Biomineralisation of the cartilage-bone interface in the degenerating joint.
Thambyah, A; Goh, TC; Young, A; Broom, ND
University of Auckland, Auckland, New Zealand
Senior author nd.broom@auckland.ac.nz

INTRODUCTION
The zone of calcified cartilage (ZCC) has been a notoriously difficult region to study. The significance of this zone has been suggested in previous literature as the site where important changes take place in the pathogenesis of the osteoarthritic joint (Burr 2004). The changes include an advancing calcification front in the cartilage matrix and a bone cement line that progresses into the ZCC. The ZCC is difficult to isolate, image and test mechanically. We hypothesise that a comprehensive investigation of this region in the osteoarthritic joint would present new insight into the biomineralisation processes that takes place with disease and develop upon current ideas on bone formation in the osteoarthritic joint.

METHODS
Five fresh bovine patellae, obtained from mature cows, were used in this study. These patella were chosen based on positive staining from Indian ink showing osteoarthritic cartilage disruption (Thambyah and Broom 2007). Osteochondral blocks approximately 14mm by 14mm were extracted from the distal-lateral section from each patella. Blocks were then divided into three groups each containing 5 samples.

RESULTS
Due to limited space, the XRD curves are not shown here. These results however showed articular cartilage as having a smooth curve devoid of any peaks, and is typical of an ‘amorphous-material’ response. Upon removal of the cartilage layer and sequential scanning from ZCC to bone, typical peaks at about 32º (typical for calcium hydroxyapatite mineral) was obtained consistently. There was a gradual reduction in this peak intensity, from ZCC to bone suggestive of a reduced mineral content. This reduction was greater for samples from region B.

DISCUSSION
The data suggests that the ZCC contains more of a mineral phase than bone in the degenerate cartilage-bone tissue. Also the bone spicules are very similar to the morphological description of ‘cutting cones’ seen in new bone formation. From integrating the data obtained from the different techniques, we suggest that for the increasingly degenerative joint: (1) the ZCC becomes harder than bone due to increased mineralisation; (2) that the developing ZCC possibly provides a ‘mineral-reservoir’ for new, primary bone formation.

REFERENCES

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