

Adolescent idiopathic scoliosis: conservative management and treatment

JASON BLACK BSc (Hons) MCSP

Clinical Manager, Scoliosis SOS

With contribution from **MICHAEL BRADLEY** BSc



Conservative management of scoliosis consists of either bracing or physiotherapeutic scoliosis-specific exercises (PSSE), and should initially be applied with the aims of limiting the progression of scoliosis above surgical thresholds and, in the longer term, of improving the patient's quality of life, pain and aesthetics. Bracing comes in all varieties; selected by a trained and experienced practitioner, it should be applied full time during the patient's adolescence and periods of growth. Exercise should be prescribed by a clinical expert and designed around curve-specific and proven modalities to target the individual's exact circumstances.

LEARNING OUTCOMES

- 1 Introduction to the aims of conservative management.
- 2 Recognition of use of bracing in the management of scoliosis.
- 3 Recognition of physiotherapeutic scoliosis-specific exercises.
- 4 Understanding resources available for further reference.

Aims of conservative management

The primary role of conservative scoliosis management is conventionally accepted as aiming to limit curve progression, especially during a patient's adolescent stages of growth (Weiss *et al* 2006a).

Typically, adolescent idiopathic scoliosis (AIS) does not, except in extreme cases, cause any significant health problems during growth. However, the resulting surface deformity frequently has a negative impact on the adolescent body image and self-esteem that can give rise to quality of life issues and, in worst cases, psychological disturbances.

While the treatment of scoliosis in adolescent patients is generally in an attempt to halt the progressive nature of the deformity, secondary complications can frequently be ignored or bypassed during initial assessment. No treatments succeed in absolute correction to a "normal" spine and even reduction of the deformity is difficult. If the scoliosis surpasses a critical threshold of a Cobb angle (Cobb 1948) of around 30°, the risk of health and social problems in adulthood increases significantly (Bettany-Saltikov *et al* 2014).

These problems can include reduced quality of life, disability,

pain, increased cosmetic deformity, functional limitations, sometimes pulmonary problems, and progression during adulthood. Because of this, management of scoliosis includes the prevention of secondary problems associated with the deformity.

In recent years, the consensus with regard to conservative management has changed and goals of treatment readdressed with the specific aims to show that the main focus of conservative management should be shifted from the precise measurement of the lateral curvature, to more socially relevant measures such as aesthetics, quality of life and pain (table 1).

Current knowledge in the UK and USA

A possible reason for the negative beliefs towards conservative management of scoliosis within the clinical community in western Europe and the USA is the lack of knowledge within the physical therapy community and associated clinical specialists. The teaching concerning scoliosis management at undergraduate and postgraduate level within the physiotherapy curriculum in the UK, Canada and the United States, to name a few, is minimal. Most clinicians, both

RANK	AIM	% OF RESPONDERS
1	Aesthetics	100%
2	Quality of life	91%
3	Disability	91%
4	Back pain	87%
5	Psychological wellbeing	84%
6	Progression in adulthood	84%
7	Breathing function	84%
8	Scoliosis Cobb degrees	84%
9	Need of further treatment in adulthood	81%

TABLE 1: Goals of treatment for scoliosis (Negrini *et al* 2012)

"NO TREATMENTS SUCCEED IN ABSOLUTE CORRECTION TO A 'NORMAL' SPINE AND EVEN REDUCTION OF THE DEFORMITY IS DIFFICULT"

physiotherapists and surgeons in these jurisdictions, normally do not appreciate the difference between PSSE and general physiotherapy and the knowledge of bracing protocols is somewhat limited to specialist centres and clinics.

A study conducted by Drake *et al* (2014) of 178 physical therapist students in the USA demonstrated that in a multiple-choice questionnaire of 10 questions concerning diagnosis and management of scoliosis, the average score was 43% and only 8% of the participants answered at least 70% questions correctly. In a follow-up study conducted by Black *et al* (2016), 206 final-year physiotherapy students from universities in the UK were asked seven multiple-choice questions about their knowledge of scoliosis. Of these, 165 completed the entire questionnaire and only 7% answered at least four questions correctly. These results were similar those of a comparable study completed in Polish universities (Cziazynski *et al* 2008).

With an increasing drive towards self-referral to physiotherapy in the UK, it is essential to know the different conservative management inputs available to patients with scoliosis.

