Winter 2023 • Vol 19 No 1

THE ACADEMY TODAY

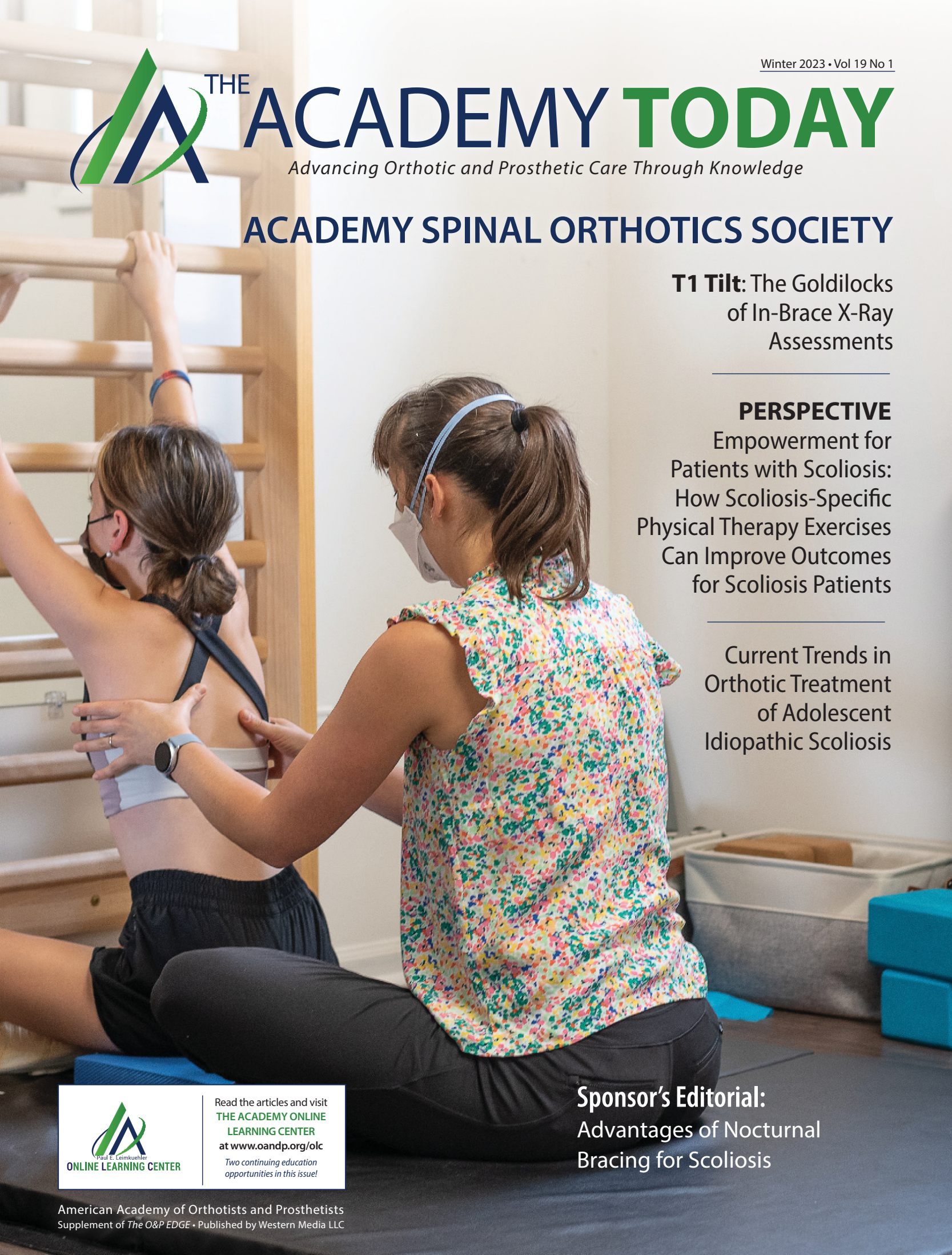
Advancing Orthotic and Prosthetic Care Through Knowledge

ACADEMY SPINAL ORTHOTICS SOCIETY

T1 Tilt: The Goldilocks of In-Brace X-Ray Assessments

PERSPECTIVE
Empowerment for Patients with Scoliosis: How Scoliosis-Specific Physical Therapy Exercises Can Improve Outcomes for Scoliosis Patients

Current Trends in Orthotic Treatment of Adolescent Idiopathic Scoliosis



Sponsor's Editorial:
Advantages of Nocturnal Bracing for Scoliosis

Paul E. Leimkuehler
ONLINE LEARNING CENTER

Read the articles and visit
THE ACADEMY ONLINE LEARNING CENTER
at www.oandp.org/olc
Two continuing education opportunities in this issue!

