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Different hip rotations influence hip abductor muscles activity during isometric side-lying hip abduction in subjects with gluteus medius weakness

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ABSTRACT

The purpose of this study was to establish the effects of different hip rotations during isometric side-lying hip abduction (SHA) in subjects with gluteus medius (Gmed) weakness by investigating the electromyographic (EMG) amplitude of the Gmed, tensor fasciae latae (TFL) activity, and gluteus maximus (Gmax), and the activity ratio of the Gmed/TFL, Gmax/TFL, and Gmed/Gmax. Nineteen subjects with Gmed weakness were recruited for this study. Subjects performed three isometric hip abductions: frontal SHA with neutral hips (SHA-N), frontal SHA with hip medial rotation (SHA-MR), and frontal SHA with hip lateral rotation (SHA-LR). Surface EMG amplitude was measured to collect the EMG data from the Gmed, TFL, and Gmax. A one-way repeated-measures analysis of variance was used to determine the statistical significance of the Gmed, TFL, and Gmax EMG activity and the Gmed/TFL, Gmax/TFL, and Gmed/Gmax EMG activity ratios. Gmed EMG activity was significantly greater in SHA-MR than in SHA-N. TFL EMG activity was significantly greater in SHA-LR than in SHA-N. The Gmed/TFL and Gmed/Gmax EMG activity ratios were also significantly greater in SHA-MR than in SHA-N or SHA-LR. The results of this study suggest that SHA-MR can be used as an effective method to increase Gmed activation and to decrease TFL activity during SHA exercises.

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1. Introduction

The gluteus medius (Gmed) is the primary muscle that acts as a hip abductor (Standring et al., 2005), a pelvis stabilizer in a unilateral stance against gravity (Al-Hayani, 2009; Gottschalk et al., 1989), and a controller hip adduction and internal rotation eccentrically (Moore and Dalley, 1999). Accordingly, Gmed weakness can lead to lateral hip pain (Strauss et al., 2010), iliotibial-band friction syndrome (Fredericson et al., 2002; Lee et al., 2012), patellofemoral pain syndrome (Cichanowski et al., 2007; Robinson and Nee, 2007; Magalhães et al., 2010; Nakagawa et al., 2012), and osteoarthritis of the knee (Hinman et al., 2010). Therefore, many therapeutic exercise protocols have focused on Gmed activity for prevention and rehabilitation in clinical and athletic training settings.

Many previous studies have examined the effectiveness of various exercises to increase Gmed activity including a single-leg stance, hip clams, side steps, bridging, sideways hop exercises, and side-lying hip abduction (SHA) (Bolgla and Uhl, 2005; Distefano et al., 2009; McBeth et al., 2012; Selkowitz et al., 2013). Of these various exercise, SHA exercise is frequently used in rehabilitation sessions because it can be performed early in a rehabilitation program to generate proper neuromuscular control and strength since it is a less demanding exercise as an open kinematic chain exercise. Additionally, SHA is effective in targeting Gmed muscle activity. Previous study reported that Gmed activity was greater than almost 16% of maximal voluntary isometric contraction (MVIC) than single-limb squat, band walk, single-limb

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