Aspects of conservative management

There are two primary approaches to conservative therapy in scoliosis that should be recognised and discussed further:

BRACING THERAPY

Bracing, or spinal orthotics, is widely regarded as the main non-surgical treatment of AIS during a patient's growth period and can occasionally be used for adult scoliosis. It is regularly used independently or in combination



FIGURE 1: Boston brace

with exercises (Weiss *et al* 2006b). The definition of bracing is the application of external corrective forces to the trunk. In the current era of bracing, there is not a commonly accepted approach and so expertise and experience dictates the approach taken by the individual therapist. This has led to the development of several different schools of thought on brace construction (Negri & Grivas 2010).

A number of different types of brace have been developed internationally. These are named, primarily through the town of their development, the name of the designer, or their specific, theoretical approach. The braces traditionally available in the USA and the UK are the rigid Boston braces (figure 1), the flexible Spine-Cor braces (figure 2) and the more historically and now less frequently used Milwaukee Brace.

Throughout Europe there has been significant progress and development in relation to brace design and research, including that undertaken with the Lyon,

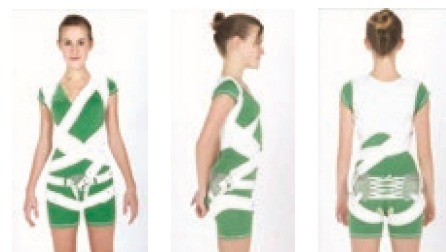


FIGURE 2: Spine-Cor brace

Sforzesco, Ginsengen and Cheneau braces.

No matter the type of brace applied, two issues prevail when considering the effectiveness of bracing treatment: compliance and prescription.

Compliance is imperative to successful bracing care and is incredibly hard to measure. It is usually accepted that the patient's and, where appropriate, their parents' report of how many hours a day the brace is worn is a reliable figure, and those who confess to non-compliance tend to have worse results from bracing treatment (MacLean *et al* 1989).

Some braces have been developed which can help monitor the compliance of the patient through the measurement of temperature or humidity sensors.

Another major issue with regard to the effectiveness of a brace is the prescribed time of wear on a daily basis. This treatment time can vary dramatically, but it is generally accepted and 📌

"THE KNOWLEDGE OF BRACING PROTOCOLS IS LIMITED TO SPECIALIST CENTRES AND CLINICS"

"OPINION ON PHYSIOTHERAPEUTIC SCOLIOSIS SPECIFIC EXERCISES IS DIVIDED"

recommended to be 23 hours a day in patients during main growth periods. The effectiveness of part-time bracing has been questioned heavily in recent years (Negrini & Grivas 2010).

THE BrAIST STUDY

In 2013, several medical centres joined together to perform a randomised controlled trial (RCT) to investigate whether bracing was effective in adolescents with curves between 20 and 40 degrees (Weinstein *et al* 2013). They set about to study not only if bracing therapy was successful in limiting curve progression to 50 degrees, but also to highlight what factors affected treatment success.

Known as the "BrAIST Study", it was the first of its kind and conclusively highlighted that, when bracing therapy was applied correctly with patients in high risk of progression to surgery, 72% of brace wearers could avoid surgical recommendations, compared to only 48% of patients in the observation group.

Alongside this, the authors highlighted both the importance of bracing compliance and treatment time, showing that as the brace wear time increased, so did the success rate (figures 3 and 4).

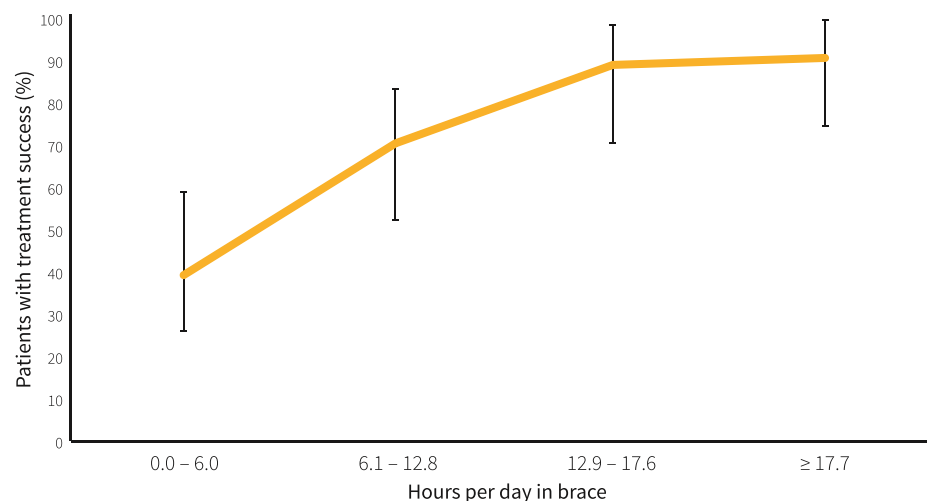


FIGURE 3: Rate of treatment success according to hours of daily brace wear (Weinstein *et al* 2013)

