

The Role of Physiotherapy in the Treatment of Scoliosis

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Introduction

The role of physiotherapists in the treatment of scoliosis can be somewhat unclear and sometimes controversial. Many therapists have little exposure to the treatment of this condition^{4 5} which is in part related to the lack of education on spinal deformities at university as well as the relatively low acceptance rate by scoliosis surgeons and specialists for the inclusion of physiotherapy in the comprehensive management of scoliosis. Despite increasing research supporting treatment, the number one reason given for this lack of inclusion is limited evidence of efficacy.

This article seeks to review the diagnostic factors which influence physiotherapy treatment and to review the known efficacy and role of physiotherapy in the treatment of Adolescent Idiopathic Scoliosis.

Key Considerations in the Treatment of Scoliosis

1. Diagnosis

Scoliosis is a structural alteration to the normal curves in the spine. During active growth periods the spine develops curves in the frontal and sagittal planes however the scoliotic spine develops with axial rotation which alters the normal development of these curvatures. These changes can result in a rib hump or a rotational lumbar prominence as well as altering the normal lordosis and kyphosis resulting in a kypho-scoliosis, thoracic lordosis, sway, flat back, etc.

For a patient to be diagnosed as having a scoliosis, the lateral curvature in the frontal plane must measure greater than 10 degrees. Approximately 2-3%⁶ of children under the age of 16 will have scoliosis however the majority will not progress.

Curves are commonly defined by the location of the apex and the Cobb angle. The Cobb angle is a measurement of the angle in the frontal plane between the superior vertebral end plate of the most tilted vertebra above the curve apex and the lower endplate of

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⁴ Parent EC, Buyks D, Clough J et al, Therapy objectives, treatments modalities and outcomes used by physiotherapists for adolescent idiopathic scoliosis in Alberta, Canada

⁵ Cindy L. Marti, Steven D. Glassman, Patrick T. Knott, Leah Y. Carreon, and Michael T. Hresko, Scoliosis Research Society members attitudes towards physical therapy and physiotherapeutic scoliosis specific exercises for adolescent idiopathic scoliosis, *Scoliosis*. 2015; 10: 16.

⁶ Weinstein SL, Dolan LA, Cheng JCY, Danielsson AJ, Morcuende JA. Adolescent idiopathic scoliosis. *Lancet*. 2008;371(9623):1527–1537.

the most tilted vertebra below the apex. Measures of vertebral rotation may also be quantified through imaging.

Curves may be classified as major and minor⁷ which denotes the relationship of their magnitude to each other. If more than one curve is present it may be described as a double major or a major with an associated minor curve(s). The Lenke⁸ or SRS classifications are the most commonly used taxonomies of curve type.

The Lenke system, while widely used by surgeons to plan surgeries, is not widely used by physiotherapists as it requires side-bending radiographs and is meant for bigger curves. Scoliosis Research Society (SRS) definitions with reference to curve apex are as follows: Cervical (C1 to C6-6 disc), cervico-thoracic (C7 to t1), Thoracic (T2 to T11-12 disc), Thoraco-lumbar (T12 to L1), Lumbar (L1-2 to L4-5 discs), and Lumbosacral (L5 and below)⁹.

For a physiotherapist the location of curve can be important when using Physiotherapeutic Specific Scoliosis Exercises (PSSE)¹⁰ as these treatment techniques base their approach on the specificity of curve location. This knowledge also determines the need and effectiveness of other types of treatment which can influence treatment planning i.e. bracing is less effective in a thoracic double major curve.

⁷ Revised Glossary of Terms SRS Terminology Committee and Working Group on Spinal Classification

⁸ <http://www.orthobullets.com/spine/2076/lenke-classification-of-ais>

⁹ SRS E-Text: The Primary Resource for Education in the Field of Spine Deformity Care <http://etext.srs.org/>

¹⁰ See below



2. Idiopathic vs. Non-idiopathic scoliosis

Scoliosis is typically divided into two major categories: idiopathic and non-idiopathic. This division reflects the underlying causes with the term idiopathic identifying the lack of consensus on the cause of these curves. One of the key features of the idiopathic-type of scoliosis is that it is not associated with any other conditions.

a. Idiopathic scoliosis

Idiopathic scoliosis is typically divided into 4 categories based on age and risk for progression. There is more difficulty determining risk for progression of the early onset types of scoliosis (<age 10) which justifies the need for closer monitoring in this age group. The risk for progression is more predictable in the adolescent age group and is sometimes described as linear, however each patient should be approached individually as not all curves progress as predicted.