American Academy of Orthotists and Prosthetists
Supplement of *The O&P EDGE* • Published by Western Media LLC

CONTENTS

Message from the President Academy Spinal Orthotics Society 3

Introduction 4
Scott Thach, MSPO, CPO/L

T1 Tilt: The Goldilocks of In-Brace X-RayAssessments 5
Megan Glahn Castille, MS, CPO/L

PERSPECTIVE 8

Empowerment for Patients with Scoliosis: How Scoliosis-Specific Physical Therapy Exercises Can Improve Outcomes for Scoliosis Patients
Erica Hosken, PT, DPT
Jason Schon, MD
Leda McDaniel, PT, DPT, OCS

Current Trends in Orthotic Treatment of Adolescent Idiopathic Scoliosis 15
Kathleen Carroll, MS, MSPO, CPO, FAAOP

SPONSOR'S EDITORIAL:
Advantages of Nocturnal Bracing for Scoliosis 22

Indicates continuing education opportunity on the Paul E. Leimkuehler Online Learning Center (OLC) at www.oandp.org/olc.

Published by Western Media LLC, DeskChair, 201 East 4th Street, Loveland, CO 80537; Phone: (303) 255-0843; Fax: (303) 255-0844; Email: info@opedge.com.

THE ACADEMY **TODAY**

WINTER 2023 • Volume 19, No 1

(202) 380-3663 • Fax (202) 380-3447
www.oandp.org

PERSPECTIVE
Empowerment for Patients with Scoliosis:

How Scoliosis-Specific Physical Therapy Exercises Can Improve Outcomes for Scoliosis Patients

The following are actual statements from the families of children who have been diagnosed with scoliosis:

- Our doctor told us to wait and see, but we were hoping there is something we can do right now.
- We want our daughter to wear her brace as much as possible, but she just can't. She doesn't like to wear it to school, and she obviously doesn't wear it when she's playing volleyball. Is there anything else she can do besides bracing?
- We are so afraid of surgery. We will do anything to avoid surgery.
- It's been six months since our last X-ray. She's wearing her brace 16-plus hours per day, and the curve has gotten worse! We are so frustrated and upset. Isn't there something—anything—we can do?

Sadly, statements like these are commonly heard by those who work with patients with juvenile and adolescent idiopathic scoliosis (AIS). Families of these children often feel helpless, frustrated, and fearful. They are desperate for conservative treatment options for their children, want to avoid invasive spinal surgery, and are sometimes given few options other than the extremes of a surgical approach or a wait-and-see approach to treatment. Bracing is one conservative option that is often prescribed. However, as illustrated by the statements above, bracing can present challenges because braces can be uncomfortable to wear for lengthy periods of time or because children or teens may become self-conscious of their appearance in braces. Furthermore, children and family may become discouraged if the scoliotic curve worsens despite best efforts to wear the brace as prescribed.

Fortunately, there is another conservative option (other than or in addition to bracing) available for these patients that can help keep their curves from worsening: scoliosis-specific physical therapy exercise. Variations of this type of therapy have been practiced for more than 100 years.[1]

Physiotherapy scoliosis-specific exercises (PSSE) have been shown to stabilize curves and prevent curve progression for some individuals. In many cases, PSSE can even reduce the Cobb angle, especially when used with bracing.

This article provides an overview of the Schroth Method and the Barcelona Scoliosis Physical Therapy School (BSPTS) Rigo Concept, which are most commonly used PSSE treatments in the United States. Additionally, this article outlines the goals of these treatment options, reviews the evidence for PSSE treatments, and demonstrates the effectiveness of PSSE in conjunction with bracing for patients who "fail" bracing and patients who prefer not to brace.

Direct links for scoliosis-specific resources, including the 2011 and 2016 Society on Scoliosis Orthopedic and Rehabilitation Treatment (SOSORT) treatment guidelines are provided, as well as an app that Align Physical Therapy, a privately owned physical therapy practice in Atlanta, Georgia, built for patients, families, and healthcare professionals. The app provides treatment guidance based on individual patient data and SOSORT guidelines. Other resources include links to searchable directories of practitioners trained in the BSPTS Rigo Concept and the Schroth Method. These directories can help providers, patients, and families find a PSSE-trained physical therapist throughout the United States.

Understanding PSSE, the BSPTS Rigo Concept, and the Schroth Method

PSSE, the BSPTS Rigo Concept, and the Schroth Method are all conservative treatment options for patients with scoliosis. These specialized interventions may include movement training, postural awareness/correction, breath training, sensory training, and cognitive training.