TREATMENT	SUCCESS (%)	FAILURE (%)	TOTAL
Brace	38 (74.5)	13 (25.4)	51
Observed	27 (41.5)	38 (58.5)	65
Total	65 (56.0)	51 (44.0)	116

FIGURE 4: Results of BrAIST study (Weinstein *et al* 2013)

PHYSIOTHERAPEUTIC SCOLIOSIS SPECIFIC EXERCISES

In contrast to the large amount of high-level research in place to support the application of bracing therapy in the treatment of scoliosis, opinion on physiotherapeutic scoliosis specific exercises (PSSE) is far more divided among international specialists. In fact the guidelines from the Scoliosis Research Society (SRS) state: "Alternative treatments to prevent curve progression... such as chiropractic medicine, physical therapy, yoga, etc. have not demonstrated any scientific value in the treatment of scoliosis. However, these and other methods can be utilized if they provide some physical benefit to the patient such as core strengthening, symptom relief, etc. These should not, however, be utilized to formally treat the curvature in hopes of improving the scoliosis" (SRS 2016).

The recently published Society of Scoliosis Orthopaedic Rehabilitation

and Treatment (SOSORT) guidelines recommend, given the perceived risk of progression based on the patient's age, skeletal maturity and curve severity, the use of PSSE as part of a range of interventions deemed appropriate, depending on the patient's and therapist's willingness to consider more or less aggressive options. In skeletally immature patients, i.e. those measured on the Risser sign (2010) of 3 or less, with curves between 11 degrees and over 30 degrees, and in skeletally mature patients measured at Risser 4 or 5 with curves from 11 to 45 degrees, SOSORT suggests exercises to pursue the following goals:

- to stop, or reduce curve progression at puberty
- to prevent or treat respiratory dysfunction
- to prevent or treat spinal pain syndromes
- to improve aesthetics via postural correction.

Further, when patients are prescribed a rigid brace, SOSORT always recommends the associated use of PSSE.

The main issue with PSSE when faced with the research is the lack of distinction within the literature between scoliosis specific exercises, general exercises, osteopathy, yoga etc., thus care should always be taken to apply proven and researched approaches with implementation of specific principles (Rigo & Grivas 2010). The latter generic exercises tend to consist of low impact stretching and strengthening activities, whereas the more specific PSSE are a



FIGURE 5: The Schroth method (Weiss 2011), practiced here at the Barcelona Scoliosis Physical Therapy School (BSPTS)



FIGURE 6: The scientific exercise approach to scoliosis (SEAS) (Romano *et al* 2015)

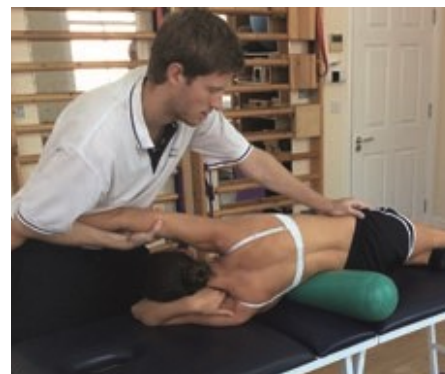


FIGURE 7: The functional individual approach to scoliosis (FITS) (Bialek 2011)

programme of curve-specific protocols individually adapted in response to the magnitude, site and characteristics of the individual patient's curve (Bettany-Saltikov *et al* 2014).

Traditionally accepted, widely used and recommended therapeutic approaches are available, all of which follow the four standard features described in the 2005 SOSORT consensus paper (Weiss *et al* 2006b):

- a) patient and family education
- b) 3D self-correction
- c) stabilisation in correction
- d) training in activities of daily living.