- I. Infantile idiopathic scoliosis is diagnosed when first seen in a child under age 3
- II. Juvenile idiopathic scoliosis is diagnosed in children ages 4 to 9.

- III. Adolescent idiopathic scoliosis is diagnosed when the spine curvature changes during the growth spurts commonly occurring around puberty (between ages 10 and 18)¹¹.
- IV. Adult idiopathic scoliosis occurs in patients older than 18. This condition can also be referred to as de Novo scoliosis. Many of these new diagnoses are related to spinal degeneration however, when the onset is not coincident with periods of skeletal growth, other non-idiopathic causes should be considered.

b. Non-idiopathic scoliosis

The non-idiopathic type of scoliosis is associated with other conditions and/or underlying causes. The causes are typically divided into two categories.

- I. Neuromuscular scoliosis. This type of scoliosis is associated with neuromuscular diseases i.e., Arnold-Chiari malformation/syrinx or trauma to the spinal cord.
- II. Syndromic scoliosis is related to other diseases i.e. Marfans syndrome, spina bifida.

3. Indications for additional monitoring

For a physiotherapist working with scoliosis a primary consideration is determining the type of scoliosis. If the patient has been seen by a specialist or pediatrician this diagnosis may already be clear however when the physiotherapist is the first to diagnose the condition consideration should be given to the need for further investigation and/or referral.

Screening for further testing can be particularly important in the non-idiopathic patient as an undiagnosed Marfan's syndrome, syring, Chiari Malformation, etc. can have serious health consequences¹². These patients should be referred for monitoring/testing by the appropriate specialist. The following considerations can assist in determining the need for additional testing¹³:

1. Is the patient under age 10?

The most common scoliosis (AIS) occurs in the teens. Earlier onset need to be monitored and/or investigated more closely both for the unpredictability of the progression and for the likelihood of non-idiopathic causes.

2. Is the patient still growing?

¹¹ <http://www.srs.org/professionals/online-education-and-resources/srs-e-text>

¹² Horn P, Scoliosis Early Identification of Affected Patients, Clinician Reviews August 2012;Vol 22;8: 16-22

¹³ Janicki J. et al, Scoliosis: Review of diagnosis and treatment, Paediatr Child Health Vol 12 No 9 November 2007

Bracing is only effective while the spine is still growing. There is typically a window of approximately 2 years, occurring around puberty, when this treatment can limit the likelihood of curve progression. If the patient is under age 18 consideration should be given to referral for quantification of spinal maturity and degree of curvature.

3. How large is the curve?

The larger the curve the more likely it is to progress¹⁴. The younger/less skeletally mature the patient is the greater the risk for progression¹⁵. Younger children and adolescents, particularly with larger curves, are more likely to require additional monitoring and/or intervention.

4. Is the patient male or female?

Although the incidence of scoliosis in males and females is equal the presence of larger curves is more typical in females. A significant curve in a male can be more indicative of non-idiopathic type of scoliosis and sometimes represents an indication for an MRI¹⁶.

5. Are there other signs of concern?

The presence of upper motor neuron signs, connective tissue disorders, café au lait¹⁷ spots, spinal hairy patch etc. all can be markers of non-idiopathic types of scoliosis. These factors can be indicative of the need for additional investigation.

4. Treatment of AIS

Primary goal of treatment

As there is no consensus on causation, the prevention of scoliosis cannot be a goal at this time. The primary goal of treatment is prevention of curve progression.

