Sensors show success of bracing for scoliosis

By Terry Stanton

Bracing is effective for adolescent idiopathic scoliosis when compliance is good

Investigators who used sensors to monitor brace wear by patients with idiopathic adolescent scoliosis found that patients who wore their Boston brace consistently achieved better results than those who were less compliant. The study, “Brace Treatment Controls Progression in Adolescent Idiopathic Scoliosis,” conducted by Donald E. Katz, CO; J. Anthony Herring, MD; and colleagues, was named the outstanding clinical scientific paper at the 2010 annual meeting of the Pediatric Orthopaedic Society of North America.

The effectiveness of brace treatment for adolescent idiopathic scoliosis remains controversial and unproven, in large part due to the lack of accurate monitoring of wear. Estimates of wear by the patient, the parents, the treating physician, and the orthotist are unreliable, according to the authors. In the first year of bracing, for example, physicians fail to identify 25 percent of patients who were noncompliant with prescribed wear.

Grading on a curve
In the study, the investigators followed 100 of 126 patients whose curves were between 25 degrees and 45 degrees. The participants were prescribed Boston braces outfitted with heat sensors (Fig. 1) that measured the exact hours of brace wear. Patients were prescribed either 16 or 23 hours of brace wear, and the orthopaedic teams were blinded to the wear data. When treatment was completed, hours between brace wear were compared and the frequency of curve progression of 6 degrees or more and with progression to surgery.

Overall, the authors found a correlation between hours of brace wear and curve progression. The effect of brace wear duration was seen most markedly in patients with Risser scores of 0 or 1 at the beginning of treatment and in patients with open triradiate cartilage at the onset.

Patients who wore their braces to school and immediately afterward fared the best. In 82 percent of patients who wore braces more than 12 hours per day, curves did not progress, while lack of progression was seen in only 31 percent of those who wore the brace less than 7 hours ($p = 0.0003$). An inverse correlation was also seen between hours of wear and the need for surgical management ($p = 0.0001$).

The key to this study was the temperature data logger that was installed within each orthosis to achieve an accurate record of wear. Because the logger is not small enough to be concealed, patients were told that its purpose was to record accurate daily brace wear times for patients with adolescent idiopathic scoliosis. A previous trial had shown that the duration of wear as estimated by an algorithm was found to correspond to the actual logged wear duration with an accuracy of 99.93 percent.

When the patient puts on the brace, the sensor quickly equilibrates to within a few degrees of body temperature. The investigators recorded a wear time once the temperature stabilized to between 90°F and 99°F.

Tracking progress
The Boston braces were custom-fitted to the patients. After about 4 weeks of wear, patients returned for a standing posteroanterior (PA) radiograph while wearing the brace to document the amount of curve correction.

Subsequently, patients returned to the clinic every 4 months for a standing PA radiograph while not wearing the brace. Radiographic

### Table 1: Risser Scale

<table>
<thead>
<tr>
<th>Risser</th>
<th>Description</th>
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<tbody>
<tr>
<td>Risser 0</td>
<td>No ossification of the iliac apophysis</td>
</tr>
<tr>
<td>Risser 1</td>
<td>Ossification present but less than one quarter of the length of the iliac crest</td>
</tr>
<tr>
<td>Risser 2</td>
<td>Ossification between one quarter and one half of the length of the iliac crest</td>
</tr>
<tr>
<td>Risser 3</td>
<td>Ossification between one half and nine tenths of the crest</td>
</tr>
<tr>
<td>Risser 4</td>
<td>More than 90 percent of the crest being capped</td>
</tr>
<tr>
<td>Risser 5</td>
<td>Fusion of the apophysis to the crest</td>
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</tbody>
</table>

Bottom line
- A heat sensor fitted in a brace allowed investigators to record accurate daily brace wear times for patients with adolescent idiopathic scoliosis.
- Bracing can be effective in preventing progression of curvature in these patients.
- Bracing effectiveness depends on the length of time (hours per day) the patient wears the brace; a minimum of 12 hours per day of brace wear is required for efficacy.