SOSORT and PSSE

SOSORT was founded in 2004 to promote and encourage conservative, evidence-based treatment for people with scoliosis. SOSORT provides education, guidelines, and consensus about treatment options.[2] SOSORT recommends "physiotherapy scoliosis-specific exercises" for patients with scoliosis according to published guidelines. There are seven schools recognized by SOSORT that teach scoliosis-specific exercise: Lyon (France), Katharina Schroth Asklepios (Schroth; Germany), Scientific Exercises Approach to Scoliosis (SEAS; Italy), BSPTS Rigo Concept (Spain), Dobomed (Poland), Side Shift (UK), and Functional Individual Therapy Scoliosis (FITS) approach (Poland).[1] Most PSSE-trained physical therapists in the United States are trained in the BSPTS Rigo Concept or the Schroth Method because of the closer proximity to training within those schools. Patients can only be taught PSSE by a physical therapist trained in one of the above

PSSE methods because the treatment is highly specialized and very different from traditional physical therapy.

The Schroth Method

The Schroth Method was developed by Katharina Schroth in Germany in 1921 to address her own moderate scoliosis curve. Initially, Schroth was treated with a traditional course of bracing. She then started experimenting with different exercises to discover a more functional way to improve her scoliosis. Taking inspiration from how a balloon inflates, Schroth began using a mirror for visual feedback as she tried to breathe into the concavity of her curve to reduce the asymmetry caused by her scoliosis. Through trial and error, she discovered that she could improve her posture if she performed corrective exercises to strengthen certain muscles and train her proprioception to achieve a more neutral spinal posture.[3]

Schroth then went on to work with others who were suffering from scoliosis and were disenchanted with treatments such as bracing alone or surgery. As time went on, she trained others in her method of correcting spinal posture with a three-dimensional understanding of scoliosis. The Schroth Method has been refined over the years by trained Schroth practitioners, informed by their experience working with thousands of individuals with scoliosis.

The Schroth Method currently encompasses specific evaluation and individualized treatment recommendations and principles. First, a thorough evaluation takes place so the trained Schroth Method practitioner can prescribe individualized exercises by classifying the scoliotic curve type and teaching treatment techniques that match this three-dimensional understanding of spinal asymmetry. Classification in the Schroth Method divides the body into "body blocks" to help describe the changes to body shape that occur due to scoliosis and associated compensations.

The body blocks demonstrate side-shifting, rotation, and compression on the concave side and expansion on the convex side of the scoliotic curve (Figure 1).[1] Once the scoliosis curve is classified, the Schroth-trained

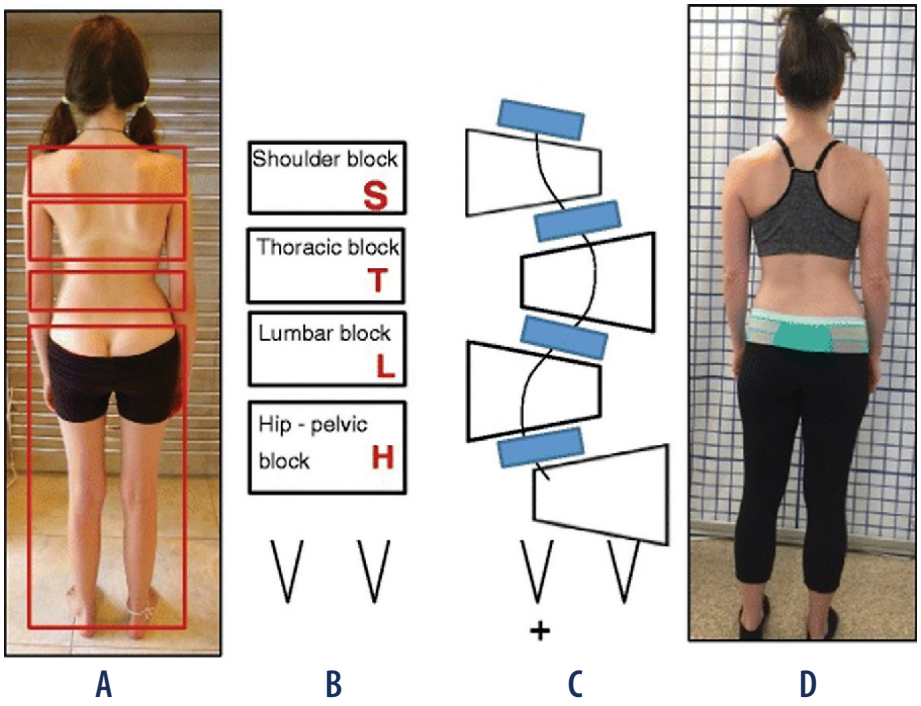


Figure 1. Body blocks used in Schroth Method evaluation and treatment. *Reproduced with permission from Berdishevsky (2016).*[1]

physical therapist can provide instruction on improving the patient's posture by using corrections at the pelvis to improve the alignment and then using the Schroth correction principles.

