

## Information Statement

### AAOS-SRS-POSNA-AAP

#### Screening for Idiopathic Scoliosis in Adolescents

B. Stephens Richards, MD

Michael Vitale, MD

*This Statement was developed as an educational tool based on the opinion of the authors. It is not a product of a systematic review. Readers are encouraged to consider the information presented and reach their own conclusions.*

#### Executive Summary

Many states mandate school screening to identify children at risk for scoliosis, though recent studies have cast some controversy on the effectiveness of routine scoliosis screening. Previous studies have both supported and discouraged routine screening.

Prevention of severe scoliosis is a major commitment of physicians caring for children with spinal deformities. For this reason, the American Academy of Orthopaedic Surgeons (AAOS), the Scoliosis Research Society (SRS), the Pediatric Orthopaedic Society of North America (POSNA), and the American Academy of Pediatrics (AAP) convened a task force to examine issues related to scoliosis screening and to put forth the present information statement. The societies acknowledge the important role of a systematic review of the literature as well as the role of consensus expert opinion in the common situation where the available evidence does not yet exist to speak definitely for, or against, an evaluation or intervention.

Costs involved with scoliosis screening are relatively low on a societal level and may justify the possibility of preventing surgery in adolescents with scoliosis. Adolescents without significant spinal deformity who are referred to a specialist for evaluation often do not require radiographs. For those who do need radiographic evaluation, it is important to know that the radiation exposure using current day radiographic techniques, including digital radiography, is significantly smaller than in the past.

Opponents to scoliosis screening have focused on concerns about a low predictive value of screening, and the cost effectiveness of referral. There have also been concerns about the possibility of unnecessary treatment including brace use, and the effect of exposure to radiation when radiographs are obtained.

With regard to early treatment in those adolescents detected with moderate scoliosis, the available data neither definitively supports nor refutes the efficacy of bracing. To most effectively answer this, a well-organized level one study is needed. Such a study, a five-year multi-center randomized controlled trial of bracing sponsored by the NIH/NIAMS, is currently underway.

In 1996 U.S. Preventive Services Task Force (USPSTF) concluded that there was insufficient evidence to make a recommendation for, or against, screening. However, in 2004, the USPSTF changed their **position and recommended *against* the routine screening of asymptomatic adolescents for idiopathic scoliosis.** The AAOS, SRS, POSNA, and AAP have concerns that this change in position by the USPSTF came in the absence of any significant change in the available literature, in the absence of any change in position statements by the AAOS, SRS, POSNA, and AAP, and in the absence of any significant input from specialists who commonly care for children with scoliosis.

As the primary care providers for adolescents with idiopathic scoliosis, the AAOS, SRS, POSNA, and AAP do not support any recommendation *against* scoliosis screening, given the available literature.

## **Information Statement:**

### **Screening for Idiopathic Scoliosis in Adolescents**

#### **Purpose**

The purpose of the current information statement is to provide material to patients, physicians and decision makers regarding issues related to screening for scoliosis. Screening is defined as a clinical, rather than radiographic, examination.

#### **Introduction**

Adolescent idiopathic scoliosis is a spine deformity characterized by lateral and rotational curvature of the spine. It usually becomes evident in the early adolescent years and, although significant progress has been made in the genetic study of this disorder, its cause presently remains unknown, thus the label "idiopathic" scoliosis. Curve progression is unpredictable, though a subset of children with adolescent idiopathic scoliosis may exhibit rapid progression. In the year 2000 there were more than 4500 operations performed for the primary diagnosis of adolescent idiopathic scoliosis in patients between the ages of 10 and 18<sup>1</sup>. This spinal disorder can have a significant impact on the physical and psychosocial health of affected individuals.

Prevention of severe scoliosis is a major commitment of orthopaedic surgeons caring for spinal deformities. Beginning in 1984, the American Academy of Orthopaedic Surgeons (AAOS) and the Scoliosis Research Society (SRS) formally endorsed the concept of school screening for the early detection of scoliosis in children whose deformities may have gone unnoticed. This endorsement was based on the assumption that early detection in those children at risk for worsening would lead to the institution of non-operative treatment that could have a positive impact on the long-term natural history of this disorder. Without treatment, many curves could be expected to worsen over the long-term, with some of them eventually needing surgical intervention. In addition, those children with more significant scoliosis, who may have no other symptoms, could be detected by clinical screening at a time when surgical treatment for their deformity could be performed most effectively.

