



Lower Extremity Strength and the Range of Motion in Relation to Squat Depth

by

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The purpose of this study was to determine which variables of the range of motion (ROM) and strength of the hip, and ankle are associated with squat depth. In total, 101 healthy subjects (64 males, 37 females) participated in the study. Outcome measures consisted of the ROM of hip flexion, hip internal rotation, external rotation, ankle dorsiflexion with an extended and flexed knee joint, and strength of the hip flexor and ankle dorsiflexor. Squat depth was measured using SIMI motion analysis software. Pearson correlation was used to determine the relationship between variables and squat depth. Multiple stepwise regression analysis was performed to determine variables associated with squat depth. The multiple regression model indicated that ankle dorsiflexion with a flexed knee and the hip flexion ROM were significantly associated with squat depth in male subjects ($R^2 = 0.435$) and ankle dorsiflexion with an extended knee and dorsiflexor strength were significantly associated with squat depth in female subjects ($R^2 = 0.324$). Thus, exercises to increase the ROM of the ankle dorsiflexion, hip flexion, and dorsiflexor strength can be recommended to improve squat performance. Future studies should assess an increased ROM of the ankle dorsiflexion, hip flexion, or dorsiflexor strength effect on deep squat performance.

Key words: dorsiflexion, hip flexion, range of motion, squat.

Introduction

Squatting is a common and popular exercise among athletes and the general public (Escamilla et al., 2001; Fry et al., 2003; McCurdy et al., 2005). In particular, it has been used to increase strength of the lower extremity muscles and the correct position is taught during squatting to minimize strain on the joints and potential injury to the low back and knees (Potvin et al., 1991; Escamilla, 2001; McCurdy et al., 2005; Kritz et al., 2009). In weightlifting and power lifting, a high flexion angle of the lower limb is frequently required, and this may induce increased musculoskeletal stress or injury to the knee

(Escamilla, 2001; Hemmerich et al., 2006; Sriwarno et al., 2008; Kritz et al., 2009; Kathiresan et al., 2010; Schoenfeld, 2010).

The squat is defined as a sitting posture with dorsiflexed ankles, a deeply flexed knee and hip (Kathiresan et al., 2010) and is one of the multiple joint movements performed in a closed kinetic chain (Schoenfeld, 2010). The optimal performance pattern of the squat has been described as the hips, knees, and ankles being aligned in parallel, with no mediolateral movement, while the heels remain on the ground at all times (Kritz et al., 2009). Faulty movement

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