The Schroth Method includes five principles of correction: (1) auto-elongation (detorsion); (2) deflection; (3) derotation; (4) rotational breathing; and (5) stabilization. Just as Katharina Schroth viewed breath work as foundational to her treatment, breathing techniques underpin the effective prescription and application of the Schroth Method. An important part of the Schroth Method, rotational angular breathing, or orthopedic breathing, is a breathing technique that helps expand the rib cage in the collapsed areas to return it to a position closer to a typical anatomical position.[1]

BSPTS Rigo Concept

The BSPTS Rigo Concept is another type of PSSE based on the original Schroth Method. The BSPTS Rigo Concept originated at the Elena Salva Institute in 2019. This institute was founded in Barcelona, Spain, in 1968 by physiotherapist Elena Salvá. Salvá traveled to Germany in the 1960s and met with Katharina Schroth and her daughter, Christina Lehnert-Schroth. Salvá learned about the Schroth Method from Schroth and her daughter. Salvá's daughter, Gloria Quera-Salvá, DO, married Manuel Rigo, MD. In 1989, Quera-Salvá and Rigo (with other local physiotherapists in Spain) began educating physiotherapists worldwide in the Schroth Method. They researched their work and modified their strategies and standards of care, which led to an evolution of the methodology over time. This evolved method needed a new name, so in 2008, BSPTS was officially founded.

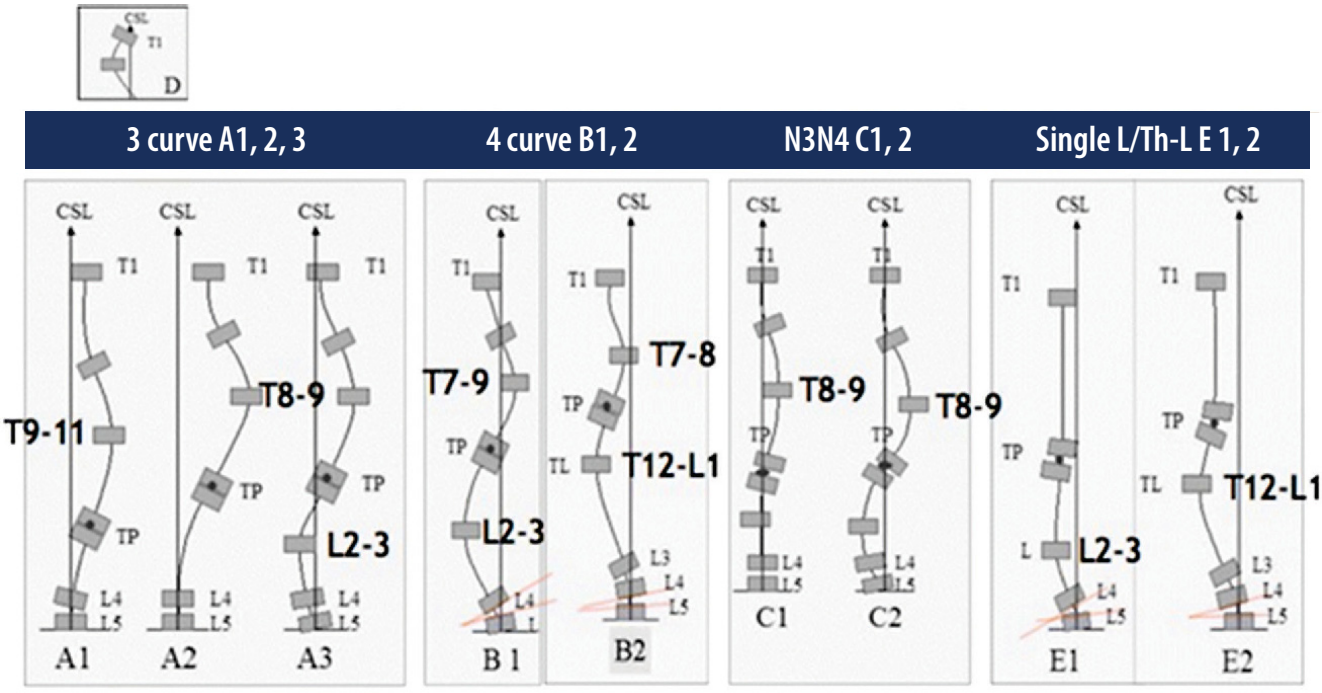
In 2019, BSPTS was restructured with a new educational pathway for physical therapists, orthotists, and physicians.

The BSPTS Rigo Concept is "a plan of cognitive, sensorimotor, and kinesthetic training to teach the patient to improve his/her scoliosis posture [with] the assumption that scoliosis posture promotes curve progression."[1] BSPTS Rigo Concept exercises involve performing elongation, creating muscle tensions in three dimensions, and performing stabilization. The 2010 Rigo X-ray classification was developed to correlate bracing and physical therapy interventions (Figure 2).

