The Relationship Between Hip Abductor Muscle Strength and Magnitude of Pelvic Drop Following a 3-Week Strengthening Protocol in Non-Specific Low Back Pain Patients

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Context: The hip abductor muscles (HABD) have been theorized to play a primary role in maintaining horizontal pelvic position during single limb stance. The Trendelenburg test (TT) examines the ability of the hip musculature to maintain this horizontal pelvic position. However, no study has specifically tested this theory. No study has objectively measured the magnitude of pelvic drop (MPD) while performing the TT or investigated this relationship during walking. Finally, no study has tested whether increased HABD strength would reduce the MPD.

Objective: (1) To examine the relationship between HABD strength and MPD for patients with non-specific low back pain (NSLBP) and healthy controls (CON). (2) To determine the effect of a 3-week HABD strengthening protocol on changes in HABD strength, MPD, and pain for NSLBP patients. At baseline, we hypothesized that NSLBP patients would exhibit reduced HABD strength and greater MPD compared to CON. Following strengthening, we hypothesized increases in strength and decreases in MPD and pain would occur.

Design: Interventional.
Setting: Clinical research laboratory.
Participants: Fifteen NSLBP patients (38.8 ± 10.4 years; mass, 67.6 ± 10.4 kg) and 10 healthy CON (29.9 ± 11.1 years; mass, 73.1 ± 15.7 kg).
Methods: Baseline measures included: (1) bilateral HABD strength using a hand-held dynamometer and (2) MPD during 10 consecutive footfalls by placing retroreflective markers on the posterior superior iliac spines and recording with a 60-Hz camera. NSLBP patients rated their average weekly pain using a 10-cm visual analog scale (VAS). NSLBP patients completed a 3-week HABD strengthening protocol and all measures were repeated.

Main Outcome Measures: Maximal voluntary HABD strength was normalized to body mass (%BW). Two-dimensional MPD was calculated in degrees of motion below horizontal. VAS score was measured in centimeters. Between and within-group differences were examined using one-way and repeated measures ANOVA.

Results: At baseline, NSLBP exhibited 27.5% reduced HABD strength ($P = .01$) compared to CON (NSLBP: 13.1 ± 4.5% BW; CON: 18.1 ± 3.9% BW). No significant differences in MPD were measured during either the static TT or when walking. At 3-week follow-up, a significant increase in HABD strength (NSLBP: 16.9 ± 3.2%; $P = .03$) was noted, but no differences were observed in MPD during the static TT or when walking. Pain decreased by 38.3% (VAS-Baseline: 6.0 ± 1.5 cm; VAS-Post: 3.7 ± 2.1 cm).

Conclusions: NSLBP patients demonstrated reduced HABD strength compared to CON at baseline and, in 3 weeks, increased strength and decreased pain. Despite increases in strength, the NSLBP group exhibited no change in MPD during the static TT or when walking. These results suggest that the HABD may not be primarily responsible for controlling a horizontal pelvic position.

Altered Muscle Activity During Gait After Eccentric Exercise of the Biceps Femoris

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Objective: The effect of muscle damage on gait is unclear. In addition, the variability between injured athletes makes identifying differences during gait more difficult. Therefore, the purpose of our study was to assess the effect of an eccentric exercise protocol of the biceps femoris on lower-limb muscle activity and knee angular displacement during gait.

Subjects: A sample of 9 subjects from the university population (3 men and 6 women, height = 170.2 ± 9.2 cm, mass = 70.3 ± 12.0 kg, age = 22.6 ± 3.3 years) volunteered for this study. Subjects did not have any lower extremity injury and were simultaneously participating in a larger study.
**Methods:** Baseline measurements for knee function and evoked tenderness were collected using the International Knee Documentation Committee (IKDC) questionnaire and an algometer. Surface EMG electrodes were used to evaluate muscle activity of the tibialis anterior, lateral head of the gastrocnemius, vastus lateralis, and biceps femoris. All subjects walked on a treadmill at a self-selected speed and 10 gait cycles were recorded. Subjects then performed an eccentric hamstring protocol on an isokinetic dynamometer until they could only generate 50% of their maximum voluntary contraction of their hamstring. All subjects returned to the laboratory 48 hours after the exercise protocol and all dependent measures were collected again. Muscle activity was analyzed by computing rms values for five phases of the gait cycle. Knee angular displacement was computed on four phases. A paired sample t-test was used to evaluate knee function, and separate repeated measures ANOVAs were used to analyze the evoked tenderness, knee angle, and muscle (alpha = 0.05).

**Results:** Delayed onset muscle soreness was observed in all subjects as indicated by a significant decrease in function and a significant increase in evoked tenderness ($t = 5.83, P < .001$) and $F(2,16) = 4.01, P = .039$, respectively. No significant changes of knee range of motion during gait were noted after the eccentric exercise. A significant day X phase interaction was observed for the biceps femoris and the gastrocnemius ($F(4,32) = 11.11, P < .001$) and $F(4,32) = 3.17, P = .026$, respectively.