#### **Screening for scoliosis – The Evidence For and Against**

Routine clinical screening for scoliosis continues to be controversial with less than half of the states in the U.S. currently legislating school screening. Previous studies have both supported<sup>2,3</sup>, and discouraged routine screening<sup>4,5,6</sup>. There have been no recent scientific publications on screening for scoliosis.

In 1993, Montgomery and Willner<sup>3</sup> supported the routine use of school screening. They reported that the introduction of school screening programs decreased the relative risk of progression into a surgical range by a factor of eight. They obtained an 8 times greater risk of deterioration of the curve to 45°, diagnosed and qualifying for surgery, without the screening program, without modifying the indications for treatment before and after the implementation of the screening program. Their conclusion was that screening decreased the demand for surgery because scoliosis would be detected at a younger age with smaller curves, thus having a better prognosis.

Conversely, other investigators provided different conclusions. Yawn et al<sup>4</sup> reported on a population-based school screening program in Rochester, Minn. In this retrospective cohort study, 4.1% (68/2242) of children screened positively and were referred for evaluation. The Positive predictive value was low (.05) and they concluded that roughly 450 children would need to be screened for every child who subsequently received treatment as a result of screening. A limitation of this study is that the community in Rochester isn't representative of the general population, with more than 90% of the population being white, having higher-than-average income, and having excellent access to specialized care.

A year later, the same investigator<sup>5</sup> examined issues related to charges, including the primary care visit, orthopedist visit, and radiographs. The total costs were estimated to be \$34.40 per child screened, \$4,198.67 per case identified and \$15,115.20 per child treated. These estimates were significantly higher than those previously reported.

Twenty years ago, Morais, Bernier and Turcotte<sup>6</sup> concluded that the prevalence of the disease was too low to benefit from a screening program. The authors commented on their concern of radiation exposure that the children may have undergone following clinical screening. Of note, radiation exposure is significantly reduced with current techniques of shielding, use of special films, and the institution of digital radiography.

Each of the above studies has significant flaws with regard to methodological rigor. To date, no level I evidence studies have been performed on screening for scoliosis, and such a study is unlikely to be performed at the current time. Therefore, definitive conclusions regarding the effectiveness of scoliosis screening cannot be made from the available evidence in the literature. This concern was echoed by the 1996 U.S. Preventive Services Task Force (USPSTF) report which concluded that there was insufficient evidence to make a recommendation for, or against, screening<sup>7</sup>. However, in 2004, the USPSTF changed their recommendation<sup>8</sup>. Citing a low predictive value of screening, a relatively small percentage of children who progress, and the possibility of unnecessary treatment including brace use, they issued a recommendation *against* the routine screening of asymptomatic adolescents for idiopathic scoliosis. Of note, the Task Force's change in their recommendation was largely based on a change in methodological approach of the USPSTF, rather than any real change in available information.

A recent article (May 2007) examined professional opinion concerning the effectiveness of bracing relative to observation in adolescent idiopathic scoliosis<sup>9</sup>. The authors polled a group of clinicians with significant experience with scoliosis treatment. While there was significant variability in opinion among the expert panel, on average the expert panel felt that bracing would decrease the risk of progression in premenarchal patients by 20 – 30%, depending on the exact clinical scenario. Thus, it appears that many of those who most commonly treat scoliosis perceive a potential positive effect of bracing.

As the primary care providers for adolescents with idiopathic scoliosis, the AAOS, the SRS, the Pediatric Orthopaedic Society of North America (POSNA), and the American Academy of Pediatrics (AAP) do not support any formal recommendations *against* scoliosis screening, given the available literature. All four societies recognize the benefits that can be provided by effective clinical screening programs, including 1) the potential prevention of deformity progression by brace treatment and 2) the earlier recognition of severe deformities requiring operative correction.

### **Treatment for those detected from scoliosis screening**

In general, treatment must attempt to alleviate current problems and symptoms, and to ultimately alter long-term natural history. Brace treatment for scoliosis is the most effective primary non-operative method used over the past 40 years. In recent years, refinements have been made in identifying which patients with idiopathic scoliosis may benefit most with this treatment<sup>10</sup>.

