IMPROVED LOWER EXTREMITY NEUROMUSCULAR ACTIVATION AND GROUND REACTION FORCE TIMING AFTER PROGRESSIVE RESISTANCE, WHOLE BODY, LONG-AXIS ROTATIONAL TRAINING

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Introduction
Optimized neuromuscular activation and ground reaction force timing may improve athletic performance and decrease injury risk.1,2

Methods
Over 4 weeks, Group 1 performed 9, 20 min training sessions consisting of 7 sets on a Ground Force 360 Device (Center of Rotational Exercise, Clearwater, FL, USA). The control group (Group 2) did not use the test device.

Groups continued regular athletic activities (soccer, basketball, tennis, swimming, volleyball, running) without increasing intensity or volume.

Surface EMG electrodes were applied over the gluteus maximus (GMX), gluteus medius (GME), vastus medialis (VM), rectus femoris (RF), vastus lateralis (VL), medial hamstrings (MH), biceps femoris (BF) and gastrocnemius (G) of the left (preferred stance) lower extremity.

A retro-reflective marker placed over an athletic shoe marked the left foot fifth metatarsal head.

Independent sample t-tests with Bonferroni adjustments were used to compare group mean change differences (MCD)(P ≤ 0.0045).

Time-synchronized EMG (1000 Hz), two-dimensional sagittal plane kinematic (60 Hz), and peak resultant ground reaction force (GRF) (1000 Hz) data were collected as subjects, responded to a random audio cue by moving as quickly as possible from an athletic ready position to kick a traffic cone placed 40 cm in front of the force plate with their left foot.

Results
Groups did not differ for cue timing (Group 1 = 1484 ± 3916 msec; Group 2 = 14704 ± 2261 msec, P = 0.92). Group 1 displayed earlier GMX (P = 0.004) (◇), GME (P = 0.001) (▷), RF (P = 0.003)(▲), MH (P = 0.004)(♦), and BF (P = 0.002)(◻) neuromuscular activation MCD compared to Group 2. Significant differences were not observed for VM (○), VL (♦), or G (★).

Discussion & Conclusions
Earlier neuromuscular activation timing (gluteus maximus, gluteus medius, rectus femoris, medial hamstrings, and biceps femoris), improved kick quickness, and earlier peak GRF timing was only observed in the training group. Findings suggest that device training may improve sports performance and decrease injury risk.

Recommendations
Further study is indicated to determine the efficacy of Ground Force 360 device use for decreasing the incidence of non-contact lower extremity injuries among high risk athletic populations.

References


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Purpose
To evaluate the efficacy of progressive resistance, whole body, long-axis rotational exercise training for improving lower extremity neuromuscular activation and ground reaction force timing.

Participants
36 healthy, recreational athletes (age = 24.1 ± 5 yrs, height = 175.7 ± 10 cm, weight = 72.9 ± 11 kg) were randomly assigned to groups with an equal number of men and women.

Median 2000 IKDC Self-Reported Activity Level was 3 (well-trained and frequently sporting) for both groups. Range = level 2 (sporting sometimes) to level 4 (highly competitive).