THESIS: Squat Depth in Relation to Potential Injury of the Knees and Lumbar

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Introduction: Squats are one of the most widely used exercises in the strength and conditioning community. It is considered to have superior biomechanical similarities to athletic movements which could help enhance performance. It is also proven to be effective in improving leg strength and physical functioning in the general population. Although squatting is an exceedingly popular exercise, it is associated with an elevated risk of overuse injury in the low back and the knees. The purpose of the study is to examine the mechanics and muscle activation patterns in the knee and lumbar region during different squatting depths (deep, parallel, and partial). The main research question is how squatting at different depths affects the biomechanics in the knee and lumbar regions. Specifically, does performing a deep squat place a greater mechanical load on the knees and lumbar compared to a partial or parallel squat? Also asking the question of which muscle groups will be most active in the deep squat. It is hypothesized that the deep squat will put a higher mechanical load on the knees and lumbar. It is also hypothesized that EMG readings will show the highest quadriceps, hamstring, and erector spinae activation in the deep squat position. But show no difference in gluteus maximus activity between conditions.

Methods: Testing was broken down into two collection days. On the first day, participants performed a three-repetition max (3RM) barbell back squat in the deep squat position. Their 3RM was used to give a predictive 1RM that was used for the main collection. On the second

day, participants performed squats with three different depths in a randomized order with a resistance level set at 75% of their predictive 1RM. Performing each squat in one set of three repetitions. 3D motion capture with force plates was used to determine the mechanics of the squat movements to determine mechanical load. Electromyography (EMG) was also used to assess activation patterns of muscles in the leg and lumbar region. **Results:** The main findings suggest that higher knee flexion will influence more moments and quadricep/hamstring muscle activation in both the concentric and eccentric phases of the squat. Trunk flexion did show an increase as the knee flexion increased between depths. The erector spinae and gluteus maximus muscle activation did not show to be greater as knee flexion increased but instead stay consistent between each condition. **Conclusion:** Muscle activation in the lower back stayed the same through each condition. There was increased mechanical load put onto the knee region as depth increased, these increased moments will also contribute to increased muscle activation on the quadriceps and hamstrings.