

Surgeon Attitudes Toward Physiotherapeutic Scoliosis-Specific Exercises in Adult Patients With Spinal Deformities

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ABSTRACT

Background: Physiotherapeutic scoliosis-specific exercise (PSSE) has proven to be an important treatment for patients with adolescent idiopathic scoliosis. However, there is a lack of understanding of the role of PSSE in older adults with spinal deformity.

Methods: An electronic, 14-question survey with questions regarding the use of physical therapy (PT) and PSSE for adult spinal deformity was administered to all Scoliosis Research Society members. Physician location, age, specialty, years in experience, and management preferences were quantified using descriptive analyses.

Results: Of the 98 surgeons who participated in this study, the majority of respondents were from North America (71.1%), and the mean age was 51.87 ± 10.93 years; approximately 98% of respondents were orthopedic surgeons, and 48.0% had been in practice for more than 21 years. Sixty-four percent reported they prescribed PT in their practice, with 52% of respondents often using PT as nonoperative treatment; 21.4%, preoperative; and 40.8% postoperative. The primary reason for PT referral was persistent pain (40.3%), followed by impairments to the patient's balance or gait (34.3%) and difficulty with daily living activities (25.4%). The primary indications for not referring postoperative patients to PT were lack of perceived value from PT (50%), lack of evidence supporting the benefits from PT (31.3%), and a lack of physical therapists appropriately trained for scoliosis (18.8%). Of the respondents, 74% were familiar with PSSE and 66% were comfortable prescribing PSSE postoperatively. In addition, 28% of respondents agreed that >12 weeks postoperation was the ideal time for PSSE referral, followed by 6 to 8 weeks postoperation (26.2%) and immediately postoperation (18%).

Conclusions: The results show that the majority of respondents prescribed PSSE solely for nonoperative treatment. Respondents who did not prescribe PSSE reported skepticism due to a lack of perceived value. This suggests the need for further research into the benefits of PSSE.

Level of Evidence: 5.

Clinical Relevance: Physiotherapeutic Scoliosis Specific Exercises (PSSE) is an important non-operative treatment for patients with Adolescent Idiopathic Scoliosis (AIS) but is understudied in Adult Spinal Deformity (ASD) patients, suggesting further clinical research. This study demonstrates that only two-thirds of the respondents familiar with PSSE were comfortable prescribing PSSE postoperatively suggesting the need for further research into the effectiveness and benefits of PSSE in ASD patients.

Other & Special Categories

Keywords: Schroth, physiotherapeutic scoliosis specific exercises, adult deformity

INTRODUCTION

Scoliosis in adulthood may present itself as a continuation of adolescent idiopathic scoliosis (AIS), or it may develop as a result of age-related degenerative conditions.¹ The prevalence of adult spinal deformity (ASD) has been reported to be between 32% and 68%.²

Individuals with ASD present with a variety of symptoms, including pain, postural asymmetry, balance dysfunction, diminished endurance, and self-image issues, as well as diminished quality of life.¹ As

the activity level and age of patients with scoliosis continues to increase, there has been a growing need for nonoperative treatment to circumvent risks of undergoing a major operation at an older age.

Evidence for the value of nonoperative intervention in this population is limited. We can draw from a growing evidence base in the AIS population, which is seeing increased support for the role of bracing and physiotherapeutic scoliosis-specific exercises (PSSE) as the mainstays of nonoperative care for this patient population.^{3,4} The publication of the Bracing in Adolescent Idiopathic Scoliosis Trial (BrAIST) study

demonstrated the efficacy of bracing for AIS on the basis of clearly defined clinical parameters.³ Physiotherapeutic scoliosis-specific exercises are a group of approaches that consider detailed assessment of scoliotic curve patterns and involve postural correction and incorporation into daily function.^{5,6} This strategy uses various exercises, depending on the approach, that train a partnership between activation and strengthening of the deep stabilizing muscles of the spine and the core, in partnership with breathing strategies to guide the patient to a more centered alignment, then train endurance to maintain it in daily function.⁷ There are a number of different approaches that exist under the umbrella of PSSE. The most widely researched are Schroth and the scientific exercise approach to scoliosis. Physiotherapists trained to assess and manage individuals with spine deformity receive extensive postgraduate training that includes understanding scoliosis pathomechanics, progression, and thorough clinical and radiological assessment and management strategies based on each individual's 3-dimensional alignment rather than 2-dimensional alignment measurements such as pelvic tilt. In the United States, for example, the training process most widely available is Schroth training through the Barcelona Scoliosis Physical Therapy School. The basic level of training is 65 hours over 10 days, well beyond the minimal amount of scoliosis education provided at an entry-level physical therapy education program in the United States.⁸ Recent literature has provided evidence that PSSE prevents curve progression, minimizes respiratory dysfunction, prevents spinal pain syndromes, and improves aesthetics via postural correction in the adolescent population.^{1,6,9-15} PSSE has also been shown to enhance the effectiveness of bracing, demonstrating superiority over bracing alone in affecting Cobb angle magnitude, trunk rotation, and quality-of-life scores in the AIS population.¹⁶