Within this goal the first consideration is to keep the curve to less than 30-35 degrees. This magnitude is often a threshold for other treatment as these curves are more at risk for progression. Curves less than 30 degrees at skeletal maturity present a low risk of continued progression in adults. Untreated curves of 50 degrees and greater are predicted to progress at .5 degree per year¹⁸.

¹⁴ Weinstein SI, Adolescent Idiopathic Scoliosis: Prevalence and Natural history. Instr Course Lect 1988;38:115-126

¹⁵ Lonstein JE, Carlson JM. The Prediction of Curve Progression in Untreated Idiopathic Scoliosis During Growth. J Bone Joint Surg Am. 1984;66:1061-1071

¹⁶ <http://www.srs.org/professionals/online-education-and-resources/srs-e-text>

¹⁷ <http://www.srs.org/professionals/online-education-and-resources/srs-e-text>

¹⁸ Megan Raverty M, Mehbod A, Garvey T, Transfeldt E, Schwender J, Lonstein J, Winter R, Natural History of Adolescent Idiopathic Scoliosis of 50° or Greater at Maturity: Rate of Progression and Functional Outcomes, The Spine Journal 9(10), Supplement Page p.160S

The second threshold is 50 degrees. When the curve exceeds this magnitude surgery is often recommended. Most studies¹⁹ report the strongest predictive factors in determining the risk for progression of idiopathic scoliosis are age, magnitude of curve, and gender.

Currently the strongest acceptance for prevention of progression is for bracing and surgery. Recently, the BrAIST randomized controlled trial demonstrated convincingly the ability of bracing to prevent progression to surgery indication thresholds with 72% success compared to only 48% in the group under observation²⁰. This trial also demonstrated clearly the role of compliance in the brace treatment effect showing that when a rigid brace prescribed for full time wear (<18hr/day) is worn at least 13 hours a day the probability of success is high (<90%).

Despite the wide acceptance for surgery, a systematic review by the Cochrane Collaboration failed to find sufficient evidence to support its use in severe curve management. Bettany-Saltikov et al²¹ looked to compare surgical vs. non-surgical treatment of curves over 45 degrees but were unable to find any RCT's or prospective studies that met the criteria. They were unable to make any conclusions of the effectiveness of surgical vs. non-surgical management of severe adolescent idiopathic scoliosis of over 45 degrees.

Physiotherapy Goals of Treatment

In physiotherapy the goals of treatment are broader than strictly the prevention of curve progression.

The SOSORT survey by Marti et al.²² of SRS scoliosis specialists documented the key reasons for referral to physiotherapy. These referral patterns were separated into standard physiotherapy treatments and PSSE's. In Parent et al's study the survey of the standard physiotherapy techniques listed the following approaches used in the treatment of AIS:

1. stabilization exercises (76%)

¹⁹<http://www.boneandjointburden.org/docs/The%20Burden%20of%20Musculoskeletal%20Diseases%20in%20the%20United%20States%20%28BMUS%29%202nd%20Edition%20%282011%29.pdf>
<http://www.boneandjointburden.org/docs/The%20Burden%20of%20Musculoskeletal%20Diseases%20in%20the%20United%20States%20%28BMUS%29%202nd%20Edition%20%282011%29.pdf>

²⁰ N Engl J Med. 2013 Oct 17;369(16):1512-21. doi: 10.1056/NEJMoa1307337. Epub 2013 Sep 19.

Effects of Bracing in Adolescents With Idiopathic Scoliosis. Weinstein SL¹, Dolan LA, Wright JG, Dobbs MB

²¹ Bettany-Saltikov, Weiss HR, Chockalingham N, Taranu S, Srinivas S, Hogg J, Whittaker V, Kalyan RV, Arnell T, Surgical vs. Non-Surgical Interventions for People with Adolescent Idiopathic Scoliosis, a Cochrane Systematic Review, 2015:Issue 4

²² Cindy L. Marti, Steven D. Glassman, Patrick T. Knott, Leah Y. Carreon, and Michael T. Hresko, Scoliosis Research Society Members Attitudes Towards Physical Therapy and Physiotherapeutic Scoliosis Specific Exercises for Adolescent Idiopathic Scoliosis, Scoliosis. 2015; 10: 16.