With the information available in the literature today, it is difficult to speak with absolute certainty about the effectiveness of bracing. There are no level I evidence bracing studies currently in the literature. Though nearly all brace studies are level III or level IV evidence studies, many of them represent important and well-organized research and most conclude that brace treatment is effective in diminishing curve progression<sup>11-30</sup>. The most common parameter used to assess the effectiveness of brace treatment is the amount of curve progression that occurs, usually with success defined by curve progression  $\leq 5$  degrees at maturity. The other parameter used to assess the success of brace treatment is the prevention of surgery. A recent evidence-based review of the literature reported a 20 percent to 24 percent risk of needing surgery despite best efforts at bracing<sup>31</sup>. The risk of surgery without any brace treatment in the same patient

population is currently unknown. This fact alone emphasizes the importance that a level I evidence study could have in clarifying the effectiveness of brace treatment in preventing the need for surgery. Such a study, a five-year multi-center randomized controlled trial of bracing sponsored by the NIH/NIAMS, is currently underway.

### **Scoliosis screening in 2007**

Although the AAOS, SRS, POSNA, and AAP recognize that support for scoliosis screening has limitations, the potential benefits that patients with idiopathic scoliosis receive from early treatment of their deformities can be substantial. Scoliosis screening, whether in the physician's office, nurses' clinics, or school environment, provides the opportunity to diagnose the condition and make referral for appropriate medical care. Brace treatment in children with significant scoliosis may avoid the need for surgical intervention. Those with deformities in need of surgery may be identified by screening at a time when operative intervention can be performed most effectively. Many of these patients may otherwise go undetected, particularly in patient populations underserved by medicine.

Females achieve adolescence about two years before males and are afflicted with a magnitude of scoliosis requiring treatment 3-4 times more frequently than males. As a result, if scoliosis screening is undertaken, the AAOS, SRS, POSNA, and AAP agree that females should be screened twice, at 10 and 12 (grades 5 and 7), and boys once, at age 13 or 14 (grades 8 or 9).

The AAOS, SRS, POSNA, and AAP believe that school screening personnel should be educated in the detection of spinal deformity. Screening should always include the forward bending test, the most specific test for true scoliosis, though no single test is completely reliable for screening. Therefore, considerable judgment on the part of the screener is necessary to achieve an appropriate referral rate and to avoid unnecessary referrals. To meet the objectives of scoliosis screening programs, the AAOS, SRS, POSNA, and AAP recognize the need to limit the number of referrals of those individuals suspected of having scoliosis.

The AAOS, SRS, POSNA and AAP maintain their commitment to avoid the inappropriate use of spine x-rays. Not all children referred as a result of screening require x-rays. If x-rays are needed, physicians should take necessary precautions to limit the patient's exposure to radiation.

Educational materials which provide more specific guidelines for conducting school screening programs for scoliosis are available to physicians and school authorities.

### **References**

1. Healthcare Cost and Utilization Project (HCUP): Agency for Healthcare Research and Quality, 2000.
2. Ashworth MA, Hancock JA, Ashworth L, Tessier KA: Scoliosis screening: An approach to cost/benefit analysis. *Spine* 1988;13:1187-1188.
3. Montgomery F, Willner S: Screening for idiopathic scoliosis: Comparison of 90 cases shows less surgery by early diagnosis. *Acta Orthop Scand* 1993;64: 456-458.
4. Yawn BP, Yawn RA, Hodge D, et al: A population-based study of school scoliosis screening. *JAMA* 1999;282:1427-1432.
5. Yawn BP, Yawn RA, Roy A: The estimated cost of school scoliosis screening. *Spine* 2000;25:2387-2391.
6. Morais T, Bernier M, Turcotte F: Age- and sex-specific prevalence of scoliosis and the value of school screening programs. *Am J Public Health* 1985;75:1377-1380.
7. Recommendation Statement: Screening for Idiopathic Scoliosis in Adolescents. U.S. Preventive Services Task Force (USPSTF), 1996.
8. Recommendation Statement: Screening for Idiopathic Scoliosis in Adolescents. U.S. Preventive Services Task Force (USPSTF), 2004.