In adults with idiopathic scoliosis persistent since adolescence and/or de novo or degenerative scoliosis, there is a lack of data on the effectiveness of physical therapy (PT) and PSSE, suggesting the need for further clinical research. In adults with spine deformity, PSSE typically requires a more advanced level of training or certification (45 additional hours beyond a basic level of scoliosis education) on the part of the therapist and the completion of a clinical exam verifying competency in assessment and intervention skills to be safe and appropriate. In addition, the clinical application of PSSE for this patient popula-

tion, including being managed postoperatively, requires a deep understanding of the aging spine, the impact of 3-dimensional alignment changes, particularly sagittal changes, on quality of life in this population, and clinical implications of ASD surgical intervention. PSSE goals in adults are to improve pain and quality of life, slow or halt curve progression, and optimize 3-dimensional alignment in the nonoperative, preoperative, and postoperative phases of management. Existing evidence that supports PSSE in adults with spine deformity is largely limited to case reports and case series; however, the recent publication of a randomized controlled trial demonstrating effectiveness of PSSE for adult idiopathic scoliosis (AIS persistent to adulthood) indicates that PSSE may be a viable intervention option for this population. This particular study demonstrated improved disability as measured by the Oswestry Disability Index as well as improved Cobb angle measurement in the group treated with PSSE as compared with the group receiving general physiotherapy.⁵ Evidence for PSSE as distinct from traditional physical therapy in the perioperative phase (prehabilitation and postoperative care) of ASD management does not exist.

There is a need for future research in the outcomes of PSSE preoperation and postoperation to determine the effectiveness of PSSE treatment in older adults. To better direct additional research on PSSE, there must be an improved understanding of physician opinions toward PSSE in this population. Therefore, the aim of this study is to understand surgeons' attitudes toward PSSE as a plausible treatment option compared with traditional low back physical therapy in older adults with ASD.

METHODS

This is a prospective survey study of the adult and pediatric spine surgeon members of the Scoliosis Research Society. An electronic, 14-question survey was administered online to 785 society members with questions regarding the use of PT and PSSE for ASD. The survey was designed and administered using SurveyMonkey. Participants were recruited through email. No incentives were provided for participation. The survey, in Table 1, evaluated for referral patterns around PT and PSSE in the ASD population. The physicians were asked to respond to questions on the basis of country of residence, age, specialty, years in experience, and management preferences. The respondents were asked whether they were comfortable recommending PT nonoperatively, preoperatively, or

Table 1. Survey questions and responses.