2. non-scoliosis specific postural approaches (73%)
3. mobilizations (55%)

In the Marti study the most common specific PSSE used were:

1. Schroth – Germany (57%)
2. Side Shift – UK (22%)
3. SEAS – Italy (21%)
4. FITS – Poland (19%)

The top reasons for the surgeon’s prescribing standard physiotherapy were:

1. in conjunction with brace treatment (58 %),
2. small curves (48 %)
3. improving post-operative outcomes (37 %)
4. treatment of pain (25 %) ²³
5. Improving aesthetics (40 %)

The top reasons for the surgeon’s prescribing PSSE’s were:

1. improve aesthetics (62 %)
2. to prevent curve progression (60 %)
3. improve quality of life (53 %).

Similarly, the SOSORT guidelines²⁴, from the international Society on Scoliosis Orthopedic and Rehabilitation Treatment identify the following four common objectives to be pursued when using PSSE’s:

1. limit curve progression
2. prevent respiratory dysfunction
3. control pain
4. improve postural appearance.

5. Physiotherapy Role in Prevention of Curve Progression

Although one of the goals of physiotherapy may be to reduce curve progression, despite increasing research support, this goal remains controversial at this time. Early support is seen in the 2012 Cochrane systematic review²⁵ for the use of PSSE’s in reducing curve

24 2011 Sosort Guidelines: Orthopaedic and Rehabilitation Treatment of Idiopathic Scoliosis During Growth. Negrini S, Aulisa AG, Aulisa L, Circo AB, de Mauroy JC, Durmala J, Grivas TB, Knott P, Kotwicki T, Maruyama T, Minozzi S, O'Brien JP, Papadopoulos D, Rigo M, Rivard CH, Romano M, Wynne JH, Villagrasa M, Weiss HR, Zaina F. *Scoliosis*. 2012 Jan 20;7(1):3. doi: 10.1186/1748-7161-7-3.

25 Romano M, et al, Exercises for Adolescent Idiopathic Scoliosis: A Cochrane Systematic Review, *Spine* 2013 Jun 15;38(14):E883-93.

progression. The Negrini study²⁶ has shown value of the use of PSSE's in reducing curve progression both with and without bracing.

Of note, in Monticone et al's study²⁷, the percentages of patients presenting improvement $>5^\circ$, stable curves (changes $< 5^\circ$) or deterioration over 5° were 62%, 38% and 0% in the exercise group and 0%, 92% and 8% in the control group, respectively. In response to 6 weeks of supervised therapy, participants in Kuru et al's trial²⁸ assessed after 24 weeks showed larger improvements in Cobb angles, Angle of trunk rotation, height of gibbosity and waist asymmetry but not SRS-23 scores than both controls under observation or having done unsupervised exercises. Other exercise trials²⁹ are ongoing and other results await publication which suggests the evidence base on PSSE effectiveness will continue to grow stronger in the near future.

With this increase in data, a shift in the acceptance of scoliosis treatment is starting to be seen in changes to the position statements of the Scoliosis Research Society (SRS) and other influential scoliosis-related associations. The 2014 SRS Statement on Physiotherapeutic Scoliosis Specific Exercises Dr. Timothy Hresko, MD: Chair, SRS Non-operative committee includes the following statement:

“Physiotherapy Scoliosis Specific Exercises have been used with spinal orthotic management in the treatment of progressive idiopathic scoliosis. The combination of the two modalities may offer advantages over more simplified treatment plans”.

In the 2015 Screening for the Early Detection for Idiopathic Scoliosis in Adolescents SRSPONA/AAOS/AAP³⁰ position Statement Dr. Timothy Hresko, MD included the following statement supporting PSSE's in scoliosis management:

“Other means for non-operative treatment of scoliosis have also been studied. Scoliosis specific exercises used to supplement brace wear or prevent progression in mild curves have been reported. A randomized clinical trial of patients with mild scoliosis of 10-20 degrees has shown that scoliosis specific exercises may prevent progression to the level of deformity that would result in brace treatment”.

