interest.

Disclosure statement: The authors have declared no conflicts of interest.

Background: OA is a chronic debilitating condition marked by cartilage destruction and bone remodelling. Histopathologically OA is characterized by changes to the tidemark mineralization front, which marks the interface between the superficial viscoelastic hyaline layer and the deep calcified layer. Tidemark duplication (therefore, advancement) is a known histological feature of OA. This has been suggested to be a consequence of the reactivation of endochondral ossification leading to thickening of the calcified cartilage and neovascularization and neoinnervation of the cartilaginous cartilage potentially leading to mechanical pain.

Methods: Femoral heads and tibial plates were taken from cadavers. Each femoral head was cut into four blocks exposing the articular surface, two superior to the fovea and two inferior. The tibial plates were cut into lateral or medial blocks. All blocks were demineralized by immersion in formal saline for a year, then embedded in wax and sliced into sections. These were divided into three even groups stained with toluidine blue, hematoxylin and eosin, and trichrome gomori. Each section was analysed by light microscopy and following the OARSI criteria set out by Pritzker et al. (2006) given a grade 0–6 based on changes to the matrix and/or cells. Student’s t-test explored associations between the presence of a dual tidemark and OARSI grade. Odds ratios were calculated for the occurrence of dual tidemarks by OARSI grade as independently defined by matrix and cells.

Results: In total, 13 cadavers (8 male, 5 female, mean age 87) were used. Both femoral heads were removed from 5 cadavers, and one femoral head in two separate cadavers. The tibial plateau was removed from 6 different cadavers. 177 sections were produced (femoral heads left n = 72, right n = 72) (tibial plates right n = 22, left n = 11). A dual tidemark was associated with a higher OARSI grade than a single tidemark [mean (s.d.) 3.41 (1.59) vs 1.11 (1.04) respectively, P < 0.001]. A matrix with an OARSI score of ≥3 predicted a 96 fold increase in the association of a dual tidemark (P = 0.0001), whereas cellular changes resulting in an OARSI score ≥2 predicted a 17.7 fold increase in the occurrence of a dual tidemark (P < 0.001).

Conclusion: We have demonstrated (for the first time) early changes in the matrix (OARSI ≥3) or chondrocytes (OARSI ≥2) strongly predict a dual tidemark. Pathologically, OA is regarded as a process that occurs from the wear and tear of articular surfaces. Our data suggest that tidemark advancement occurs at an early stage and may perpetuate further osteoarthritic change at the hyaline layer, thus mediating an alternative bottom-up mechanism. Further exploration of this may lead to novel systemic treatment strategies preventing tidemark advancement and thereby disease progression.

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