BSPTS Rigo Concept exercise positions use passive corrections (for example, rice bags, tethers, poles, exercise balls, wall bars, etc.) and active corrections for spine stabilization. Once a patient can attain a corrected position, diaphragmatic breathing can help reshape the trunk and ribcage and stabilize the spine in its best possible position. All exercise positions are followed by integrating the techniques against gravity. Subsequently, stabilization exercises are prescribed to improve the patient's ability to maintain neutral alignment of the spine, develop strength and control in this position, and help the patient find and maintain this "new normal" position while participating in activities of daily living. Treatment also includes patient education to address factors that can influence curve progression.[1]

Goals of PSSE Treatments

PSSE treatments begin with patient education and empowerment to inform collaborative treatment planning and realistic expectations for treatment effectiveness. Once a patient has been evaluated and deemed a good candidate for PSSE, treatments are prescribed on an individual basis. Common goals of PSSE treatment often include correcting scoliotic posture; preventing curve progression or reducing the Cobb angle (as appropriate); avoiding surgical intervention; and improving cosmesis, general health, breathing mechanics, self-efficacy, and quality of life. PSSE also supports the inclusion



Rigo and Weiss. *Conservative Scoliosis Treatment*. IOS press. 2008 page 303–319. Rigo et al. *Scoliosis* 2010, 5:1 http://www.scoliosisjournal.com/content/5/1/1.

Figure 2. Rigo Classification for BSPTS bracing and physical therapy. *Reproduced with permission from Berdishevsky (2016).*[1]

of appropriate adjunct treatments, such as bracing (generally for curves greater than 25 degrees) or preventing bracing (generally for curves less than 25 degrees). For patients who are braced, an additional treatment goal is learning to use their "corrected" posture while wearing their brace. Learning to use their corrected posture while wearing the brace works especially well in Rigo-type or WCR-type braces, which are designed to work with the PSSE corrections. This allows patients to work on strengthening their muscles during what would normally be passive brace-wear time. For patients with AIS and their families, PSSE treatments can provide many active treatment options other than just bracing and observation (also known as a wait-and-see approach), which can give patients some autonomy and hope for improvement. PSSE tries to comprehensively address all sequelae of AIS by providing treatments that address functional limitations in activities of daily living, reduce pain, and integrate coping strategies and psychological support for patients and their families.[1,4]

As one might expect, treatment courses vary depending on the severity of the individual's scoliosis, age, or skeletal maturity (for example, Risser or Sanders classification), motivation for active treatment approaches, and personal goals, among other variables. The active and collaborative nature of PSSE between patient and provider cannot be understated. Some patients elect to participate in the intensive treatment that PSSE prescribes, including several hours of PSSE in the clinic in a single day or over several days. During this time, patients learn their initial home exercise program. They will then return for follow-up appointments to progress their home exercise program. Patients traveling from out of town typically choose intensive treatment regimens; local families may also opt for intensive treatment to reduce absence from school. Intensive treatment regimens follow a format of two-hour sessions every few weeks. In other cases, patients are seen weekly or every other week for one-hour sessions until they are independent with their home exercise program. Most patients need eight to 12 visits (or eight to 12 hours) to achieve independence with a home exercise program. Align Physical Therapy recommends patients perform their home exercise program daily for 15–20 minutes. Furthermore, the practice recommends that patients follow up once every three months until they reach skeletal maturity so that their exercises can be adjusted as needed.

Evidence for PSSE (specifically the Schroth Method and the BSPTS Rigo Concept)

In recent years, research support for PSSE has been increasing as more studies demonstrate the effectiveness of PSSE (specifically the Schroth Method and the BSPTS Rigo Concept) in improving a variety of factors

for individuals with AIS. Since 2012, when a Cochrane Review by Romano et al. found only low-quality evidence for PSSE in treating AIS, multiple randomized controlled trials from all over the world have demonstrated moderate to high evidence of the effectiveness of PSSE for patients with mild and moderate AIS curves.[5–11] A recent meta-analysis of the efficacy of the Schroth Method reported high effect sizes (0.724 across included studies) for the change in Cobb angle.[12] Additionally, a systematic review looking at the effectiveness of PSSE and the Schroth Method supports assertions that these treatments can improve Cobb angle and angle of trunk rotation (ATR) and positively impact muscle endurance and lung vital capacity.[13] Another study found Schroth PSSE to be more effective in improving Cobb angle, ATR, and cosmetic trunk deformity than traditional core strengthening.[14] When indicated, bracing can be an integral part of the treatment prescription (beyond exercise recommendations) for patients with AIS. With this in mind, a recent study conducted by Rrecaj-Malaj et al. found that PSSE treatment effectively reduces Cobb angle and ATR in patients who are braced and in patients who are not braced. This finding may indicate that PSSE can be an effective early intervention before a scoliosis curve is large enough that bracing is recommended or an effective treatment in conjunction with bracing.[15]