²⁶ Negrini, S The Effectiveness of Combined Bracing and Exercise in Adolescent Idiopathic Scoliosis Based On SRS And SOSORT Criteria: A Prospective Study,. BMC Musculoskeletal Disorders 2014, 15:263

²⁷ Monticone M, Ambrosini E, Cazzaniga D, Rocca B, Ferrante S (2014) Active Self-Correction and Task-Oriented Exercises Reduce Spinal Deformity and Improve Quality Of Life In Subjects With Mild Adolescent Idiopathic Scoliosis. Results of a Randomised Controlled Trial. Eur Spine J 23(6):1204–1214

²⁸ Kuru T¹, Yeldan İ², Dereli EE³, Özdiñler AR², Dikici F⁴, Çolak İ, The Efficacy of Three-Dimensional Schroth Exercises in Adolescent Idiopathic Scoliosis: A Randomised Controlled Clinical Trial. ⁵Clin Rehabil. 2016 Feb;30(2):181-90.

²⁹ clinicaltrial.gov NCT01610908, NCT02807545

³⁰ SRS - Scoliosis Research Society, POSNA – Paediatric Orthopaedic Society North America, AAOS –American Academy of Orthopaedic Surgeons, AA_ - American Academy of Paediatrics

4. Physiotherapy Role in Pain Management

In her review Marti noted that the most common concern of the specialists is the alleviation of pain (72%). Despite this high level of concern only 25% of the specialists surveyed refer to physiotherapy for pain management. This discrepancy may reflect the perception that pain in scoliosis is considered a relatively negligible factor and/or the lack of research in this area.

The 50 year longitudinal review by Dr. Weinstein et al³¹ confirmed an increased prevalence of low back pain in untreated scoliosis. With an average age of 66 at the conclusion of the study, 61% of the scoliosis group reporting chronic low back pain vs. 35% of the age-matched control group. However this study also determined that the intensity of the pain was no worse than controls. There was no impact on disability with the majority being gainfully employed or homemakers.

The following two concluding statements from this review on the relationship of low back pain to function have likely had strong influence on perceptions of pain and the requirement for treatment in this population.

“Although the prevalence of back pain in untreated scoliosis likely exceeds the general population it does not appear to cause excessive disability.”

“Although scoliosis patients report more chronic back pain, those with pain have similar profiles in terms of duration and intensity of their peers and their ability to work and perform everyday activities is similar to their peers. Additionally, back pain had no larger impact on work and activities for scoliosis patients than it did for controls.”

When reading Weinstein’s article the conclusions should be viewed in context with the reference that previous perceptions of scoliosis by health care professionals predicted a life of pain and disability. These results support a better prognosis for function however based on this study the need for physiotherapy treatment for pain is at a minimum consistent with what is required in the general population and is likely to have a higher requirement.

While at this time there is limited research looking at the provision of physiotherapy for back pain in the scoliosis patient, recent evidence is promising. Of note, in Monticone et al’s³² study, participants in the exercise group also showed larger improvements in the

³¹ Weinstein SL, Dolan La, Spratt KF, Peterson KK, Spoonamore MJ, Ponsetti IV, Health and Function of Patients with Untreated Idiopathic Scoliosis: A 50 Year Natural History Study, JAMA 2003:Vol 289:555

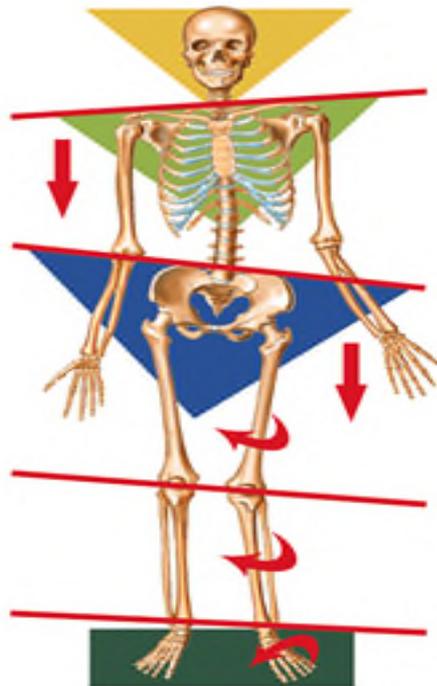
³² Monticone M, Ambrosini E, Cazzaniga D, Rocca B, Ferrante S (2014) Active Self-correction and Task-oriented Exercises Reduce Spinal Deformity and Improve Quality of Life in Subjects with Mild Adolescent Idiopathic Scoliosis. Results of a Randomised Controlled Trial. Eur Spine J 23(6):1204–1214

