermittently, they did not complete the recommended poses of 4 times a week. In addition, even in the compliant group who were asked to hold the pose for as long as possible, the mean time that the patients were able to complete the pose was less than 2 minutes. This was also found to be the case in the Fishman et al. study. It is possible that with more time dedicated to performing this planking pose that we would have seen some improvement. However, it is also plausible that if we defined compliance as completing the pose for 10 or 20 minutes per day for example that we would have had an even smaller number who were able to be compliant. Consequently, even if more time spent doing the exercises had an effect, it is questionable if that would have any practical application given the challenges of achieving compliance in this patient population. Given this, our results for both compliant and noncompliant groups demonstrate that planking exercises do not appear to be a practical treatment option.

Given that bracing is the one treatment for AIS which has clearly been shown to demonstrate a decrease in the rate of progression to a surgical magnitude, we did not feel it was ethical to prevent patients from receiving brace treatment where appropriate.[4,7] As is our typical bracing protocol, patients were instructed that they could remove the brace for physical activity such as sports or for planking. If there had been a large difference in the number of patients in the control and side plank group that were undergoing bracing, this could have been a significant confounder. However, the percentage of patients bracing in each group did not differ significantly. In addition, when we divided the groups by bracing or observation, we did not see a difference in the rate of progression between these 2 groups.

Future studies may continue to compare the different conservative treatments recommended by physicians, including general physical therapy and Schroth therapy. By continuing randomized prospective studies with different cohorts, we can hopefully elucidate which, if any, exercise modalities may limit curve progression in

patients with AIS. Nevertheless, compliance is likely to remain a challenge with any of these techniques.

This study adds additional information to the idea of SSE for AIS patients. In our series, performing side plank poses did not decrease Cobb angle. Although a previous study showed promise in improving curve magnitude with this simple planking pose, these findings were unable to be replicated in this randomized prospective study.

Authors' Note

This study has been carried out with approval from the Institutional Review Board at Children's Hospital Los Angeles.

Declaration of Conflicting Interests

The author(s) declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: Natalya Sarkisova, Joshua Yang, Tracy L Zaslow and Bianca R Edison have no conflicts to disclose. David L Skaggs: Paid consultant for Grand Rounds, Biomet, Nuvasive, and Zimmer; paid speaker or presenter for Biomet and Zimmer; has stock or stock options for Green Sun Medical, Ortho Bullets, and Zipline Medical Inc; board or committee member of Growing Spine Foundation, Growing Spine Study Group; editorial or governing board for Journal of Children's Orthopaedics, Orthopedics Today, Spine Deformity and Orthobullets; research support for Nuvasive (Co-PI, Paid to Growing Spine Foundation); publishing royalties for Wolters Kluwer Health-Lippincott Williams and Wilkins; IP royalties for Biomet; and other financial or material support for Biomet, Medtronic, Wolters Kluwer Health-Lippincott Williams and Wilkins, and Zimmer. Lindsay M Andras: Paid consultant for Biomet, Medtronic, Nuvasive, and Zimmer; paid presenter or speaker for Biomet, Medtronic, Nuvasive, Stock or stock options for Eli Lilly; board or Committee Member Pediatric Orthopaedic Society of North America and Scoliosis Research Society; editorial or governing board for *Journal of Pediatric Orthopedics*; publishing royalties for Orthobullets; and other financial or material support for Orthobullets. Vernon T Tolo: Publishing royalties, financial or material support for *Journal of Bone and Joint Surgery*, and Wolters Kluwer Health-Lippincott Williams & Wilkins. Natalya Sarkisova, Joshua Yang, Tracy L Zaslow and Bianca R Edison have no disclosures.

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Supplemental Material

Supplemental material for this article is available online.

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