Even if PSSE is not effective at reducing the Cobb angle, stabilizing the Cobb angle is beneficial because without any treatment, there is a risk that the scoliosis curve will progress. Potential risk factors for curve progression include the severity of the curve and the patient's age at initial scoliosis diagnosis, the patient's Risser score, and the onset of menstruation.[16] It is generally accepted that the younger and more skeletally immature the patient is, and the greater the degree of curvature is, the greater the risk is for curve progression. One study investigating the effects of the BSPTS Rigo Concept on Cobb angle in patients with scoliosis found that the group participating in the BSPTS Rigo Concept had maintained a stable Cobb angle at the one-year follow-up point, while a control group that did not engage in BSPTS Rigo Concept exercises experienced an increase in Cobb angle at the one-year follow-up point.[17] Another promising finding comes from Kuznia et al., who, in summarizing recent evidence for treating AIS, recommended that bracing and PSSE may be effective at slowing the progression of scoliosis.[18] Similar to scoliotic curve stabilization, avoiding bracing may be a positive outcome in those with AIS. With this outcome in mind, one study found that another form of PSSE, the Scientific Exercise Approach to Scoliosis (SEAS), reduced the bracing prescription compared to a control group who participated in traditional physical therapy.[19]

Surgical intervention to address the scoliosis curve is a more invasive treatment option and is typically only prescribed if the patient has a Cobb angle greater than 45 degrees. Avoiding surgery is a primary reason patients will participate in bracing and PSSE for scoliosis. Rigo et al. retrospectively looked at the prevalence of surgery in an untreated group of patients with scoliosis from a center with a nonintervention policy compared to a center with an active conservative management policy that included bracing and PSSE using the Schroth Method. Patients with an initial curve angle of 20–25 degrees were treated with Schroth Method PSSE. Patients with an initial curve angle of 25 degrees or greater or those who experienced curve progression were treated with the Schroth Method and a Rigo System Chêneau brace. They found that 5.6 percent of patients who participated in PSSE alone or bracing and PSSE underwent a spinal fusion, and a worst-case analysis found that at most, 14.1 percent of patients (assuming all lost to follow-up) had a spinal fusion. This is still a significantly lower number of patients requiring spinal fusion surgery compared to a center that did not offer active conservative management. By comparison, 28.1 percent of the patients seen by the nonintervention center underwent spinal fusion surgery. These results suggest that PSSE and bracing or PSSE alone may reduce the need for spinal fusion surgery.[20]

Other Outcomes of PSSE and Future Research Directions

As previously discussed, one of the troubling sentiments expressed by patients with scoliosis and their families is that they can feel helpless. Patients may experience negative body image and other psychological sequelae from this condition. Some of the previously mentioned studies suggest that PSSE treatment can improve physical outcomes (for example, reduction in Cobb angle, angle of trunk rotation, etc.) and that individuals participating in these types of treatments (for example, PSSE, the Schroth Method, and the BSPTS Rigo Concept) can experience improvements in muscle endurance, health-related quality of life, and self-image.[6,8]

Studies of PSSE typically compare an exercise group that performs PSSE in addition to receiving the standard of care (for example, including bracing when indicated) to a control group that receives only the standard of care. In addition to bracing, the standard of care could include curve progression monitoring (i.e., a wait-and-see approach), psychological support, and traditional physical therapy treatments, such as spinal mobilization, stretching, strengthening, and, in some cases, balance and proprioception training.[6,8,10,11,13]

One challenge in discussing the effectiveness of PSSE is that despite commonalities among these interventions, there is no established consensus on the most effective treatment parameters (for example, treatment duration, frequency, or intensity). Some data suggests that performing Schroth exercises in a clinic with expert supervision may be superior to doing prescribed Schroth exercises exclusively at home (i.e., a home exercise program).[10] Further research is needed to explore the specific parameters in which PSSE, the Schroth Method, and the BSPTS Rigo Concept are the most effective.

