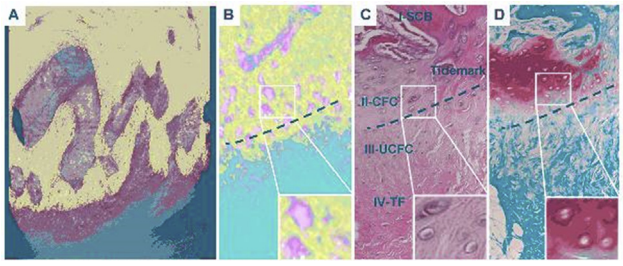

Fig 1: A: A 3D visualization Image of BTJ, the top was bone, while the bottom was tendon. B: The four layer structure of BTJ was distinguished in a CT slice; bone was defined as yellow, while the blue was appointed to the tendon area. Fibrocartilage zone was located in the middle area. A tidemark crossed the fibrocartilage zone throughout for dividing the uncalcified fibrocartilage and calcified fibrocartilage was visible as a light blue line, largely matched with the histomorphology observation by H&E (C) and Safranin O (D) staining.

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DIFFERENTIAL EFFECTS OF PTH(1-84) THERAPY ON BONE TISSUE MINERALIZATION, COLLAGEN CROSSLINKING AND MECHANICS IN HEALTHY AND DIABETIC RATS

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Objective: Type 2 diabetes mellitus increases skeletal fragility despite normal BMD. Impaired bone turnover and collagen crosslinking are likely contributors, but it remains unclear how these affect tissue-level bone mechanics. Anti-osteoporosis medications are being explored as therapeutic options; however, it is unknown whether they reverse the diabetic effects on bone tissue itself. We studied the effect of diabetes and bone-anabolic treatment on bone mechanics, surface tissue mineral density (sTMD) and non-enzymatic glycation (NEG) in Zucker Diabetic Fatty (ZDF) rats. We hypothesized that diabetic rats have inferior mechanics that cannot be fully restored due to a lack of effect on NEG and TMD in the new bone tissue.
Methods: Ten-week old ZDF diabetic and non-diabetic rats were given 75 μg/kg PTH(1-84) or vehicle five days per week over 12 weeks (4 groups, N=7 per group). The right femora and L4 vertebrae were excised, micro-CT scanned, and tested to failure in 3-point bending and uniaxial compression, respectively. The sTMD was calculated as the mineral content in the bone tissue within 30μm of the surface. Bone tissue mechanical properties were determined from the mechanical tests. The NEG content was determined from sample fluorescence (370nm ex, 440nm em).
Results: Diabetic rats demonstrated significantly poorer ultimate stress (fem: -10%, vert: -20%), strain (fem: -5%, vert: -22%) and toughness (fem: -13%, vert: -42%) with a higher vertebral sTMD (+1.6%) and trend towards higher femoral NEG (+35%, p=0.07). In the non-diabetics PTH increased vertebral ultimate strain (+24%) and femoral toughness (+28%) and ultimate strain (+21%). In the diabetic animals no improvements in mechanics were observed with PTH, while femoral ultimate stress (-13%) and toughness (-27%) were decreased in the treated compared to the non-treated diabetics. Lower levels of NEG (-38%, vert) and sTMD (-2.1% vert, -1.4% fem) were observed with PTH in the non-diabetics, whereas no effect of PTH on these variables was observed in the diabetic animals. A multiple regression model showed independent associations with mechanics for sTMD at the femur, and for NEG and sTMD at the vertebra.
Conclusion: This study demonstrated that diabetes weakens the tissue biomechanics of ZDF rat bone, and that the positive effect of PTH treatment observed in non-diabetics is absent. Both mineral (sTMD) and collagen (NEG) contributed independently to the mechanical properties, and the reduced mechanics after PTH treatment in diabetic animals are likely due to an inability to add new bone matrix with normal (low) levels of NEG, supporting our hypothesis.

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THE RELATIONSHIP BETWEEN HYALINE CARTILAGE AND SUBCHONDRAL BONE LESIONS IN THE PATIENTS WITH KNEE OSTEOARTHRITIS

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Background: Cartilage damage which leads to the end disease known as osteoarthritis, is a leading cause of morbidity in the aging population. It is characterized by the progressive loss of articular cartilage and subchondral bone lesions. Plain radiographs remain the gold standard for diagnosis and monitoring of progressive knee changes. However, X-rays were strongly attenuated by the mineralized tissues. Therefore, subchondral abnormalities occur during disease progression remains to be elucidated through the use of high-resolution radiological imaging methods.
Objective: To compare the subchondral architecture of osteoarthritis and normal articular cartilage at different regions using high-resolution peripheral quantitative computed tomography (HR-pQCT).
Methods: The proximal tibial was resected as single osteochondral unit during total knee replacement surgery. To obtain accurate knee radiographs, the X-ray films before and after surgeries were analysed. Cartilage degenerative regions were assessed using the modified 3-graded Outerbridge classification. Grade A: normal; Grade B: (i) softening and swelling of the cartilage, or (ii) fragmentation and fissuring of an area that does not reach subchondral bone. Grade C: erosion of cartilage down to bone. A total of ten osteochondral units from the patients with osteoarthritis and three normal osteochondral units from the Bone Bank (Department of Orthopaedic Surgery, University of Malaya) were scanned with high-resolution peripheral quantitative computed tomography (HR-pQCT) system. The volumetric bone mineral density of the subchondral bone plates and the trabecular subchondral bones were measured. Scanning Electron Microscope (SEM) was used to observe and measure the microstructure of cartilage interface.
Results: Based on the volumetric bone density analysis, the grade B lesion of osteochondral units (mean+standard deviation: 716+62 mg HA/cm^3) were not showed significantly difference with normal osteochondral units (725+13 mg HA/cm^3). However, the grade C lesion of osteochondral units have the highest bone volume (72+13 mg HA/cm^3) which showed significantly higher than the grade B and normal osteochondral units. In grade C exposed-subchondral bone showed a trend of bone remodelling caused by increased levels of hydroxyapatite (HA) (Fig. 1). Furthermore, cartilage degeneration was detected by SEM where the observation of deformed cellular lacunae in the cartilage suggests that a precocious functional collapse involves the whole thickness of the cartilage, probably due to increase in the number of empty lacunae.
Conclusion: The bone remodelling has evidently changed morphology of subchondral bone found in osteoarthritis patients suggested that bony bed level must have a role in the progression of the cartilage degeneration.

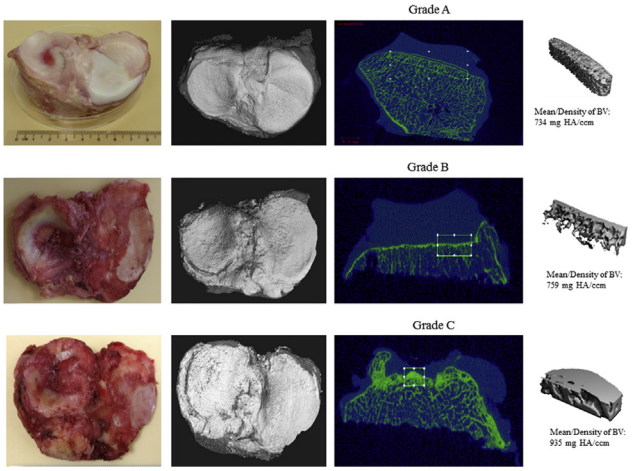

Figure 1 Cartilage degenerative regions were assessed using the modified 3-graded Outerbridge classification