Comparison of Hip Strength Outcomes between Treatment Methods of Legg-Calve-Perthes Disease

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INTRODUCTION:

A variety of nonsurgical and surgical methods are utilized to treat Legg-Calve-Perthes disease (LCPD) depending on the age at onset, stage, and severity of the disease. Nonsurgical methods include bracing, weight relief, and activity restrictions. Greater trochanter apophysiodesis (GTA) and proximal femoral varus osteotomy (PFVO) are two commonly performed operative methods. While improving femoral head containment to prevent femoral head deformity, PFVO decreases the neck shaft angle (NSA) and the articulo-trochanteric distance (ATD), which may alter the hip abductor muscle mechanics. This alteration in mechanics can produce hip muscle weakness and a persistent limp or abductor lurch, an abnormal gait due to significant abductor weakness. The purpose of this study was to quantify the hip muscle strength of patients treated nonsurgically or with GTA only compared to those treated with PFVO+GTA using a Biodex isokinetic testing. We hypothesize that patients treated with PFVO+GTA, when compared to those treated with GTA or nonsurgically, will have decreased NSA, ATD, and abductor muscle strength.

METHODS:

This is an IRB approved retrospective review of 40 LCPD patients treated with GTA/nonoperatively or PFVO+GTA. This study included patients with unilateral and bilateral LCPD who underwent Biodex isokinetic hip strength testing after treatment at age 6-14 years old. Patient demographics were collected via chart review. NSA, ATD, and Waldenstrom classification at or near the time of strength testing were measured on x-rays using software. Hip flexion, extension, abduction, and adduction strengths were measured using Biodex isokinetic testing machines from patients who underwent strength testing. Patients completed 2 practice repetitions as a warmup for each muscle group testing prior to performing 5 maximal strength repetitions. Strength data was collected on the peak force during the 5 repetitions. Data was normalized to body mass and reported as a percent difference to the unaffected side. Strength of the treated side was compared to that of the untreated side and reported as a percent difference. This difference in strength between sides was compared between the treatment groups.

RESULTS:

No significant difference in patient demographics was found between the 20 patients in the nonoperative/GTA group and the 20 patients in the PFVO+GTA group except for age at treatment (6.17 ± 2.31 vs. 7.77 ± 1.25, p=0.004) (Table 1). The age at Biodex testing was similar between the two groups. We found no significant difference in hip muscle strength between the unaffected and affected side regardless of treatment received (Table 2). The PFVO+GTA group had significantly greater change in NSA compared to the GTA/nonoperative group (8.75° ± 8.66° vs. 0.90° ± 7.83°, p=0.004). There was no significant difference in the change in ATD between groups (Table 3). No significant correlation was found between any variable of hip strength with NSA or ATD.

DISCUSSION AND CONCLUSION:

Patients treated with PFVO+GTA did not have significant weakening of the hip muscle strength despite having a lower NSA on the operated side when compared to patients treated with GTA/nonsurgically. This study provides new information about the muscle strength after PFVO+GTA and will help counsel patients and parents before surgery. A larger prospective study is needed to confirm our findings.

Table 1. Patient demographics. Comparison of patient age, sex, BMI, days between intervention and test, and days of non-weight bearing following intervention between treatment groups.

	Nonop/GTA (N=20)	PFVO+GTA (N=20)	p-value
Age at treatment (years)	6.17 ± 2.31	7.77 ± 1.25	0.004
Age at test (years)	10.42 ± 1.77	10.97 ± 1.29	0.30
Percent male	95%	90%	>0.99
Percent unilateral involvement	90%	90%	>0.99
BMI at test	19.68 ± 3.74	18.98 ± 3.71	0.40
Days between intervention and test	1102 ± 527	1029 ± 310	0.84
Days of non-weight bearing	397 ± 437	342 ± 88	0.98

Table 2. Hip strength outcomes. Strength difference of treated hip compared to the untreated hip.

	Nonop/GTA (N=20)	PFVO+GTA (N=20)	p-value
Flexion (% difference)	-6% ± 27%	-7% ± 22%	0.98
Extension (% difference)	-4% ± 30%	7% ± 27%	0.14
Abduction (% difference)	-1% ± 23%	-8% ± 25%	0.29
Adduction (% difference)	4% ± 33%	-1% ± 24%	0.74

Table 3. Radiographic measurements. Comparison of NSA, ATD, and Waldenstrom classification at time of testing.

	Nonop/GTA (N=20)	PFVO+GTA (N=20)	p-value
NSA difference (degrees)	0.90 ± 7.83	8.75 ± 8.66	0.004
ATD difference (mm)	6.70 ± 587	4.30 ± 7.09	0.36
Waldenstrom classification	3b- 55% 4- 45%	3b- 75% 4- 25%	