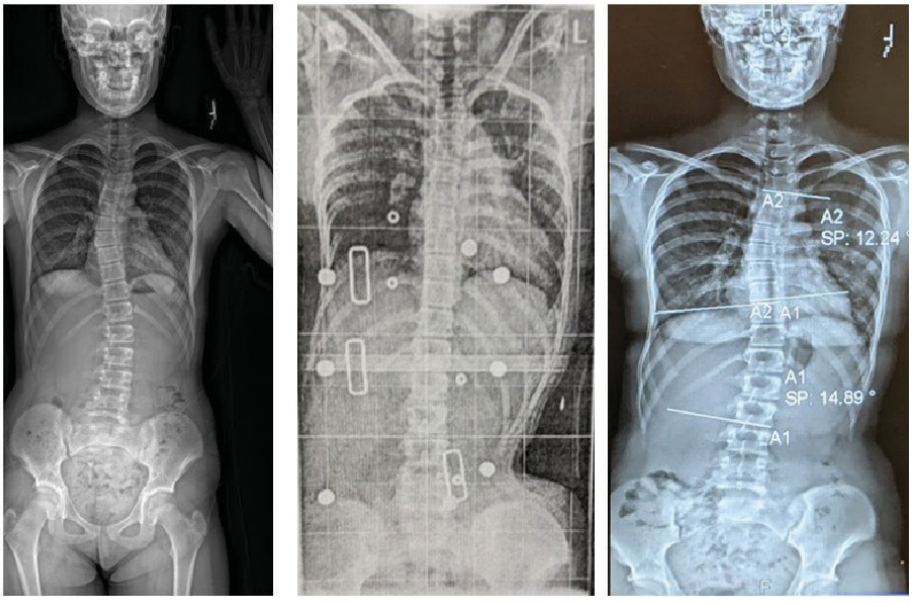
Clinical Experience Supports PSSE Use

PSSE offers patients and their families an active, conservative option for treating scoliosis. PSSE teaches patients how to manage their condition over the long term, make decisions that are safe for their spines, and participate more fully and safely in functional and recreational activities. PSSE can be used throughout the patient's life, providing a scoliosis management strategy from childhood to adulthood. In addition to the positive physical outcomes that may result from PSSE treatments, some data suggests that patients perceive benefits from PSSE treatments independent of changes in Cobb angle measurements.[11] This finding is important given that physical therapy treatment plans seek to involve patients (and their families if the patient is under 18 years of age) in a collaborative decision-making framework designed to improve physical health, mental health, emotional health, and quality of life. Align Physical Therapy practitioners have found that patients and their families are eager to participate in PSSE because they feel it provides a meaningful way to influence their health and work toward mitigating or reversing scoliotic curve progression.

Clinical Outcomes at Align Physical Therapy

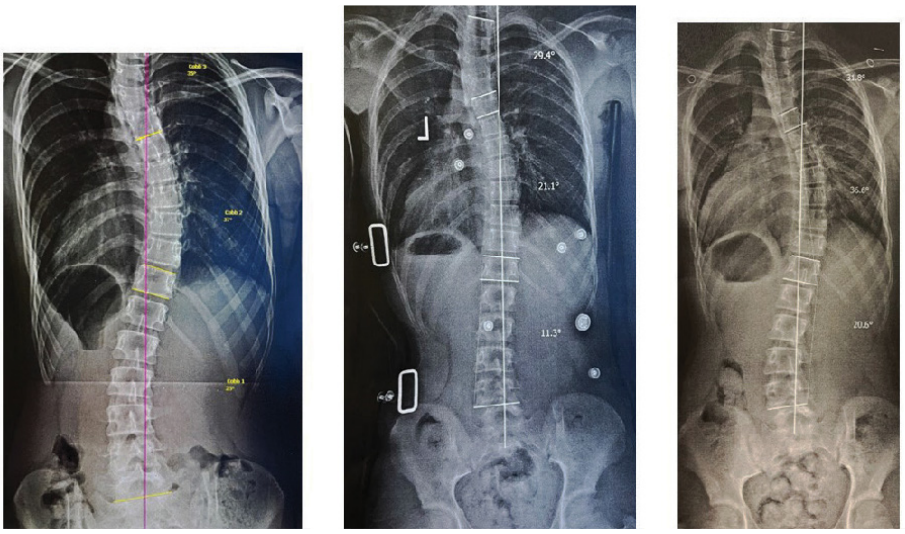
Overall, the clinical experience in treating patients with scoliosis at Align Physical Therapy corroborates the positive research findings outlined above. Following are a few clinical outcomes:

Patient A is a 14-year-old female who began intensive PSSE treatment at Align Physical Therapy in August 2019 at age 11 (Risser Classification 0). Initial X-rays revealed 34-degree thoracic and 24-degree lumbar Cobb angles. She was fitted with a Providence night brace, and her mother requested physical therapy in addition to bracing treatment. The patient's treatment began with two hours of intensive treatment



December 2019 | January 2021 (Providence brace) | January 2022

Figure 3. Patient A



December 2021 | December 2021 (Rigo Chêneau brace) | January 2022

Figure 4. Patient B

once per month and has progressed to two hours of intensive treatment every three to four months. Patient A currently has a 12.24-degree thoracic curve and a 14.89-degree lumbar curve (Figure 3).

