INTRODUCTION
Thoracic hyperkyphosis is a well defined spinal condition, which historically has been successfully treated using conservative orthotic management. When utilizing orthotic management as a treatment modality, the gold standard of treatment has been the application of a Thoraco-Lumbo-Sacral-Orthosis (TLSO). (Carlson, 2003). In this case study approach, a subject who presents with a rare combination of thoracic hyperkyphosis and pectus carinatum, is examined and treated with a unique TLSO design. There are many different documented types of kyphosis (McMaster, 1999). Occasionally, kyphosis is a mal-alignment associated with neurological disorders or syndromes such as Marfan’s Syndrome. In those cases, the patient may present with other mal-alignments, contractures, chest wall deformities, spinal abnormalities, and/or other systemic health problems which can create difficulties and challenges regarding successful orthotic treatment. Due to the anterior posture that is accompanied by hyperkyphosis it is more common to see a pectus excavatum deformity rather than pectus carinatum. The patient who presents with a hyperkyphosis and pectus carinatum poses some difficult challenges to the orthotist who must take into account the flexibility of both deformities, the potentially competing corrective sagittal plane forces, the optimal TLSO design, and how any correction of the deformities may affect spinal balance and overall function. The case study to follow addresses all of these concerns and presents outcomes which support the importance of spinal balance.

METHOD
Subjects: Subject is a 12 year old male diagnosed with thoracic hyperkyphosis and pectus carinatum. Subject is 85 lbs and stands at 5’6”. The thoracic kyphosis measures 60 degrees during standing at an apex of T6 and a Risser score of 1. Apparatus: Patient was treated with a custom thermoplastic TLSO design molded from a Risser cast. The TLSO design consisted of a sternal shield/pad complex with lateral plastic extensions to promote shoulder retraction. The sternal shield complex had velcro subaxillary straps that connected to the proximal posterior aspect of the TLSO for static progressive pectus correction. Procedures: TLSO was designed and fit and the patient received an in-brace xray to evaluate: kyphosis angle, lumbar lordosis, and spinal balance in both the sagittal and frontal planes. Patient then returned for regular monthly follow up visits for assessment. Data Analysis: Standard sagittal angles and spinal balance were calculated using xray analysis.

RESULTS
Radiographic analysis reveals that while the patient’s hyperkyphosis did not reduce as a result of TLSO application, lumbar lordosis was significantly reduced to 25 degrees from 50 degrees and spinal balance was very much improved with the patient's head being centered over his pelvis. The patient's pectus carinatum was also dramatically improved as a result of TLSO application

DISCUSSION
The subject in this case study has an extremely unique diagnostic combination of hyperkyphosis and pectus carinatum. While chest wall deformities occasionally present with hyperkyphosis, pectus excavatum is much more common than carinatum. Initially, the lack of shoulder girdle and thoracic flexibility caused the investigator to question the effectiveness of kyphotic correction. While a goal of the orthotic intervention was the reduction of lumbar lordosis and improvement in spinal balance, the degree to which those measures positively improved was not expected. The forces applied to reduce the pectus deformity did not appear to counteract the resulting vertical posture of the subject and the subject’s satisfaction following TLSO application highlight the importance of spinal balance which is often overlooked relative to the cobb angular measurements (Smith, 2003).

CONCLUSION
The importance of Cobb angles has been well established in the literature. Both the improved resultant vertical posture of the subject and the subject’s satisfaction following TLSO application highlight the importance of spinal balance which is often overlooked relative to the cobb angular measurements (Smith, 2003).

REFERENCES