Effect of Varus Rotational Osteotomy (VRO) on Upper Extremity Motion during Gait in Cerebral Palsy

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BACKGROUND

Children with Cerebral Palsy (CP) are restricted in upper and lower extremity (LE) movement. Surgical, medical, and rehabilitation interventions focus on improving gait and upper extremity (UE) function, but rarely on the reciprocal relationship between the two, despite the role of arm movement as an essential component in normal gait. Understanding the reciprocal relationship between UE and LE intervention on upper body and lower body symmetry during gait is essential to a coordinated, comprehensive and multidisciplinary treatment of this population.

AIM

The purpose of this study was to analyze the effect of Varus Rotational Osteotomy (VRO) surgery (a commonly performed LE intervention) on UE motion and symmetry during gait. We hypothesized a change in UE motion following surgery. We also hypothesized decreased asymmetry in UE joint variables.

METHODS

UE kinematic data was extracted from a database of standard gait analysis studies. 20 children with CP (GMFCS levels I and II), age range: 3-13 (mean age 7.4 ±2.7) met the study criteria. 14 subjects had a diagnosis of diplegia, and 6 a diagnosis of hemiplegia. All subjects had a gait analysis test performed prior to surgery and at an average follow-up of 1 year post-surgery. Elbow and shoulder joint angles were analyzed (Figure 1). Asymmetry indices were calculated for all joint variables using the following formula:

\[
ASI = \text{absolute value } \left( \frac{\text{right value} - \text{left value}}{\text{right value} + \text{left value}} \right) \times 100
\]

A repeated measures ANCOVA was used to test all variables pre and post-surgery.

RESULTS

• There was a significant difference in range in R elbow and R Shoulder abduction range of motion that was closer to published normative data (p<0.05) Figure 2.
• There was no change in magnitude or asymmetry indices for elbow and shoulder. However, when compared to typically developing children elbow asymmetry pre-operatively was significantly different (p<0.05), and post-operatively was not (Figure 3).

DISCUSSION/CONCLUSION

Preliminary results support our hypothesis that LE intervention alone can effect change in UE function, and is the first step in quantifying UE motion to demonstrate a reciprocal relationship between extremities.

Further studies will examine the effect of LE surgery in a hemiplegic population, who demonstrate more marked asymmetry, as well as explore the reciprocal effects of UE and LE interventions during gait in order to provide a coordinated approach to treatment.

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