Adolescent Idiopathic Scoliosis: Immaturity Predicts Progression, but Is More Brace Wear Time Beneficial?

Commentary on an article by Lori A. Karol, MD, et al.: “The Effect of the Risser Stage on Bracing Outcome in Adolescent Idiopathic Scoliosis”

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The study by Karol et al. evaluated the relationship between the Risser stage and bracing outcome for adolescent idiopathic scoliosis (AIS). Previous studies, including the important Bracing in Adolescent Idiopathic Scoliosis Trial (BRAIST), have generally described combined results for patients at Risser stages 0, 1, and 2. However, Karol et al. evaluated each stage of maturity independently. Brace wear time was also measured objectively with a thermal monitor in each brace. One hundred and sixty-eight patients were followed from the time of brace delivery until cessation of bracing or surgical intervention. This provided a large cohort of patients at Risser stage 0 for subgroup analysis. One limitation of the study, as noted by the authors, is that some of the subgroups became small, but several useful observations were identified by this study.

The rate of progression to a curve magnitude requiring surgery was 44.2% for patients at Risser stage 0, 6.9% for patients at Risser stage 1, and 0% for patients at Risser stage 2. This confirms the importance of growth velocity in scoliosis progression. These findings also call into question all studies that have combined patients at Risser stages 0, 1, and 2 in the analysis of the results. The patients at Risser stage 0 were further subdivided into those with open triradiate cartilage and those with closed triradiate cartilage. The patients with closed triradiate cartilage seemed to benefit from ≥18 hours of brace wear, while those with open triradiate cartilage did not. However, there were only 10 patients in each of these Risser stage-0 groups, and the average curve magnitude at initiation of treatment was less in the closed triradiate cartilage group. For the entire cohort of patients at Risser stage 0, the authors reported that there was no association between hours of brace wear and progression to surgery.

The absence of a correlation between brace wear time and curve progression for patients at Risser stage 0 seems to contradict the authors’ recommendation for ≥18 hours of brace wear for patients at Risser stage 0, and this should be examined further. Prior to closure of the triradiate cartilage, 63% of the patients had progression to a curve magnitude requiring surgery regardless of brace wear time. Following closure of the triradiate cartilage, the proportion of children requiring surgery decreased to 32.4% and then decreased dramatically after the appearance of the iliac apophysis. Since closure of the triradiate cartilage occurs nearer to peak height velocity, the improved results following closure of the triradiate cartilage may represent another time point of adolescent growth instead of reflecting the benefits of prolonged brace wear.

Compliance with brace wear was objectively measured, but these data may be influenced by patient choices during the course of treatment. As noted previously, the rate of curve progression to a magnitude requiring surgery was 44.2% for patients at Risser stage 0, 6.9% for patients at Risser stage 1, and 0% for patients at Risser stage 2. The daily brace wear time in these groups averaged 11.3, 13.4, and 14.2 hours, respectively. This might suggest that a longer duration of brace wear was associated with improved results. However, patients with scoliosis are not blinded to the ongoing results of their bracing while they are being treated. Thus, a patient whose curve has progressed while he or she was being compliant may decide that the treatment is ineffective and decrease the brace time voluntarily. In other words, noncompliance may follow curve progression instead of being the proximate cause of curve progression. Studies of medication compliance have shown that “long-term persistence was most strongly influenced by perceived treatment efficacy over time.” In other words, failing treatments lead to poor compliance and this may be reflected in the final average brace wear time for scoliosis.

Although previous studies have demonstrated a beneficial effect of bracing, the minimum duration of brace wear remains uncertain despite objectively measured compliance. To adequately study the effect of brace compliance on outcomes, it would be necessary to blind the patients to their results during the course of treatment, or to analyze the timing of noncompliance to determine whether decreased brace wear preceded or followed awareness of curve progression.

The scientific literature regarding compliance is extensive and has identified many factors that influence compliance. These include the burden of treatment, physician factors, patient characteristics, perceived severity of illness, and numerous additional variables. Long-term compliance with oral medications for chronic illnesses is often <50%, and approximately 20% of patients with osteoporosis discontinue treatment in the first 6 months of therapy. It may be unrealistic for orthopaedic surgeons to expect compliance with ≥18 hours of rigid brace wear regardless of parental control or physician exhortations. In this regard, it behooves

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us to search for the minimum duration of brace wear and alternative methods to decrease the duration of brace treatment. Additional research is needed to evaluate management of low bone density and to continue investigations into the roles of serotonin, melatonin, and calmodulin on scoliosis progression.

This study brings us closer to determining the timing and indications for various treatments for AIS. The authors further documented that patients at Risser stage 0 have the greatest risk for curve progression. The patients at Risser stage 0 with open triradiate cartilage and curves of >30° are likely to progress to a curve magnitude requiring surgery regardless of compliant brace wear. This important study provides additional evidence that immaturity and curve magnitude are the overriding predictors of curve progression. Until we are able to manage scoliosis with medications, limited bracing, or growth modulation surgery, this study will help to guide our current management using conventional thoracolumbosacral orthoses.

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References