THE EFFECT OF RISSER SIGN ON THE LIKELIHOOD OF FAILURE WITH BRACING IN ADOLESCENT IDIOPATHIC SCOLIOSIS

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INTRODUCTION
To determine the incidence of surgical curves in children wearing orthoses for the treatment of AIS, and to assess the influence of the Risser sign and compliance on the likelihood of surgery.

METHOD
222 patients were prospectively enrolled in this IRB approved study between the years of 2008 and 2013. All patients were treated with a TLSO-type orthosis, which was either the Boston brace or a CAD/CAM design TLSO with two thermochron data loggers embedded which recorded brace wear each 15 minutes.

RESULTS
We had a total of 164 patients with complete data from the date of brace delivery to the date of either brace discontinuation or surgery. Of the 117 Risser zero patients, 44 had open triradiate cartilages and 73 were closed. Fifty-three of 117 Risser zero patients who have completed bracing (45.3%) have undergone surgery for progressive scoliosis or have reached surgical magnitudes, compared to two of 28 Risser one patients (7.1%), and none of the 19 Risser two patients. The rate of surgery was 32.9% in the 73 patients who were Risser zero with closed triradiates, and 65.9% in the 43 patients who had open triradiates. In just analyzing the Risser zero patients, the risk of requiring spinal fusion if a Risser zero child wears a brace at least 15 hours per day was 46.5%. Conversely, the risk of requiring spinal fusion if a Risser zero child does NOT wear a brace an average of 15 hours per day is 33 of 74, or 44.6%. Therefore, wearing a brace 15 hours per day is not effective in Risser zero patients. Only 18 of the 117 Risser zero patients wore their brace 18 hours daily, and only 7 of the 18 went on to surgery (38.9%). The remaining 99 Risser zero patients wore their orthoses less than 18 hours daily, and 46.5% of them went on to surgery. Risser one patients fared better, with no patient who wore their brace greater than 6 hours requiring surgery. None of the 19 Risser two patients required surgery, regardless of their brace wear, but only 3 wore their brace less than 12 hours per day on average. Unfortunately, this study is underpowered to conclude with certainty that bracing is not needed in the Risser 2 population. Those patients with open triradiates were found to go on to surgery in 57.1% of cases despite 15 hours of daily wear. At 18 hours of measured wear, we found that 7 of 9 children (77.8%) progressed to surgery despite being very compliant. In chart review, these 7 compliant surgical patients experienced rapid progression during peak growth velocity, and all had curves 33 degrees or greater when the brace was prescribed. In comparison, there were 9 patients who were Risser zero but had closed triradiates at the time of brace prescription who wore their brace 18 or more hours daily. None of these ten patients experienced surgical progression, and only one had worsening of their curve by 6 or more degrees.

DISCUSSION
We compared our success rate in preventing surgical correction with the article by Lonstein and Winter (1994), which reported the success rate in Risser 0 and 1 patients grouped together with curves ranging from 20 to 50 degrees. In the 20 to 29 degree curve range, Lonstein and Winter report that 9% of patients progressed to surgery. In combining our study’s Risser 0 and 1 patients with curves between 25 and 29 degrees (n=44), we found a 13.6% rate of surgery.

CONCLUSION
In conclusion, there is a highly notable relationship between advancing Risser sign and orthotic success. Risser one and two patients were noted to meet with success. All but two Risser one patients (neither of whom reached 6 hours of daily brace wear) avoided surgery. Whether this proves the efficacy of bracing in this group or lends support to the lack of evidence that these children need a brace cannot be determined from this data. Risser zero patients are most likely to progress, and even those that are compliant with brace wear are likely to require surgery if their triradiate cartilages are nonossified at the start of the brace wear period and their curves measure 30 degrees or more.

CLINICAL APPLICATIONS
We recommend that Risser zero patients with closed triradiates should be encouraged to use their braces 18 hours daily, Risser one patients 12 hours daily, and the role for bracing in Risser two patients is unknown. Risser zero patients with open triradiates should be prescribed full time brace wear, and bracing started at 20 degrees. Bracing in a Risser zero/open triradiate patient with a curve of 40 degrees or more is likely futile in preventing progression to a surgical magnitude.

REFERENCES