INTRODUCTION
There is evidence that traditional time-domain measures are not sensitive to the changing dynamic properties of the postural control system [1]. Frequency domain measures such as the spectral characteristics associated with sway may be more effective in detecting important but not easily identifiable changes in the physiological control systems underlying balance [1]. Frequency domain analysis has not yet been performed to study standing balance in AIS but has been applied on the ground reaction forces developed during gait by Giakas et al. [2] in scoliotic and healthy individuals. The objective of this study was to use time and frequency domain analyses to test if the Boston brace affect balance in AIS.

METHODS AND PROCEDURE
Fifteen AIS girls were fitted with a Boston brace. At the four month follow-up, standing balance was assessed using the center of pressure (COP) displacements measured from a force plate. Subjects were tested with and without the brace. Quiet standing balance was tested at the four month follow-up using an AMTI force platform (AMTI, Newton, MA, USA). Values for each set of time and frequency parameters were averaged for each condition. Paired t-tests were performed to compare out-of-brace and in-brace conditions at the four month follow-up. Differences of p<0.05 were considered statistically significant. A Bonferroni correction procedure was applied to control Type I error by adjusting the p values when analyzing the above-mentioned parameters [3].

RESULTS
The mean position of the COP and the sway area were similar with or without a body brace. Figures 1 and 2 illustrate the average power spectra distribution of the center of pressure displacements as it was measured in the antero-posterior and medio-lateral directions, respectively. Though the first peak in the power spectra was not statistically significant while the second peak was statistically smaller with the Boston brace in the antero-posterior direction (p = 0.012) and larger along the medio-lateral axis (p = 0.022).

In the antero-posterior direction, there was a statistically significant shift towards higher mean (p = 0.012) and median (p = 0.003) frequencies with the brace on, whereas no difference was noted in the medio-lateral direction. Time domain parameters did not prove useful for differentiating between the in- and out-of-brace conditions in AIS individuals. The second peak in the power spectra could be associated with an inverse double pendulum motion.
DISCUSSION

A body brace is usually prescribed to control spinal deformities that are less than 40° and progressive. Few studies have addressed its effect on balance and, of those that have, all of them have used time-related parameters such as displacements of the center of pressure. The objective of our study was to use time and frequency domain approaches to test the hypothesis that a Boston brace could result in less balance control in adolescent idiopathic scoliosis. Giakas et al. [2] consider harmonic analysis more appropriate and more sensitive than time domain analysis for showing differences between scoliotic and non-scoliotic girls. Using only time domain data, one could assume that the Boston brace restrains the lateral deviation of the spine without disturbing the standing balance of scoliotic subjects. Our time-dependent results were fairly similar to those previously reported [4,5,6]. The absence of statistical significance in the time domain parameters could be due in part to larger variations in individuals fitted with a Boston brace, although the mean values were usually higher.

To our knowledge, no one has reported the effect of bracing on the mean positions of the COP. In our study, the use of a Boston brace did not substantially displace the mean COP in either the antero-posterior or the medio-lateral direction. However, it was known by Aubin et al. [7] that the Boston brace shifts the spine and rib cage anteriorly, and that forward displacement of the top vertebra is likely to increase the hypokyphosis and decrease the normal physiological curvatures. Korovessis et al. [8] corroborated these observations. In our study, the mean antero-posterior COP was not statistically affected by use of the Boston brace. It can therefore be assumed that any forward shift of the trunk and spine caused by the brace was offset by a backward shift in other body segments. According to a study by Karlsson et al. [9], frequency analysis can be used to detect fundamental differences in postural sway that cannot be observed visually. In our study, only the frequency-dependent parameters have shown that standing balance was affected in adolescent idiopathic scoliosis subjects fitted with a Boston brace.

SUMMARY

Time-dependent parameters used in this study did not prove useful for differentiating between the in-brace and out-of-brace conditions. Spectral analysis highlighted increased stiffness in the antero-posterior direction and less control in the medio-lateral axis in standing balance between in-brace and out-of-brace conditions in AIS.

REFERENCE
