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Research Paper Review

Progressive hip rehabilitation: The effects of resistance band placement on gluteal activation during two common exercises

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Cambridge EDJ, Sidorkevicz N, Ikeda DM & McGill SM

Reviewed by Dr. Demetry Assimakopoulos DC (Research Review Service)

ABSTRACT

Background: *A critical issue for constructing a progressive rehabilitation program is the knowledge of muscle activation levels across exercises and within exercise modifications. Many exercises are offered to enhance gluteal muscle activation during functional rehabilitation but little data exists to guide the progression of exercise intensity during rehabilitation. The objective of this paper was to examine the effects of altering resistance band placement during 'Monster Walks' and 'Sumo Walks.'*

Methods: *Nine healthy male volunteers formed a convenience sample. Sixteen electromyography channels measured neural drive of selected muscles of the right hip and torso muscles. Three resistance band placements (around the knees, ankles and feet) during the two exercises were utilized to provide a progressive resistance to the gluteal muscles while repeated measures ANOVA with Bonferroni adjustment was used to assess differences in mean EMG. The presentation of exercises and band placement were randomized.*

Findings: *Examining muscle activation profiles in the three hip muscles of interest revealed the progressive nature of the neural drive when altering band placement. Tensor fascia latae (TFL) demonstrated a progressive activation moving the band from the knee to the distal band placement, but not between the ankle and foot placements. Gluteus medius demonstrated a progressive activation moving distally between band placements. Gluteus maximus was preferentially activated only during the foot placement.*

Interpretation: *The band placements offered a progressive increase in resistance for hip rehabilitation, specifically the gluteal muscles. The added benefit of placing the band around the forefoot was selective enhancement of the gluteal muscles versus TFL presumably by adding an external rotation effort to the hips. This information may assist those who address gluteal activation patterns for patients suffering hip and back conditions where gluteal activation has been affected.*

ANALYSIS

Author's Affiliations
Department of Kinesiology, University of Waterloo, Canada.

Background Information
For decades, there has been a large interest in the relationship between hip and spine function. Investigation into this relationship has lead many authors to suggest an association between low back pain and a functional gluteal muscle inhibition (1, 2).

Many studies have gone on to prove that lumbopelvic muscle imbalances are a potential predictor of low back pain, and that progressive rehabilitation focusing on core stability and gluteal strengthening is beneficial in sub-groups of individuals with low back pain (3). The goal of any rehabilitation program is to tailor the progression of exercises according to the patient's capabilities, from low-to-high activation levels, in order to make the patient better symptomatically, and depending on the practitioner's philosophy, functionally.

The authors of this study sought to understand the influence of resistance band placement on muscle activation profiles during two common exercises. Specifically, they wanted to describe changes in activation according to the placement of a mini-band around the knees, ankles and feet during two rehabilitation exercises called 'Monster Walks' and 'Sumo Walks.' Additionally, the authors wanted to determine if a more distal band placement can increase hip abductor (glutes, TFL) activation and whether or not clinicians can preferentially activate the gluteal muscles (Gmed and Gmax) by placing the band around the foot due to the creation of an internal rotation moment about the hip.

PERTINENT RESULTS

Primary Analysis
- TFL activation increased with more distal band placement while performing the Sumo Walk (i.e. comparing knee band placement to forefoot band placement). There was no significant increase in activity of the TFL when comparing a forefoot band placement to an ankle band placement. Similar results were seen with performance of the Monster Walk.
- While performing the Sumo walk exercise, placing the band around the forefoot required significantly more Gmed activation in comparison to both the knee and ankle conditions.
- The Monster walk exercise showed a progressive increase in Gmed EMG activation with more distal band placement. There was an increase in EMG activity with only a trend toward significance when changing placement from the ankle to the forefoot while performing this exercise, but a clearly significant increase in EMG activity when comparing knee band placement to forefoot band placement.
- Gmax EMG activity increased significantly with placement of the band around the forefoot while performing the Sumo Walk exercise in comparison to both knee and ankle band placements. The Monster Walk showed similar increases in Gmax EMG activity with more distal band placement (i.e. comparing a proximal knee placement to more distal forefoot band placement). However, no significant difference in Gmax activity was observed when comparing knee to ankle or ankle to foot band placements.

Secondary Analysis

- The lumbar spine maintained a motionless neutral or near neutral spinal position (with a minor trend towards flexion) while performing both the Sumo and Monster Walks.

CLINICAL APPLICATION & CONCLUSIONS

Placing the mini-band around the forefoot creates additional activation and thus potential clinical 'value' for gluteal activation, due to the fact that it creates an internal rotation moment that must be overcome by the glutes. When the glutes counteract the internal rotation moment about the hip with a relative (and often isometric) external rotation, they are activated tremendously. Additionally there was not significant increase in TFL activity with forefoot band placement in comparison to ankle band placement, indicating that it is possible to preferentially activate the gluteal muscles.

Both the Sumo Walk and the Monster Walk should be integrated into the rehabilitation exercise repertoire of clinicians, especially with individuals who suffer from sensitivity and/or pain in specific lumbar spine postures (i.e. flexion or shear intolerance). Essentially, what the authors were trying to say with the results of the secondary analysis is that these two exercises are spine safe. The authors also suggest that these exercises be combined with proprioceptive sandals (Janda Shoes – 4), clamshell and core exercises to emphasize hip strength through a fixed and stable spine.

STUDY METHODS

Nine healthy male volunteers were recruited from a university community. The participants were instructed to perform two exercises that were up-right modifications of walking gait, while in a semi-squat: 'The Monster Walk' in the saggital plane and 'The Sumo Walk' in the frontal plane (see photo below). While performing the Monster Walk, the participants were instructed to walk while maintaining a hip width stance, while at the same time, having to overcome a medial resistance of an elastic band. During The Sumo Walk, the participants were asked to start in the same stance as The Monster Walk, but to also simply 'side-step' in the frontal plane. Each subject was instructed to maintain an abdominal brace and a neutral spinal posture, and to move in a slow and controlled fashion.

Three band placements were used: knee (at the tibial tuberosity), ankle (lateral malleoli) and forefoot. The order of band placement was randomized for each participant performing the exercise. Each individual performed 3 consecutive trials of each band placement as per the randomized order. Repeated measure ANOVA was used to compare the main effect of band placement on EMG activity for each muscle.

EMG electrodes were placed on the rectus abdominus, external oblique, internal oblique, upper and lower erector spinae, latissimus dorsi, Gmed, Gmax, TFL and biceps femoris. Additionally, each participant was outfitted with equipment for motion capturing using reflective markers.

A secondary analysis was performed to determine dynamic hip and spine posture and movement while performing the exercises described above. To do this, kinematic joint angles for the hip and spine were measured using the Visual 3D software. No additional statistics were done for this secondary analysis.

STUDY STRENGTHS / WEAKNESSES

Strengths

- Very creative study
- Randomization of order of band placement
- Measurement of spinal motion to determine if these exercises are safe for individuals with certain movement intolerance (ie. flexion or shear intolerance).

Weaknesses

- Use of only one grade of resistance for each participant. This can lead to increased variation in normalized EMG.
- Low sample size: many of the findings show a 'trend towards significance' with more distal band placement. It is not unreasonable to assume that with more bodies to test, these results would have become significant. A lower sample size decreases the statistical power of the study.
- Inability to assess deep muscles of the hip (i.e. Gmin). This would necessitate the use of in-dwelling EMG. Surface EMG, as was used in this study, can only measure the activity of more superficial musculature.

Additional References

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