

# Bracing for Impact – Bracing in Adolescent Idiopathic Scoliosis

Kshitij Chaudhary<sup>1</sup>

## Abstract

Bracing plays a vital role in the non-operative treatment of adolescent idiopathic scoliosis (AIS), especially when detected early. Recent high-quality studies confirm that bracing can alter the natural progression of a curve, potentially preventing the need for surgery. The concept is based on the ability of external force to guide spine growth, which has been experimentally proven. However, bracing cannot straighten the spine; its primary goal is to halt the curve's progression.

The evidence for bracing is strong, with studies showing that approximately two-thirds of AIS curves can be controlled through bracing. However, there are concerns about the broad application of bracing indications, potentially leading to unnecessary treatment for some patients. Identifying the 25% of patients who will benefit from bracing remains a challenge.

Bracing is most effective when applied to curves between 25-45° during the rapid growth phase, but compliance is crucial for success. The choice of brace type matters less than its quality and corrective effect. The practice of bracing requires a close orthotist-surgeon relationship, and follow-up visits are essential to monitor progress.

Ultimately, bracing remains a valuable non-surgical option for AIS, but careful patient selection and close monitoring are necessary for optimal results

**Keywords:** Brace, Adolescent idiopathic scoliosis.

## Introduction

Braces for adolescent idiopathic scoliosis (AIS) are an integral part of non-operative treatment, especially when detected early. Over the years, bracing has been controversial for various reasons, but recent high-quality studies have confirmed that bracing is the only non-operative means of changing the natural history of a curve, thus potentially avoiding surgery.[1] The concept of using a brace is rooted on the ability of the external force to guide growth of the spine. This notion has been proven experimentally by Aronsson et al.[5] However, bracing cannot straighten the

spine in adolescent patients. At best, the brace can stop progression of the curve.

Early detection and non-surgical treatment of bracing for AIS was one of the founding goals of the Scoliosis Research Society. As all curves at a given time are small, if one can detect them early, it would allow all curves to be treated non-surgically. This as a noble goal, but screening for scoliosis is imperfect. School screening is not universal due to these limitations. The natural history of AIS curves is variable. We still have no reliable means to identify, which curves will worsen and will be benefitted by bracing.[3]

## Evidence for Bracing

There is a good body of evidence that states that natural history of can be changed and that progression can be prevented in some patients. Early retrospective studies demonstrated that about two-third of the curves were controlled.[2,3] This was confirmed by several prospective studies that too found that about two-third curves could be controlled.[1, 2] BRAIST randomized clinical trial (RCT) study demonstrated that curves between 20 and 45° had a success rate (<50° at maturity) of 72% (approximately two-third) with bracing compared to 48% who were not braced. This RCT was stopped early because bracing was effective.

However, it is important to note that about 48% of patients who were observation group did not reach the surgical threshold of 50°. Similarly, about

<sup>1</sup>Orthopaedic Spine Surgeon, Department of Orthopaedics, P.D. Hinduja National Hospital and Research Centre, Mumbai, Maharashtra, India.

### Address of Correspondence

Dr. Kshitij Chaudhary,  
1417, OPD Building, PD Hinduja Hospital and Research Center, Veer Savarkar Marg, Mahim, Mumbai, 400016, India.  
E-mail: dr\_kshitij.chaudhary@hindujahospital.com

Submitted Date: 18 Jan 2023, Review Date: 10 Feb 2023, Accepted Date: 23 Mar 2023 & Published Date: 30 Jun 2023

© Authors | Journal of Clinical Orthopaedics | Available on www.jcorth.com | DOI:10.13107/jcorth.2023.v08i01.561

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41% of patients in the brace group who spent little time wearing the brace did not reach surgical threshold. This suggests that the current bracing indications are too broad and we need to brace at least three patients, to save one patient from surgery. Therefore, many remain skeptic about potentially unnecessary brace treatment for many to save a few from surgery. While bracing seems to alter natural history for these group of AIS patients who are at high risk for progression, it seems to do so approximately 25% of the time. At present, we are unable to identify, which are these 25% who will benefit from bracing.

