Tendoachilles lengthening and gastrocnemius recession in ambulatory children with cerebral palsy

Are we under or over correcting based on gait analysis?

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Introduction

Equinus of the foot and ankle is the most common deformity encountered in cerebral palsy (CP). There is great concern of iatrogenic weakening of the gastroc soleus complex with surgical correction of equinus due to the potential for development of progressive calcaneus deformity and crouch gait. To preserve ankle plantar flexion power there has been a trend towards use of gastroc recession (GR) instead of tendo achilles lengthening (TAL) to maintain the integrity of the soleus musculotendinous unit.

Purpose

1. Compare the outcome of TAL and GR in ambulatory children with CP through review of pre-operative and post-operative instrumented gait analysis.
2. Assess for evidence of over correction of equinus deformity after GR or TAL.

Gastrocnemius Recession (GR) Tendoachilles Lengthening (TAL)

Methods

Patients with a diagnosis of CP who presented for pre-operative and post-operative instrumented gait analysis were retrospectively identified from a gait analysis database. A chart review was completed to identify patients who had undergone surgical correction for equinus deformity with either a GR or TAL. Pre-operative and post-operative sagittal plane kinetic and kinematic gait data was analyzed. Bilateral procedures were considered individually for analysis. Gait analysis was performed an average of 1.51 years post operative (range 0.39-4.07 years).

Results

Forty patients with 53 procedures were identified. There were 30 patients in the GR group and 23 in the TAL group. The distribution of hemiplegic and diplegic patients was asymmetric with more hemiplegic patients in the TAL group and more diplegic patients in the GR group (Figure 1). Mean age at surgical intervention was 9.6 years. Pre-operative equinus deformity was worse in the TAL group in comparison to the GR group with significantly lower average ankle flexion at foot strike (-13.2° vs -7.4°, p=0.003) and a trend towards lower max ankle flexion in stance (1.8° vs 4.9°, p=0.102). Both groups showed significant post-operative improvement in average maximum ankle flexion during stance (Figure 2). The TAL group showed a significant increase in dynamic stance phase range of motion (2.5°, p=0.030), which was not seen in the GR group (-1.8°, p=0.503)(Figure 3). The maximum stance phase ankle power increased by 0.2 W/kg in the TAL group and decreased by 0.2 W/kg in the GR group (p=0.001) (Figure 4). Overcorrection was considered in patients two standard deviations above published normal gait data. One patient in the TAL group (3.3%) and one patient in the GR group (4.3%) demonstrated evidence of overcorrection.

Discussion

TAL and GR are effective at correcting equinus deformity in ambulatory children with CP. Post operative instrumented gait analysis demonstrated improved average maximum ankle flexion during stance in both groups; however, the TAL group showed greater improvement in dynamic ankle range of motion. The TAL group showed significant improvement in max ankle power generated in stance. We believe this difference in ankle power is partially attributed to the difference in dynamic range of motion since ankle motion is needed to generate power. Similar amounts of over correction were seen in each group.

Limitations

• This study has only short to medium term follow-up after surgical intervention. Longer term follow-up is needed to better assess for evidence of overcorrection leading to development of crouch gait.
• Concurrent surgical procedures were performed at the time of GR and TAL which may affect ankle kinetics and kinematics.
• Asymmetric distribution of hemiplegic and diplegic patients in the GR and TAL groups makes these results only applicable for the appropriately selected patient population.

Conclusion

TAL and GR were found to effectively correct equinus deformity in ambulatory CP. TAL resulted in improved dynamic ROM and consequently maximus ankle power in stance. However, these results can only be applied to an appropriately selected patient population and caution must be used not to overcorrect in patients at high risk of calcaneus deformity and progressive crouch gait.

References

