

The effect of external load position on patellar tendon kinetics during the

Spanish squat

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The Spanish squat (SPS) is an exercise that places high demands on the patellar tendon compared to a bodyweight squat (Needham, R.A., Corns, A., Bodden, J., Walker, P., Carter, R. (2019, July 31–August 4). A biomechanical investigation of the Spanish squat: The effect of trunk inclination and load on quadriceps activity and patellar tendon force [Poster presentation]. International Society of Biomechanics, Calgary, Canada). In the corresponding study, an increase in peak patellar tendon force (PTF) was noted when trunk posture moved from a 45° angle to a 90° angle relative to the horizontal. When an external load was included, a 20 kg dumbbell held anterior to the upper sternum, there was a further increase in peak PTF. Therefore, the aim of this study was to assess the effect of different external load positions on peak PTF during the SPS. With institutional ethical approval, 10 male participants (mean age: 33.2 ± 8.2 years; stature: 1.76 ± 0.05 m mass: 87.5 ± 13.2 kg) (mean \pm s) performed the SPS under three conditions; (SPS) bodyweight with no additional load, (SSG) both hands holding a 20 kg dumbbell anterior to the upper sternum; (SSLW) holding a 10 kg dumbbell in the left and right hand. All SPS conditions were compared to the single leg decline squat (SLDS). Motion capture and force plate data were collected. A metronome was used to standardise a three second count for the eccentric and concentric phase. Patellar tendon force was determined by dividing the knee extensor moment by the estimated patellar tendon moment arm. The mean from three trials were analysed. Mean peak PTF was significantly different between the squat conditions, $F(3, 27) = 23.328$, $p < .001$. Post hoc analysis with a Bonferroni adjustment revealed that mean peak PTF increased significantly during the SLDS in comparison to the SPS ($M=1287\text{N}$, 95% CI [722, 1852], $p < .001$), SSG ($M=1154\text{ N}$, 95% CI [514, 1794], $p = .001$), SSLW ($M=1100\text{N}$, 95% CI [317, 1883], $p = .006$). There was no significant difference in mean peak PTF between the SPS, SSG and SSLW. However, there was a subtle incremental increase in mean peak PTF as external load was introduced (SSG) before moving posteriorly and laterally to the body (SSLW). This study has provided further guidance on the progression and regression of the SPS exercise via an understanding on the position of external load.