Question	Response	n (%)
Region	North America	69 (71.1)
	Europe	11 (11.3)
	Asia	8 (8.2)
	South America	7 (7.2)
	Australia	1 (1)
	Middle East	1 (1)
Please describe your training:	Orthopedic spine	94 (97.9)
	Neurosurgery spine	2 (2.1)
Did you do a fellowship in the following (mark all that apply):	Orthopedic spine surgery	52 (53.1)
	Pediatric orthopedic surgery	54 (55.1)
	Combined ortho-neuro spine surgery	3 (3.1)
How many years have you been in practice?	0–10 years	25 (25.5)
	11–20 years	26 (26.5)
	>21 years	47 (48)
Do you treat adult spinal deformity in your practice?	Yes	52 (53.1)
	No	46 (46.9)
Do you utilize the services of physical therapy for your patients with adult spinal deformity?	Yes	49 (63.6)
	No	28 (36.4)
If yes, when do you refer for adult spinal deformity patients to physical therapy? (check all that apply)	Nonoperative management	51 (52)
	Presurgical optimization	21 (21.4)
	After surgery	40 (40.8)
If you indicated that you refer patients to physical therapy after scoliosis fusion surgery, what percentage of your patients do you refer?	0%–20%	26 (40)
	21%–40%	5 (7.7)
	41%–60%	6 (9.2)
	61%–80%	7 (10.8)
	81%–100%	21 (32.3)
If you refer patients for physical therapy, what are the reasons for referral?	Persistent pain	27 (40.3)
	Impaired balance/gait	23 (34.3)
	Difficulty with ADLs	17 (25.4)
If you do not refer patients after scoliosis fusion surgery to physical therapy, what are the reasons you do not refer?	Lack of evidence for the role of physical therapy	15 (31.3)
	Lack of perceived value for the role of physical therapy	24 (50)
	Lack of access to physical therapists with appropriate knowledge of scoliosis and surgical procedure/precautions	9 (18.8)
Are you familiar with physiotherapeutic scoliosis-specific exercise (PSSE) such as Schroth physical therapy for scoliosis?	Yes	67 (73.6)
	No	24 (26.4)
If you are familiar with PSSE such as Schroth physical therapy for scoliosis and have a local provider, would you feel comfortable to refer to their care after the fusion to work on impaired respiratory function, difficulty with ADLs, impaired balance and gait, and any pain?	Yes	50 (65.8)
	No	26 (34.2)
What time frame after surgery is ideal to refer to PSSE?	Immediately post-op	11 (18)
	3–4 weeks post-op	9 (14.8)
	6–8 weeks post-op	16 (26.2)
	8–12 weeks post-op	8 (13.1)
	>12 weeks post-op	17 (27.9)

Abbreviations: ADLs, activities of daily living; post-op, postoperative.

postoperatively; they were also asked whether they did not recommend PT and, if so, why not. Specific questions about perspectives on PSSE and optimal treatment times to initiate PT following surgery were also asked. Descriptive statistical analysis was performed using SPSS software (version 23.0, IBM Corp, Armonk, NY).

RESULTS

Surgeon Demographics

A total of 98 surgeons responded to the survey request. The majority of the respondents were

orthopedic surgeons (97.9%) and the rest were neurosurgeons (2.1%), with a mean age of 51.87 ± 10.93 years. Of the respondents, 53% had been trained in an orthopedic spine fellowship; 55.1%, pediatric orthopedic fellowship; and 3.1%, combined ortho-neuro surgery fellowship. The majority of respondents were from the United States (66.3%); others from Canada (4.1%), Brazil (4.1%), and Australia (3.1%). Stratified by region, the majority of respondents were from North America (71.1%), followed by Europe (11.3%), Asia (8.2%), South America (7.2%), and the Middle East (1%). A majority of respondents had

Table 2. Characteristics of surgeons prescribing physical therapy for patients with adult spinal deformity.

	No	Yes	P Value
Region			.052
North America	23	54	
Europe	2	8	
Asia	1	2	
South America	0	0	
Australia	1	1	
Middle East	0	1	
Years in training			.389
0 to 10	7	17	
11 to 20	9	20	
21 or more	12	30	
Specialty			.533
Orthopedic spine surgeon	27	46	
Neurosurgical spine surgeon	0	2	
Fellowship			
Pediatric	25	10	.000
Orthopedic spine	4	43	.000
Ortho-neuro combined	0	3	.297

more than 11 years of clinical experience, which was measured by the number of years in practice: 25.5% of respondents had been practicing for 0 to 10 years, 26.5% for 11 to 20 years, and 48.0% for more than 21 years. These results are summarized in Table 2.

Practice of PT Referral for Patients With Spine Deformity

Surgeon practice patterns showed that 53.1% of respondents treat ASD in their practice. Of the total data set, 64% reported prescribing PT in their practices, with 52% of respondents often using PT as nonoperative treatment; 21.4%, preoperative; and 40.8%, postoperative. Of the surgeons who treat spine deformity in clinical practice, 90% reported prescribing PT in their practices, with 86% of respondents using PT for nonoperative management, 40% in the prehabilitation phase, and 73% postoperatively.

Practice of PT Referral for Patients With Spine Deformity After Surgery

Of those who indicated referral to PT after spinal deformity surgery, 40% of respondents reported prescribing PT for 0% to 20% of their patients, whereas 32.3% reported prescribing PT for 81% to 100% of their patients. The primary reason for PT referral was persistent pain (40.3%), followed by impairments to the patient balance or gait (34.3%) and difficulty with daily living activities (25.4%). The primary indications for not referring postoperative patients to PT were

lack of perceived value from PT (50%), lack of evidence supporting the benefits from PT (31.3%), and a lack of physical therapists appropriately trained for scoliosis (18.8%).