function, pain, self-image and mental health of the SRS-22 questionnaire. Schreiber et al³³ also found significantly larger benefits with Schroth exercises than in controls on SRS-22 pain and self-image domains. Further Zapata et al³⁴ showed in a RCT that spinal stabilization exercises helped reduce the numeric pain rating scores and the patient-specific functional scales scores in patients receiving supervised than unsupervised 8 week of therapy.

5. Physiotherapy and Screening for Scoliosis

Although screening for scoliosis is no longer standard, there is increasing support for regular testing during growth periods. A task force from the Scoliosis Research Society³⁵ recommends that females be screened twice, at age 10 and 12 years of age. Males should be screened once at between ages 13-14. This frequency reflects the increased risk in females for larger curves.

Observation of standing posture asymmetries followed by observation of the spine in forward flexion³⁶ are the norms for determining if further testing is required i.e. 3 foot



standing view X-ray.

³³ The Effect Of Schroth Exercises Added to the Standard of Care on the Quality of Life and Muscle Endurance in Adolescents With Idiopathic Scoliosis - An Assessor and Statistician Blinded Randomized Controlled Trial: "SOSORT 2015 Award Winner". Schreiber S, Parent EC, Moez EK, Hedden DM, Hill D, Moreau MJ, Lou E, Watkins EM, Southon SC. *Scoliosis*. 2015 Sep 18;10:24.

³⁴ Spinal Stabilization Exercise Effectiveness for Low Back Pain in Adolescent Idiopathic Scoliosis: A Randomized Trial.

Zapata KA¹, Wang-Price SS, Sucato DJ, Thompson M, Trudelle-Jackson E, Lovelace-Chandler V.

³⁵ <https://www.srs.org/about-srs/news-and-announcements/position-statement---screening-for-the-early-detection-for-idiopathic-scoliosis-in-adolescents>

³⁶ <http://www.tsrhc.org/scoliosis-screening>

Physiotherapists are well suited through their education and training to perform these screening tests. The observation of posture for asymmetries should include the frontal alignment of the spine, the height of the shoulders, the hip and waist shapes and the forward bending test.

The forward bending test consists of checking if the spine is straight while the patient bends forward slowly beginning with the neck with the hands together while keeping the legs straight until the hands are between the knees. If a side to side back difference is noted and a spine deviation is noted it suggests a scoliosis is present. Using a scoliometer to quantify the amount of side to side height difference during the forward bending test tilt exceeding 5 to 7 degrees³⁷ is suggestive that a scoliosis will be detected on radiographs.



The importance to emphasize screening for scoliosis is further supported by the fact that bracing and exercise treatments to be effective need to be applied to smaller curves before reaching skeletal maturity. Early detection of scoliosis is therefore important to identify

³⁷ <http://www.srs.org/about-srs/quality-and-safety/position-statements/screening-for-the-early-detection-for-idiopathic-scoliosis-in-adolescents>

adolescents at risk of progression and offer the chance to try non-operative therapies while they may be most effective³⁸.