**Discussion:** All subjects experienced a decrease of hamstring EMG activity and an increase in gastrocnemius activity in late swing. While there was a significant change in muscle activity, there was not a significant change in knee angle during the gait cycle.

**Conclusion:** Biceps femoris eccentric exercise significantly affects the motor control of the lower limb during gait.

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**Comparison of Electronic and Traditional Medical Record Systems in Enhancing Documentation Compliance within a Collegiate Athletic Training Clinic**

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**Rationale:** Within the past decade, contemporary electronic medical records systems (EMRS) have been introduced into widespread use in numerous allied health care settings. Promising to improve data collection and retrieval methods, EMRS offer several advantages over traditional medical records systems (TMRS), most notably in the retrieval of historical data, injury trends, and general epidemiology information. Additionally, many EMRS vendors frequently claim such systems enhance documentation compliance due to ease of use and decreased time required to generate medical records following a patient encounter. Despite aggressive marketing and compelling rationale, athletic trainers and athletic therapists have been relatively slow to implement EMRS compared to other allied health care professions. The purpose of this investigation was to compare documentation compliance between a TMRS and an EMRS in a university varsity athletic training clinic. Eight certified athletic trainers and 9 athletic training students participated in the study.

**Methods:** During a 16-week semester, all patients were required to sign in prior to any evaluation, treatment, or rehabilitation. Documentation compliance (DC) was determined by comparing potential documentation (ascertained from athlete sign-in sheets) to actual documentation (determined by auditing all generated patient records daily). During the first 8 weeks of the investigation, a TMRS was used and DC was calculated. Concurrently, participants underwent a series of training seminars in preparation for the introduction of the EMRS. During the following 8 weeks, an EMRS was used and DC calculated in the same manner. Additionally, all participants completed a survey regarding their opinion of both the TMRS and the EMRS at the conclusion of each 8-week period. After 16 weeks, DC levels from the two methods were compared using a t-test.

**Results:** DC was significantly higher when using the TMRS than when using the EMRS ($P < .001$). Survey data revealed a significant difference in perceived time, ease of use, and completeness favoring the TMRS ($P < .05$).

**Conclusion:** Although many have encouraged the introduction of EMRS in athletic training and athletic therapy settings, further studies are warranted to determine the most effective strategy to use in introducing such technology into the traditional athletic training and therapy environment.

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**Active Isolated Stretching: An Investigation of Mechanisms of Action**

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**Rationale:** The Active Isolated Stretching (AIS) technique proposes that by contracting a muscle (agonist) the
opposite muscle (antagonist) will relax through reciprocal inhibition and lengthen without increasing muscle tension. The clinical effectiveness of AIS has been reported but its mechanism of action has not been investigated at the tissue level. Proposed mechanisms for increased range of motion (ROM) include mechanical or neural changes, or an increased stretch tolerance. The purpose of the study was to investigate changes in mechanical properties (ie, stiffness) of skeletal muscle in response to acute and long-term AIS stretching for the hamstring muscle group.

Methods: Recreationally active university-aged students (n = 10) classified as having tight hamstrings, by a knee extension test, volunteered for the study. All stretch procedures were performed on the right leg, with the left leg serving as a control. Each subject was assessed twice: at an initial session and after completing a 6-week AIS hamstring stretch training program. For both test sessions active knee extension (ROM) to a position of “light irritation,” passive resisted torque and stiffness were determined before and after completion of the AIS technique (2 × 10 reps). Data were collected using a Biodex System 3 Pro (Biodex Medical Systems, New York, NY) isokinetic dynamometer. Surface electromyography (EMG) was used to monitor vastus lateralis (VL) and hamstring muscle activity during the stretching movements. Between test sessions, 2 × 10 reps of the AIS bent knee hamstring stretch were performed daily for 6 weeks.

Results: Subjects extended the knee significantly further (session 1: 158.4° ± 12.6°; session 2: 173.3° ± 11.5°) after completing the long-term stretching program (P < .05). AIS also produced increases in ROM within the first session after a single bout; however, it was impossible to conclusively determine whether these changes were statistically significant, due to changes in the control leg ROM. No significant change was found in stiffness values. In both test sessions VL EMG activity (0.4326 ± 0.35 and 0.7443 ± 0.49, respectively) was significantly greater than hamstring activity (0.0866 ± 0.17 and 0.1671 ± 0.26) during AIS.

Conclusions: Long-term AIS appears to be effective at increasing ROM. A trend for the immediate benefits is also evident. AIS does not appear to affect mechanical mechanisms because there was no change in stiffness values. The contribution of neural mechanisms is also apparent and requires further investigation.

Reference
tion; however, a trend for increased joint laxity with this graft should be noted, particularly for female patients. The BPTB allograft seems to match the BPTB autograft for most test outcomes; however, it did not show the significantly better subjective results and reduced operation-site symptoms that is often discussed and theorized in literature. Specific considerations based on an athlete’s respective sport, their expectations of the graft, and postoperative goals for physical activity are key factors for consideration when determining graft choice.

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