Practice of PSSE Referral for Patients With Spinal Deformity

Of the respondents, 74% were familiar with PSSE and 65.8% were comfortable prescribing PSSE postoperatively. The largest group of respondents had been in practice for more than 21 years, suggesting that older physicians were more likely to recommend PT. Of the respondents, 28% agreed that >12 weeks postoperation was the ideal time for PSSE referral, followed by 6 to 8 weeks postoperation (26.2%) and immediately postoperation (18%). North American spine surgeons and those trained in pediatric and orthopedic fellowships were more familiar with PSSE ($P < .05$). These results are summarized in Table 3. Despite being more familiar with PSSE, there was no difference in the rate of referral to PSSE among pediatric, orthopedic, or ortho-neuro combined fellowship training. The characteristics of surgeons using PSSE are summarized in Tables 4 and 5.

DISCUSSION

Physiotherapeutic scoliosis-specific exercise is emerging as a viable nonoperative treatment for the AIS population^{4,10,11,17} but has been relatively understudied in adult idiopathic scoliosis and de novo degenerative scoliosis.⁵

In North America, the Scoliosis Research Society, Pediatric Orthopaedic Society of North America, and American Association of Orthopaedic Surgeons believe scoliosis-specific exercises can decrease the likelihood of curve progression in adolescents.¹⁸ There is no similar collective guidance on adults with scoliosis. In addition, there is insufficient evidence to support the efficacy of nonsurgical modalities of treatment for adults with scoliosis. Evidence to date suggests that operative intervention is superior to nonoperative intervention, with improved quality-of-life measures following operative management.^{19–21} However, surgical management should be reserved for clinical presentations dominated by pain, neurological involvement, decreased function, and when nonoperative management has failed.¹ Nonoperative intervention

Table 3. Surgeon use of PT and PSSE.

	Response	n (%)
If you indicated that you refer patients to physical therapy after scoliosis fusion surgery, what percentage of your patients do you refer?	0%–20%	26 (40)
	21%–40%	5 (7.7)
	41%–60%	6 (9.2)
	61%–80%	7 (10.8)
	81%–100%	21 (32.3)
If you refer patients for physical therapy, what are the reasons for referral?	Persistent pain	27 (40.30)
	Impaired balance and gait	23 (34.30)
	Difficulty with ADLs	17 (25.40)
If you do not refer patients after scoliosis fusion surgery to physical therapy, what are the reasons you do not refer?	Lack of evidence for the role of physical therapy	15 (31.25)
	Lack of perceived value for the role of physical therapy	24 (50.00)
	Lack of access to physical therapists with appropriate knowledge of scoliosis and surgical procedure/precautions	9 (18.75)
What time frame after surgery is ideal to refer to PSSE?	Immediately post-op	11 (18.3)
	3–4 weeks post-op	7 (11.67)
	6–8 weeks post-op	16 (26.67)
	8–12 weeks post-op	9 (15)

Abbreviations: ADLs, activities of daily living; post-op, postoperative; PSSE, physiotherapeutic scoliosis-specific exercise; PT, physical therapy.

should be the first line of defense for ASD, and emerging nonoperative treatment techniques such as PSSE deserve a thorough evaluation. This study reports on survey results from 98 surgeons on their attitudes toward physical therapy and, in particular, PSSE as a distinct treatment option in older patients with ASD.

Study results demonstrated that a significant number of surgeons (36.36%) did not use PT at all for patients with ASD. This result may reflect the current evidence base that demonstrates the increased efficacy of operative management over nonoperative management in this patient population.^{19–21}

For surgeons referring patients to PT, a majority referred patients with deformity for nonoperative

management (91.07%), with relatively fewer surgeons referring patients after surgery (71.43%). Furthermore, a majority of surgeons referring patients to PT or PSSE referred patients for persistent pain or impaired balance and gait, rather than for difficulty with activities of daily living or impaired respiratory function, which suggests a perceived benefit of PT for specific symptoms of ASD.

Survey results showed that approximately 71% of respondents referred patients for PT after scoliosis fusion surgery; however, only approximately 66% felt comfortable referring to a therapist who provides PSSE following fusion surgery. These results indicate either lack of access to therapists trained in PSSE or remaining skepticism regarding

Table 4. Familiarity and knowledge of PSSE among surveyed surgeons.

