

The Effects of a Heel Lift on Squat Biomechanics

LEXY CLARK¹, MO MOESLIN¹, DONOVYN MURRAY², JARED COBURN FACSM², & KEVIN CHOE^{1,2}

¹Department of Kinesiology; Whittier College; Whittier, CA

²Center for Sport Performance; Department of Kinesiology; California State University, Fullerton; Fullerton, CA

Category: Undergraduate

Advisor / Mentor: Choe, Kevin (kchoe@whittier.edu)

ABSTRACT

The barbell squat is an effective exercise for improving lower extremity function. During the descent of a squat, the hip and knee joints flex while the ankle joint dorsiflexes. The hip and knee joints then extend and the ankle joint plantarflexes when standing up. During the squat, some athletes use shoes with an elevated heel or other means of heel elevation to achieve lower squat depth. Research has suggested that use of heel elevation may improve range of motion (ROM) of the lower extremity joints and improve stability of the movement during deep squats, especially with an external load. **PURPOSE:** The purpose of this study was to compare lower extremity biomechanics during the back squat exercise in a heel-lift (HL) vs non-heel lift (NHL) condition. We hypothesized that the HL condition would result in greater peak knee flexion angles (KFA) and greater net knee joint moments (NJM). **METHODS:** 25 healthy participants (13 male, 12 female, 23.6±3.14 yrs., 1.70±0.08 m, 72.24±12.86kg) who had back squatted at least once per week for the last three months were recruited for data collection. 2 visits were required from each participant with the first visit involving back squat one-repetition-maximum (1RM) testing (101.62±41.40kg). During the second visit, participants underwent 3-D biomechanical analyses for the back squat with and without heel lift. Participants performed three repetitions at 75% 1RM for each condition in a randomized order, with a five-minute rest period. Squat velocity was controlled for by using a metronome set to 20 beats per minute. The 2nd of the three repetitions was used for analysis. Paired samples T-tests were used to compare peak knee NJM and peak KFA between the HL and NHL conditions. **RESULTS:** No differences were found between HL and NHL for knee NJM (2.79±0.96 Nm/kg⁻¹ vs 2.7±0.79 Nm/kg⁻¹, p=0.72) or peak KFA (126.03±15.73° vs 125.8±15.39°, p=0.83) **CONCLUSION:** Results contradict our hypothesis, as the HL did not increase the participants KFA or knee NJM. These results suggest that shoe type used during the back squat exercise may be left up to user preference as to what is comfortable for them. Future studies may aim to see if adding a HL influences lower extremity biomechanics when the load is closer to 1RM, or in other squat variations.