The other argument against bracing is the applicability of the results of a study like BRAIST in the real world. In the study, high-quality braces were made by dedicated teams who kept a close follow-up. In a country like India, reproducing results of such bracing programs at present are difficult. Hence, it is likely that the real-world success of bracing is a bit less optimistic than quoted in literature.

### Indication for Bracing

1. Curves 25–45° in the most rapidly growing time (Risser 0–1, <1 year post menarchal)
2. Smaller curves (<25°) that have documented progression (>5°) in (Risser 0–1)
3. Curves 30–45° who are Risser 2–3 may be offered but are less likely to alter natural history.

Bracing is less useful in: (1) Overweight kids, (2) high thoracic apex, (3) lordotic thoracic spine, (4) other major medical problems that interferes with bracing, (5) not compliant and do not accept the

idea of bracing, and (6) patients who have passed peak height velocity and are within 1 year of completing skeletal maturity or are 1-year post menarche.

### What Type of Brace is the Best?

- There are many different designs and supplies. The quality and the corrective effect of the brace are more important than the type. This depends on the orthotist's skill, experience, and knowledge. Percentage in brace correction correlates with effectiveness and final result in most studies.

- The Milwaukee cervico-thoracic-lumbo-sacral orthosis (TLSO) is as effective as any orthosis, but its use has declined due to patient preferences and this brace still has a limited role for curve with high apex or failure. The TLSO worn full-time is the current standard. TLSO can be custom made. The Boston Brace is the most widely studied TLSO in the literature. It is made from an "off-the-shelf" module chosen using measurements of the patient. Pads are then added at areas needed to produce correction. Trim lines are made to produce reliefs' areas.

### Issue of Compliance

The effectiveness of bracing is dose-dependent. The Texas Scottish Rite Hospital study by Karol et al. showed that 14 h a day avoid progression.[4] In BRAIST study, 13 h a day is linked with success in 90% of patients.[1] Full-time brace wear (>23 h) is more effective than part-time wear and is encouraged.

### The Practice of Bracing

The practice of bracing requires a dedicated orthotist-surgeon relationship. Ideally, the surgeon should see the

patient in the presence of an orthotist. If not possible, at least there should be good communication between the two. At aim should be to achieve more than 30% correction for thoracic and more than 50% correction for TL/L curves. PA views are obtained to reduce radiation exposure. Lateral X-rays are optional to assess effect of brace on sagittal profile. If adequate in-brace correction is not achieved, the brace should be analyzed and modified. Follow-up visits occur every 4 months during rapid growth phase and then approximately every 6 months thereafter. We prefer in-brace X-rays during the rapid growth phase to make sure the brace is working as intended. Any adjustments to the pads are made as needed. Once it is time to wean-off out of brace X-rays are obtained.

### Criteria for Stopping Brace

- Risser 4–5
- Change of height <1 cm in the past 6 months
- Females more than 2 years post menarche
- Bone age shows distal radial physics closing
- After stopping brace patients are followed up yearly for 5 years.

### Conclusion

Bracing is the only non-operative treatment that has been shown to change natural history and avoid surgery in some patients with AIS. The art of bracing requires dedicated effort from the surgeon as well as the orthotist. Communication and counseling with the family and the patient are crucial for success as compliance and acceptance for full-time brace wear is a challenge.

**Declaration of patient consent:** The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has/her given his/her consent for his/her images and other clinical information to be reported in the Journal. The patient understands that his/her name and initials will not be published, and due efforts will be made to conceal his identity, but anonymity cannot be guaranteed.

**Conflict of Interest:** NIL; **Source of Support:** NIL

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Conflict of Interest: NIL

Source of Support: NIL

### How to Cite this Article

Chaudhary K. Bracing for Impact – Bracing in Adolescent Idiopathic Scoliosis. *Journal of Clinical Orthopaedics* Jan-June 2023;8(1):38-40.