	No	Yes	P Value
Region			.001
North America	9	54	
Europe	2	8	
Asia	6	2	
South America	7	0	
Australia	0	1	
Middle East	0	1	
Years in training			.696
0–10	7	17	
11–20	5	20	
21 or more	12	30	
Specialty			.019
Orthopedic spine surgeon	22	65	
Neurosurgical spine surgeon	2	0	
Fellowship			
Pediatric	6	41	.002
Orthopedic spine	22	28	.001
Ortho-neuro combined	1	2	.781

Table 5. Surgeons comfortable recommending PSSE.

	No	Yes	P Value
Region			.165
North America	19	38	
Europe	5	3	
Asia	0	5	
South America	1	2	
Australia	1	0	
Middle East	0	1	
Years in training			.830
0–10	6	12	
11–20	9	14	
21 or more	11	24	
Specialty			
Orthopedic spine surgeon	26	48	
Neurosurgical spine surgeon	0	0	
Fellowship			
Pediatric	18	25	.109
Orthopedic spine	11	27	.333
Ortho-neuro combined	1	1	.633

the benefit of PT and PSSE in the postoperative process in ASD management. In addition, there was just a 5% difference in referrals for traditional PT following surgery (71.43%) and comfort level in referring to a therapist trained in PSSE postoperatively (65.79%), suggesting a similar perspective for the role of PSSE as for traditional PT in postoperative management.

Although a majority of surgeons reported feeling comfortable referring patients to PSSE for scoliosis after fusion surgery, there appears to be a lack of consensus over the optimal period for referral, as indicated by the stratified responses. This illustrates some confusion regarding the uses of PT and PSSE and implications of the therapy for postoperative symptom management. Respondents who did not prescribe PT postoperatively reported skepticism due to lack of perceived value from PT. The lack of consensus as well as lack of perceived value may stem from the lack of evidence around rehabilitation after spine deformity surgery.²²

There are various limitations to this particular study, primarily that only 98 surgeons participated in the survey; this was a significantly smaller sample size than expected given the number of participants eligible for this study. This introduces the possibility of selection bias, because respondents with an interest in nonoperative interventions may have been more likely to respond to the survey. Forty-eight percent of respondents were surgeons who had been in practice for more than 21 years. This is significant because conservative treatment options such as PSSE and other exercise treatment methods might not have been part of medical training or even in existence in earlier years. However, these data might also indicate the possibility that older surgeons are more likely to recommend PT or PSSE, given the percentage of surgeons indicating their use of PT as a treatment option nonoperatively and postoperatively.

With the prevalence of ASD reaching as high as 68%,² valuable and effective treatment options need to be sought out and studied. Operative treatment methods can be expensive and burdensome on patients, whereas nonoperative methods are not always successful in treating patients with significant deformity. Although patients are becoming more familiar with PSSE and other nonsurgical treatment options for ASD, the results show that surgeons are familiar and comfortable with prescribing PSSE, but don't despite patient familiarity. North Amer-

ican spine surgeons and those trained in pediatric or orthopedic fellowships are more familiar with PSSE but do not recommend it at a higher rate. Those surgeons report significant skepticism regarding the perceived benefit of PT or PSSE despite growing literature such as the BrAIST study supporting the possibility of nonoperative treatments for AIS and future large-scale observational studies. Surgeons who do prescribe PSSE for scoliosis treatment after fusion surgery have a lack of consensus on the optimal time frame for PT or PSSE treatment, adding to the need for a more comprehensive study on the effectiveness of PT or PSSE in the treatment of ASD.

CONCLUSIONS

The results show that the majority of respondents prescribed PT solely for nonoperative treatment. Respondents who did not prescribe PT postoperatively reported skepticism due to a lack of perceived value from PT. There is also considerable skepticism regarding the benefit of PSSE for postoperative symptom management in ASD, with two-thirds of the respondents familiar with PSSE and comfortable in prescribing PSSE postoperatively. The data show that despite being familiar or comfortable with prescribing PSSE, PT is not routinely used. Furthermore, North American spine surgeons and those trained in pediatric and orthopedic fellowships were more familiar with PSSE, there was no difference in the rate of referral. Therefore, further research regarding the use of PT and PSSE as an effective treatment option for the perioperative and nonoperative management of ASD is necessary to elucidate the benefits of this intervention.

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