INTRODUCTION
Arthrogryposis is a term used to describe congenital contractures that affect two or more parts of the body. Upper extremity involvement may include internal rotation of the shoulder, extension of the elbow, pronation of the forearm, and wrist/finger flexion (Bamshad, 2009). Treatment for children with arthrogryposis may include passive stretching programs, serial casting, and surgical intervention (Smith, 2002). The goals of these treatments are to increase joint mobility and function (Smith, 2002).

In this paper we will look at a single case study of two dynamic orthoses used in an individual with upper extremity involvement arthrogryposis.

METHOD
The patient is a male that was seen at The Rehabilitation Institute of Chicago (RIC) both as an inpatient and outpatient from the ages of 1 to his current age of 4. Our orthotic goal for this patient was to improve range of motion and mobility in order to achieve more functional independence.

As the patient progressed in occupational therapy, a dynamic orthosis was introduced. The first orthosis was based on a prototype by his occupational therapist Katie Davis, OTR/L. From this, two orthotist from RIC developed a trunk orthosis with dynamic flexion assist, termed “the Batsuit.” The Batsuit was used for approximately two years. This device consisted of a “vest style” TLSO and elastic bands traveling from the posterior vest, over the shoulder to attach to the wrist pieces to promote shoulder and elbow flexion assist. The vest was used over a TLSO for its ability to cross the shoulder joint and allow the individual continue to develop his own core strength and balance while minimizing trunk extension.

The second orthosis used is the Wilmington Robotic Exoskeleton (WREX). The WREX is produced by JAECO. It is a balanced forearm orthosis that is attached to a wheel chair. It uses rubber bands to partially unweight limb and enhance the individual’s active movement. A lighter, 3-D printed, and slightly modified version that attached to a trunk orthosis developed by Tariq Rahman, PhD at DuPont (Rahman et al., 2006). This system was ideal for the size and activity level of the patient.

RESULTS
In The Batsuit range of motion improvements were observed in both active elbow flexion and to a lesser extent shoulder flexion (Table 1). More importantly, for his goals, he was more independent. Prior to this orthosis he wasn’t able to sit and play without outside assistance. In the orthosis he could clap, play, interact with his environment, and begin to work on self-feeding. As the patient grew a plateau effect was noted and increasing the tension no longer had an effect. It became clear that a more robust system was needed.

The WREX system was then put into use. It has only been in use for 3 months. A major material failure was observed at less than 1 month use due to excessive tension on a nut and bolt at the wrist. The device was repaired and now uses a bolt without nut. Patient and parent acceptance took time, but eventually he was able to utilize the device successfully. He is able to self-feed and groom, and overall is more functionally independent in the WREX.

DISCUSSION
The Batsuit was used early on in treatment. Eventually a point of diminishing return was observed due its inability of the materials to resist his tension as he grew. Stronger materials used in a similar fashion may have been successfully, but this was not explored. At this time, age also could have played a significant factor in results as he didn’t always respond to directions.

The WREX also had positive results, however in the beginning we experienced material failure as well as tolerance issues. Once repaired no issues have been reported. The family thought the device was rather “bulky” in size and patient didn’t like being in the WREX initially. The patient was eventually able to adjust to the orthosis and successfully use. The long term benefits of the device are yet to be seen as has only been using this device for 3 months.

CONCLUSION
The use of these two dynamic orthoses on this particular patient was effective, both were not without
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There may be room for improvement on strength and size materials used. It is important to note that both devices were used in conjunction with occupational therapy, use without therapy was not determined.

CLINICAL APPLICATION
This case study on a single individual with a single diagnosis. These devices were effective on this particular patient with arthrogryposis, but wide scope and long term analysis of their uses was not evaluated, but maybe an area of future research.

REFERENCES