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Developing a protocol to investigate the association between the Segond fracture and anterior cruciate ligament injury

Abstract

The Segond fracture, an avulsion fracture at the anterolateral proximal tibia, is associated with anterior cruciate ligament injury in 75-100% of cases. This study aimed to develop a protocol for investigating this association by observing differences in morphometric parameters between entheseal and non-entheseal bone at different sites on cadaveric tibiae. The proximal tibiae of 5 female donors (aged 74-98) with no macroscopic evidence of knee trauma, surgery or degenerative disease were used, in compliance with the Human Tissue Act 2004. The soft tissue was dissected down to the ligamentous and tendinous insertions only. Each specimen was scanned in a Nikon XTH225 microCT scanner with *c.*80 µm pixel spacing. The images were processed with the MicroView 3D image viewer and analysis tool, which allowed virtual bone biopsy to be performed. For each specimen, Bone Volume over Total Volume (BV/TV) was measured at several entheseal and non-entheseal sites using a 5mm diameter spherical volume of interest for each site. These sites were: the 'Segond' site (ALL, ALLβ, ALLγ); anterior cruciate ligament (ACL); posterior cruciate ligament (PCL); patellar tendon (PT); iliotibial band (ITB); lateral collateral ligament (LCL); lateral tibial condyle (LC); and medial tibial condyle (MC). One-way repeated measurements ANOVA on logged values (to eliminate heteroscedasticity) indicated a difference in BV/TV between these 10 regions (P=0.0005). BV/TV for ALL was 0.17±0.03 (mean±SD), identical to ALLβ and less than all other regions. A Dunnett's post-hoc comparison of ALL to the other 9 regions gave adjusted P values as follows: ALLβ=1.00; ALLγ=0.15; LCL=0.45; ACL=0.055; PCL=0.0036; PT=0.031; LC=0.032; ITB=0.021; MC=0.018. These results suggest that ALL has smaller BV/TV than other areas. Larger studies are needed to confirm whether the differences for sites such as the ACL and PCL are real, to assist in elucidating the pathogenesis of Segond fracture and informing the management of ACL injury.

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