There are also a number of international centres that are totally dedicated to the treatment of scoliosis with the use of PSSE where, following medical evaluation, patients are taught exercises that are adapted to them and that can be incorporated into their daily living. These traditional schools of PSSE follow various methods devised by international research including the Schroth method (figure 5), the scientific exercise approach to scoliosis (SEAS) (figure 6), the Dobosiewicz method (Dobomed), the functional individual approach to scoliosis (FITS) (figure 7), the Lyon school, and the side shift method.

There are five main clinical conditions for which PSSE can be used:

1) Through sole use, as the primary treatment of AIS for mild curves, to limit and / or decrease progression and to try to avoid the use of a brace.

2) Before wearing a brace to improve the mobility and the elasticity of the spine and the trunk in order to obtain a better correction by the pressures of the brace pads.

3) In conjunction with the brace in order to reduce the side-effects such as muscle weakness, rigidity and flat back. The efficacy of internal brace pads can be improved with PSSE and exercises also help avoid the loss of 3D correction during the process of weaning off the brace.

4) During adulthood, if the scoliosis curves exceed certain thresholds, PSSE can help with any significant problems that may arise such as back pain, breathing dysfunction, contractures and progressive deformity.

5) Before and after surgical correction. Before surgery, the aim of PSSE is in maintaining the mobility of the curve to help achieve maximal correction during surgery. Post-surgery PSSE would aim to enhance the effects of surgery on back shape, balance and posture (Bettany-Saltikov *et al* 2014).

Summary

The level of evidence in the conservative management of AIS is high and is growing every year. Landmark pieces of research such as the BrAIST study are paving the way for further exploration into the conservative management of scoliosis and laying the foundations for a future that will be less focused on surgical intervention. It is widely recognised that a more holistic approach is required to treat the complexity of

issues and concerns that arise with the diagnosis of scoliosis.

The approach to scoliosis care should focus on evidence-based clinical practice (figure 8), the consequence of which will be that one patient's clinical experience can vary through treatment by different clinicians. Consideration should always be paid to the patient's own preferences, as well as the clinician's own personal experiences, especially when considering application of both bracing and PSSE.

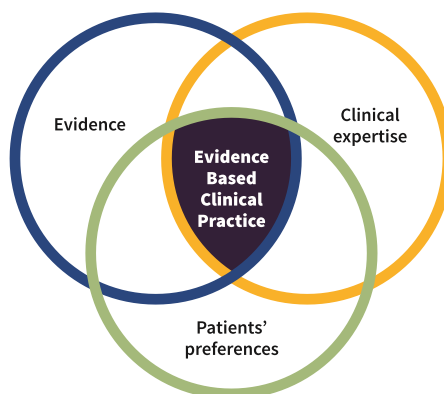


FIGURE 8: Evidence-based clinical practice (Negri *et al* 2012)

The Society of Scoliosis Orthopaedic Rehabilitation and Treatment (SOSORT) is an international society that was initially founded to develop research in the field of conservative management of scoliosis and it continues to promote clinical care through open access distribution of guidelines into the orthopaedic rehabilitation and treatment of idiopathic scoliosis.

The most recent guidelines were produced in 2011 (Negri *et al* 2012) ➔

**"CARE SHOULD ALWAYS BE TAKEN TO APPLY PROVEN
AND RESEARCHED APPROACHES"**

but are currently being updated for release in late 2016 proving that research into this field is evolving, with Level 1 evidence into bracing, and several research studies thrusting increased focus into the application of PSSE by trained and experienced practitioners, using methods other than "usual physiotherapy" (Fusco *et al* 2011).

About the author

Jason Black currently works as Clinical Manager and physiotherapist at Scoliosis SOS, London. He has worked predominantly with patients suffering from scoliosis and hyper-kyphosis for more than six years, treating more than 1,000 patients in this time.

Registered with both the CSP and HCPC, Jason has travelled internationally to further his knowledge of scoliosis and is a registered practitioner in the ScolioGold Method (UK), FITS Method (Poland) and SEAS Method Level I and II (Italy). He is also an accredited Dynamic Movement Orthotics and Langer Orthotics Practitioner.

Jason is a member of the Communication Committee for the SOSORT and has presented research at SOSORT conferences in Weisbaden, Germany (2014) and Banff, Canada (2016) as well as being a guest lecturer at many hospitals and universities in the UK.