9. Dolan LA, Donnelly M, Spratt K, et al: Professional opinion concerning the effectiveness of bracing relative to observation in adolescent idiopathic scoliosis. *J Pediatr Orthop* 2007;27:270-276.
10. Richards BS, Bernstein RM, D'Amato CR, et al: Standardization of criteria for adolescent idiopathic scoliosis brace studies: SRS Committee on bracing and non-operative management. *Spine* 2005;30:2068-2075.
11. Allington NJ, Bowen JR: AIS: Treatment with the Wilmington brace: A
12. comparison of full-time and part-time use. *J Bone Joint Surg Am* 1996;78:1056-1102.
13. Carr WA, Moe JH, Winter RB, et al: Treatment of idiopathic scoliosis in the
14. Milwaukee brace: Long term results. *J Bone Joint Surg Am* 1980;62:599-612.
15. Coillard C, Leroux MA, Zabjek KF, et al: SpineCor: A non-rigid brace for the treatment of idiopathic scoliosis: Post-treatment results. *Eur Spine J* 2003;12:141-148.
16. d'Amato CR, Griggs S, McCoy B: Nighttime bracing with the Providence brace in adolescent girls with idiopathic scoliosis. *Spine* 2001;26:2006-2012.
17. Danielsson AJ, Nachemson AL: Radiologic findings and curve progression 22 years after treatment for AIS: Comparison of brace and surgical treatment with matching control group of straight individuals. *Spine* 2001;26:516-525.
18. Emans JB, Kaelin A, Bancel P, et al: The Boston bracing system for idiopathic scoliosis: Follow-up results in 295 patients. *Spine* 1986;11:792-801.
19. Fernandez-Feliberti R, Flynn J, Ramirez N, et al: Effectiveness of TLSO bracing in the conservative treatment of AIS. *JPO J Pract Orthod* 1995;15:176-181.
20. Gepstein R, Leitner Y, Zohar E, et al: Effectiveness of the Charleston bending brace in the treatment of single-curve idiopathic scoliosis. *JPO J Pract Orthod* 2002;22:84-87.
21. Green NE: Part-time bracing of AIS. *J Bone Joint Surg Am* 1986;68:738-742.
22. Katz DE, Richards BS, Browne RH, et al: A comparison between the Boston brace and the Charleston bending brace in AIS. *Spine* 1997;22:1302-1312.
23. Katz DE, Durrani AA: Factors that influence outcomes in bracing large curves in patients with AIS. *Spine* 2001;26:2354-2361.
24. Lonstein JE, Winter RB: The Milwaukee brace for the treatment of AIS: A review of one thousand twenty patients. *J Bone Joint Surg Am* 1994;76:1207-1221.
25. Montgomery F, Willner S: Prognosis of brace-treated scoliosis: Comparison of the Boston and Milwaukee methods in 244 girls. *Acta Orthop Scand* 1989;60:383-385.
26. Nachemson AL, Peterson LE, Members of Brace Study Group of the SRS: Effectiveness of treatment with a brace in girls who have AIS. *J Bone Joint Surg Am* 1995;77:815-822.
27. Olafsson Y, Saroste H, Sodeolund V, et al: Boston brace in the treatment of idiopathic scoliosis. *JPO J Pract Orthod* 1995;15:524-527.
28. Price CT, Scott DS, Reed FR, et al: Nighttime bracing for AIS with the Charleston bending brace: Long-term follow-up. *JPO J Pract Orthod* 1997;17:703-707.
29. Rowe DE, Bernstein SM, Riddick MF, et al: A meta-analysis of the efficacy of non-operative treatments for idiopathic scoliosis. *J Bone Joint Surg Am* 1997;79:664-74.
30. Trivedi JM, Thomson JD: Results of Charleston bracing in skeletally immature patients with idiopathic scoliosis. *JPO J Pract Orthod* 2001;21:277-280.
31. Wiley JW, Thomson JD, Mitchell TM, et al: Effectiveness of the Boston brace in treatment of large curves

in AIS. *Spine* 2000;25:2326-2332.

32. Yrjonen T, Ylikoski M, Schlenzka D, et al: Effectiveness of the Providence nighttime bracing in adolescent idiopathic scoliosis: A comparative study of 36 female patients. *Eur Spine J* 2006;15:1139-1143.
33. Dolan LA, Weinstein SL: Surgical rates after bracing for adolescent idiopathic scoliosis: An evidence-based review. *Spine* 2007, in press.

© July 1984. Revised September 2007 American Academy of Orthopaedic Surgeons

This material may not be modified without the express written permission of the American Academy of Orthopaedic Surgeons.

Opinion Statement Number: 1122

For additional information, contact the Public and Media Relations Department, (847)384-4033.

---

**-PRIVACY POLICY-** Disclaimers & Agreement Advertising & Sponsorship Contact AAOS Technical Requirements Careers  
6300 North River Road Rosemont, Illinois 60018-4262 Phone 847.823.7186 Fax 847.823.8125

© 1995-2008 by the American Academy of Orthopaedic Surgeons. "All Rights Reserved." This website and its contents may not be reproduced in whole or in part without written permission. "American Academy of Orthopaedic Surgeons" and its associated seal and "American Association of Orthopaedic Surgeons" and its logo are all registered U.S. trademarks and may not be used without written permission.