6. PSSE's vs. Standard Physiotherapy

Physiotherapeutic Scoliosis Specific Exercises, also known as Scoliosis Specific Exercises (SSE's), differ from standard physiotherapy exercises. In the 2014 European Journal of Physical Medicine and Rehab, Dr. Josette Bettany–Saltikov et al³⁹ listed the key features of PSSE as:

1. Individually adapted to a patient's curve site, magnitude and characteristics
2. Performed with the therapeutic aim of reducing the deformity and preventing its progression
3. Aim to stabilize the improvements achieved with the ultimate goal of limiting the need for corrective bracing or the necessity of surgery

Additional elements may include:

1. Auto-correction,
2. Spinal elongation,
3. Isometric exercise contraction,
4. Individually taught
5. Inserted into stabilizing exercises
6. Rotational breathing

A review of the difference in the schools of thought are beyond the scope of this article however Dr Bettany-Saltikov's⁴⁰ chapter in the text book Physical Therapy Perspectives in the 21st Century provides a substantial review of the differences and commonalities of the major schools of scoliosis treatment. Similarly, a recent overview has been published in Scoliosis and Spinal Disorders⁴¹.

In Parent et al's survey of the highest ranked perceived useful treatment methods by Alberta physiotherapists, the top choices included:

1. stabilization exercises (76%)
2. non-scoliosis specific postural approaches (73%)

³⁸ <http://www.srs.org/about-srs/quality-and-safety/position-statements/screening-for-the-early-detection-for-idiopathic-scoliosis-in-adolescent>

³⁹ Bettany-Saltikov J, Parent EC, Romano M, Villagrassa M, Negrini S, Physiotherapeutic Scoliosis-Specific exercises for Adolescents with Idiopathic Scoliosis, Eur J Phys Med Rehab 2014;50, 111-121

⁴⁰ Bettany-Saltikov J, et al, Physical Therapy For Adolescents With Idiopathic Scoliosis, Physical Therapy Perspectives In The 21st Century – Challenges And Possibilities, 2012.

⁴¹ Hagit Berdishevsky H, Lebel VA, Bettany-Saltikov J, Rigo M, Lebel A, Hennes A, Romano M, Białek M, M'hango A, Betts T, de Mauroy JC, Jacek Durmala J, Physiotherapy Scoliosis-Specific Exercises – A Comprehensive Review of Seven Major Schools Scoliosis and Spinal Disorders 2016;11:20, August 2016

3. mobilizations (55%)

No physiotherapist reported the use of PSSE's in this review. This likely demonstrates a need to educate Canadian physiotherapists on the most recent evidence supporting the use of PSSE in the management of scoliosis.

7. Additional Resources for Scoliosis

Patients

a. Curvy Girls

International scoliosis peer support group. Providing support for adolescent girls both online and through meetings. Looks to destigmatize the diagnosis and the wearing of braces through peer support.

Website address: <http://www.curvygirlsscoliosis.com/>

b. SOSORT – Society on Scoliosis Orthopaedic and Rehabilitation Treatment

An international multidisciplinary organization including scientists, healthcare professionals, patients and their families

Website address: <http://www.sosort.mobi/index.php/en/>

c. National Scoliosis Foundation

A patient led advocacy and support foundation.

Website address: <http://www.scoliosis.org/>

Therapists

a. SOSORT - Society on Scoliosis Orthopaedic and Rehabilitation Treatment

Founded in 2006, and brings together scientists and clinicians focused on the conservative treatment of spinal deformities. A multidisciplinary organization including scientists, healthcare professionals, patients and their families.

Website address: <http://www.sosort.mobi/index.php/en/>

b. SRS – Scoliosis Research Society

Founded in 1966 its membership includes spine surgeons, researchers, physician assistants, orthotists and welcomes other allied health professionals working with scoliosis. It provides information for practitioners and families.

Website address: <http://www.srs.org>

c. Outcome measures

The core outcomes monitored to determine if scoliosis is progressive or if curves are improved by treatment is the Cobb angle obtained from radiographs of the full spine⁴².

On radiographs, measurements of rib alignment vertebra and pelvis alignments can also

⁴²<http://www.srs.org/professionals/online-education-and-resources/srs-e-text>

be monitored⁴³. The degree of vertebral rotation in particular has been shown to be a useful predictor of progression⁴⁴. The sagittal spinal alignment, especially in adults is closely related to pain and quality of life⁴⁵.