CONTACT DETAILS

jasonblack@scoliosissos.com

Phone: (+44) 207 488 4428

Website: www.scoliosissos.com

For further information:

Scoliosis SOS: www.scoliosissos.com

Society of Scoliosis Orthopaedic Rehabilitation and Treatment (SOSORT): www.sosort.mobi

SRS Adolescent Idiopathic Scoliosis: <https://www.srs.org/professionals/online-education-and-resources/conditions-and-treatments/adolescent-idiopathic-scoliosis>

References

Bettany-Saltikov J, Parent E, Romano M, Villagrasa M. Physiotherapeutic scoliosis-specific exercises for adolescents with idiopathic scoliosis. *European Journal of Physical Rehabilitation Medicine* 2014;50(1):111-21

Bialek M. Conservative treatment of idiopathic scoliosis according to FITS concept: presentation of the method and preliminary, short term radiological and clinical results based on SOSORT and SRS criteria. *Scoliosis* 2011;6:25

Black J, Bradley M, Drake S, Glynn D, Maude E. *Current knowledge of scoliosis in physical therapy students trained in the United Kingdom*. SOSORT Conference, Banff 2016

Cobb JR. Outline for the study of scoliosis. *American Academy of Orthopedic Surgeons*. 1948;7:261-275

Cziazynski D, Czernicki K, Durmala J. Knowledge about idiopathic scoliosis among students of physiotherapy. *Studies in Health Technology and Informatics* 2008;140:281-285

Drake S, Glidewell M, Thomas J. Current knowledge of scoliosis in physical therapy students trained in the United States. *Scoliosis and Spine Disorders* 2014;9(1):O64

Fusco C, Zaina F, Atanasio S, Romano M, Negrini A, Negrini S. Physical exercises in the treatment of adolescent idiopathic scoliosis: an updated systematic review. *Physiotherapy Theory and Practice* 2011;27(1):80-114

MacLean W, Green N, Pierre C, Ray D. Stress and coping with scoliosis: psychological effects on adolescents and their families. *Journal of Paediatric Orthopaedics* 1989;9(2):257-61

Negrini S, Grivas T. Introduction to the "scoliosis" journal brace technology thematic series: increasing existing knowledge and promoting future developments. *Scoliosis and Spinal Disorders* 2010;5(2)

Negrini S, Aulisa A, Aulisa L, Circo A, de Mauroy JC, Durmala J, Grivas T, Knott P, Kotwicki T, Maruyama T, Minozzi S, O'Brien J, Papadopoulos D, Rigo M, Rivard C, Romano M, Wynne J, Villagrasa M, Weiss HR, Zaina F. 2011 SOSORT guidelines: orthopaedic and rehabilitation treatment of idiopathic scoliosis during growth. *Scoliosis and Spinal Disorders* 2012;7:3

Negrini S, Fusco C, Minozzi S, Atanasio S, Ziana F, Romano M. Exercises reduce the progression rate of adolescent idiopathic scoliosis: Results of a comprehensive systematic review of the literature. *Disability and Rehabilitation* 2008;(10)30:772-785

Rigo M, Grivas T. Rehabilitation schools for scoliosis thematic series: describing the methods and results. *Scoliosis and Spinal Disorders* 2010;5:27

Risser JC. The Iliac apophysis; an invaluable sign in the management of scoliosis (reprint of 1958 article). *Clinical Orthopaedics and related research* 2010;468(3):646-653

Romano M, Negrini A, Parzini S, Tavernaro M, Zaina F, Donzelli S, Negrini S. SEAS (Scientific Exercises Approach to Scoliosis): a modern and effective evidence based approach to physiotherapeutic specific scoliosis exercises. *Scoliosis and Spinal Disorders* 2015;10:3

Weinstein S, Dolan L, Wright J, Dobbs M. Effects of bracing in adolescents with idiopathic scoliosis. *New England Journal of Medicine* 2013;369:1512-1521

Weiss HR. The method of Katharina Schroth – history, principles and current development. *Scoliosis and Spinal Disorders* 2011;6:17

Weiss HR, Negrini S, Rigo M, Kotwicki T, Hawes M, Grivas T, Maruyama T, Landauer F. Indications for conservative management of scoliosis (guidelines). *Scoliosis and Spinal Disorders* 2006a;1:5

Weiss HR, Negrini S, Hawes M, Rigo M, Kotwicki T, Grivas T, Maruyama T. Physical exercises in the treatment of idiopathic scoliosis at risk of brace treatment – SOSORT consensus paper 2005. *Scoliosis* 2006b;1:6