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Muscle Activity During the Star Excursion Balance Test in Healthy Adults

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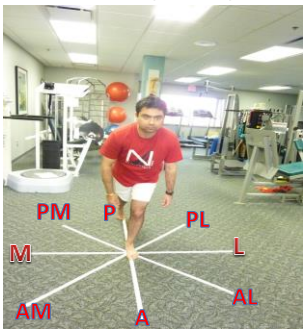
Purpose

To determine electromyographic (EMG) activity of the hip and the trunk muscles during the Star Excursion Balance Test (SEBT) performance in 8 reach directions.

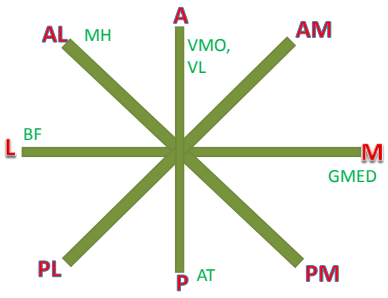
The Star Excursion Balance Test
Stance leg: Left leg



SEBT: A Clinical Tool

- Thorpe et al (2008) observed that collegiate athletes performed better than non-athletes on the SEBT.
- Plisky et al (2006) were able to predict LE injuries among high school basketball players using the SEBT.
- The SEBT was able to identify injury deficits for participants with a h/o CAI and ACL injury (Hertel et al 2006, Herrington et al 2009).
- The SEBT performance was improved after neuromuscular training in athletes and patients with CAI (Valovich et al 2009, Hale et al 2007).

Muscle activity during the SEBT in Healthy Adults



Earl et al 2001,
Norris et al 2011

Stance Leg: **Left Leg**

Theoretical Rationale

- LE muscles are direction dependent in both the healthy adults and the participants with CAI (Ahn et al 2011).
- The SEBT can be used as a functional tool to rehabilitate specific muscle group.
- Clinicians may be able to choose the reach directions during rehabilitation of the specific muscles of the LE.

Theoretical Rationale

To our knowledge only one study has measured the hip muscle activity in only 3 reach directions of the SEBT and no study has measured the trunk muscle activity during the 8 reach directions of the SEBT.

Research Design

- The study was descriptive, cross sectional, and within subject repeated measures.
- Power of the study was
- N=22

  11 males; 23.5 ± 4.2 years,

  11 females; 23.0 ± 3.6 years

Methods

Inclusion Criterion

- Healthy adults (males and females) between the ages of 18-40.
- Very lean to fair body composition (% body fat), *ACSM's Guidelines* (Escamilla et al 2006).
  - Male: 4.2 to 21.3%
  - Female: 9.8 to 24.6%

Methods

Exclusion Criterion

- History of CAI of the stance leg (determined using AII),
- UE and LE injury within last 6 months,
- History of UE (within last 6 months), LE , neck, and back surgery, head injury, or any other disorder affecting their balance.
- Currently experiencing pain anywhere in the body.
- Difficulty maintaining single leg stance for 10 seconds on either leg,
- Visible contra-lateral pelvic drop during single leg stance.

Methods

Independent Variable

Reach direction of the SEBT (8 levels)

Dependent Variable

RMS muscle activity presented as %MVIC of the:

Erector spinae (ES), External oblique (EO),
Rectus abdominis (RA) Gluteus medius (GMed),
Gluteus maximus (GMax)

Methods

Data Processing

- RMS values were used after processing the raw data.
- Mean RMS value was calculated during the 2 second eccentric phase of the each SEBT trial.
- The RMS value of the eccentric phase of the three trials were averaged for each muscle to be normalized to its respective MVIC value

Methods

Data Analysis

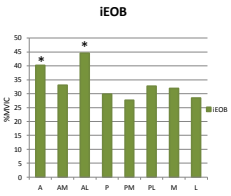
- 2-way repeated-measure ANOVA to determine interaction between muscles (8 levels)and reach directions (8 levels).
- A separate 1-way repeated measures ANOVAs were run on each muscle tested to compare the normalized EMG values across 8 excursion directions.
- Post-hoc comparisons using Sidak test.

2 way repeated measures ANOVA

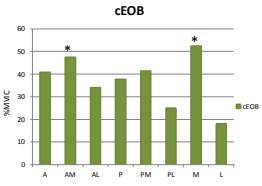
- The test was statistically significant.
- Trunk and hip muscles activity changed with change in the reach direction of the SEBT.

Results

Highest EMG activity in **AL** direction

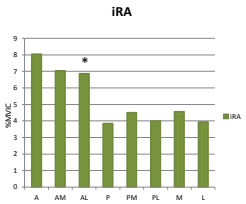


Highest EMG activity in **M** direction

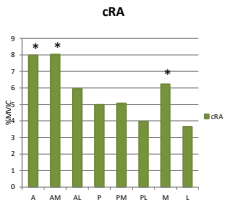


Results

Highest EMG activity in **A** direction

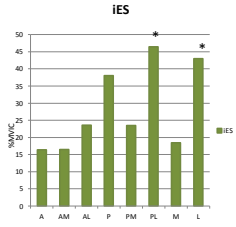


Highest EMG activity in A and AM direction

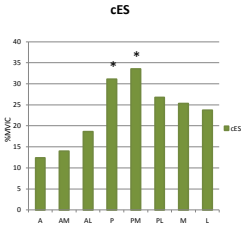


Results

Highest EMG activity in **PL** direction

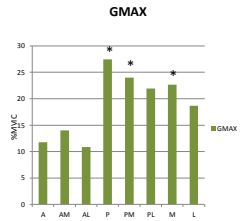


Highest EMG activity in **PM** direction

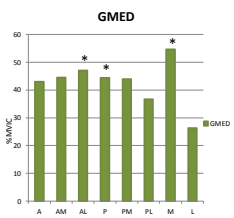


Results

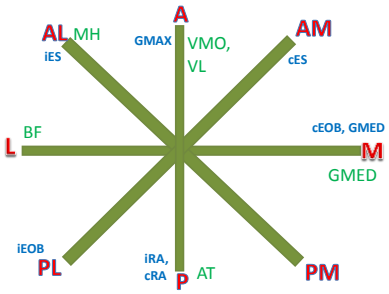
- Highest EMG activity in **P** direction



Highest EMG activity in **M** direction



Muscle activity during the SEBT in Healthy Adults



Stance Leg: **Left Leg**

Clinical use of the study results

- The SEBT can be used as a functional tool to rehabilitate specific muscle group.
- Clinicians will be able to choose the reach directions during rehabilitation of the specific muscles of the trunk and the hip muscles.

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Muscles	Directions	Mean % ± SD %	95% CI
iEOB	AL	44.5 ± 38.4	27.5 – 61.5
	A	40.1 ± 35.0	24.6 – 55.6
cEOB	M	52.3 ± 40.8	34.2 – 70.3
	AM	47.3 ± 31.7	33.2 – 61.3
	PM	41.3 ± 33.7	26.3 – 56.3
	A	40.8 ± 35	25.3 – 56.3
iES	PL	46.4 ± 20.2	37.4 – 55.3
	L	43.0 ± 18.9	34.6 – 51.4
GMED	M	54.6 ± 26.1	43.0 – 66.2
	AL	47.0 ± 25.7	35.6 – 58.4
	AM	44.4 ± 22.5	34.4 – 54.3
	P	44.3 ± 22.4	34.4 – 54.2
	PM	43.9 ± 20.6	34.7 – 53.0
	A	42.9 ± 22.8	32.8 – 53.0