Depending on the domain of research several different types of outcome measures have been used including pain ratings, Roland Morris Questionnaire, Oswestry, Euro-QoL D5. In addition, the following two questionnaires are common outcome measures more specific to AIS.

- i. SAQ – Spinal Appearance Questionnaire⁴⁶
- ii. SRS 22 – Scoliosis-Research Society questionnaire⁴⁷

However, in patients with small curves, these questionnaires originally designed for surgical cases have demonstrated high ceiling effects⁴⁸. Since physiotherapists work with scoliosis is also focused on esthetics, a number of subjective⁴⁹ ⁵⁰ photographic ⁵¹ ⁵² and 3D sophisticated postural assessments⁵³ have also been recommended.

Conclusions

The role of physiotherapists in the treatment of scoliosis is evolving. Increasingly, research is identifying the need for treatment as well as defining role of physiotherapist in the management of this condition. Screening for early diagnosis, prevention of curve progression, bracing stabilization exercises, pain management are all roles that physiotherapy may assist in however awareness of the critical points, which require the involvement of other members of the team, are important to ensure comprehensive care.

43 <http://www.oref.org/docs/default-source/default-document-library/sdsg-radiographic-measuremnt-manual.pdf?sfvrsn=2>

44 Nault ML1, Mac-Thiong JM, Roy-Beaudry M, Turgeon I, Deguise J, Labelle H, Parent S. Three-Dimensional Spinal Morphology Can Differentiate Between Progressive and Nonprogressive Patients With Adolescent Idiopathic Scoliosis at the Initial Presentation: A Prospective Study. *Spine (Phila Pa 1976)*. 2014 May 1;39(10):E601-6

45 Terran J1, Schwab F, Shaffrey CI, Smith JS, Devos P, Ames CP, Fu KM, Burton D, Hostin R, Klineberg E, Gupta M, Deviren V, Mundis G, Hart R, Bess S, Lafage V. The SRS-Schwab Adult Spinal Deformity Classification: Assessment and Clinical Correlations Based on A Prospective Operative and Nonoperative Cohort.; International Spine Study Group.

46 Carreon, Leah Y, Spinal Appearance Questionnaire: Factor Analysis, Scoring, Reliability, and Validity Testing *Spine*: 15 August 2011 - Volume 36 - Issue 18 - p E1240–E1244

47 M.A. Asher, et al , Discrimination Validity Of The Scoliosis Research Society – 22 Patient Questionnaire: Relationship To Idiopathic Scoliosis Curve Pattern And Curve Size *Orthopaedic Proceedings*, March 2003

48 Parent EC, Dang R, Hill D, Mahood J, Moreau M, Raso J, Lou E: Score distribution of the scoliosis research society-22 questionnaire in subgroups of patients of all ages with idiopathic scoliosis. *Spine (Phila Pa 1976)*. 2010 Mar 1;35(5):568-77.

49 . Zaina F, Negrini S, Atanasio S. TRACE (Trunk Aesthetic Clinical Evaluation), A Routine Clinical Tool to Evaluate Aesthetics In Scoliosis Patients: Development From the Aesthetic Index (Ai) And Repeatability. *Scoliosis*. 2009;4:3.

50 Kotwicki T. Evaluation of Scoliosis Today: Examination, X-Rays and Beyond. *Disabil Rehabil*. 2008;30(10):742–51.

51 Fortin C, Feldman DE, Cheriet F, Labelle H., Clinical Methods For Quantifying Body Segment Posture: A Literature Review. *Disabil Rehabil*. 2011;33(5):367-83.

52 Fortin C, Feldman DE, Cheriet F, Gravel D, Gauthier F, Labelle H. Reliability of a Quantitative Clinical Posture Assessment Tool Among Persons With Idiopathic Scoliosis. *Physiotherapy*. 2012 Mar;98(1):64-75.

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Acceptance of the physiotherapist's roles in the treatment of this condition requires further dissemination of the existing research within and beyond our profession. Continued studies are also needed to further consolidate the role of the area of pain management and to further define optimum protocols for prevention of curve progression.