Patient B is a 13-year-old female who presented to Align Physical Therapy in November 2021 at age 12 (Risser Classification 0). An initial X-ray demonstrated 35-degree upper thoracic, 37-degree thoracic, and 25-degree lumbar Cobb angles. After six months, the patient's follow-up X-rays show 31.8-degree upper thoracic, 36.6-degree thoracic, and 20.6-degree lumbar Cobb angles. The patient currently wears a Rigo Chêneau brace during the day and a Providence brace at night. Patient B's PSSE treatment consisted of weekly (sometimes twice weekly) one-hour appointments to learn and progress her independent home exercise program (Figure 4).

Patient C is a 15-year-old female who presented to Align Physical Therapy in August 2020 at age 13 (Risser Classification 1, pre-menstrual). An initial X-ray showed 27-degree thoracic and 20-degree lumbar Cobb angles. After six months, the patient's follow-up X-rays showed 20-degree thoracic and 15-degree lumbar Cobb angles. Her course of treatment began with two-hour intensive sessions twice per month. The frequency of the sessions decreased to once per month and then to once every two months to learn and advance an independent home exercise program. Per SOSORT guidelines, bracing was recommended by her treating physical therapist, but the patient and family elected not to use a brace in conjunction with treatment (Figure 5).

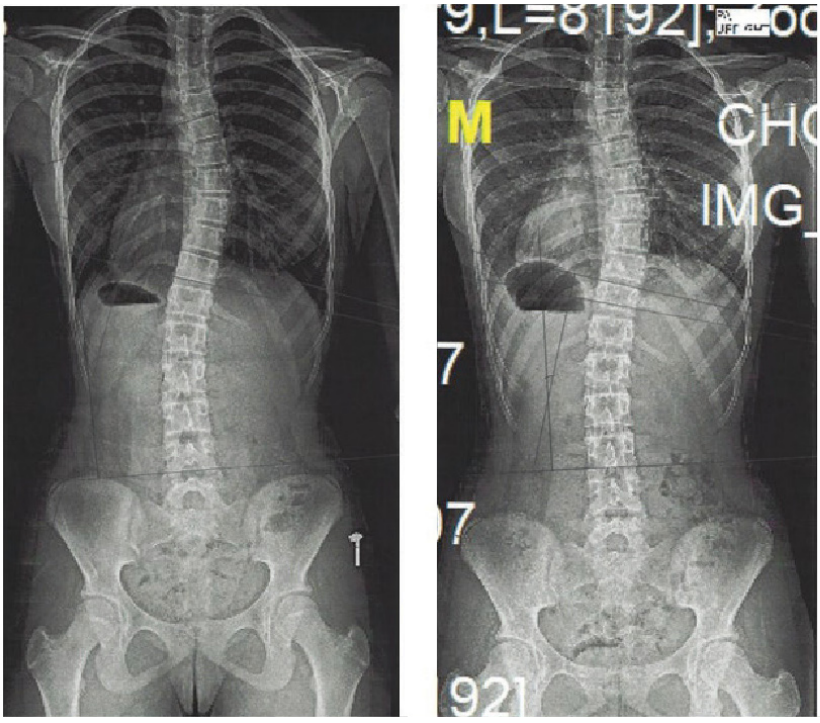
These are just three examples of patients who have benefited from PSSE in addition to or instead of bracing. As members of the healthcare team treating patients with scoliosis, we all want to see our patients meet their goals; we all want the best outcomes in terms of holistic health that are possible for our patients. Research support, clinical experience at Align Physical Therapy, and patient reports suggest that PSSE is an effective treatment that provides positive outcomes for individuals with scoliosis. If you work with patients with scoliosis, ask them if they would like to take a more proactive approach to managing their scoliosis. For patients and their families who have been told to wait and see, learning that they can do something to improve their prognosis may be life changing.

To view more case studies, visit https://align-pt.com/results.

Resources and references are available on page 24. .

Continue the Conversation

The Academy would like your feedback on this opinion piece. Please send an email to mbhaskar@oandp.org and let us know what you think. We will compile your feedback and share it with you.



Before After

Figure 5. Patient C (before and after PSSE)

Erica Hosken, PT, DPT
Align Physical Therapy
Doctor of Physical Therapy
Board Certified Orthopaedic Clinical Specialist
Certified C1/C2 BSPTS Based on the Principles of Schroth
International Society on Scoliosis Orthopaedic Rehabilitation and Treatment (SOSORT) Member
Owner, Align Physical Therapy
alignptga@gmail.com

Leda McDaniel, PT, DPT, OCS
Doctor of Physical Therapy
Board Certified Orthopaedic Clinical Specialist
Adjunct Professor, Emory University
Division of Physical Therapy
LCMCDAN@emory.edu
ledamcdaniel1@gmail.com