MECHANICAL PROPERTIES OF THE ARTICULAR CARTILAGE BENEATH THE MENISCUS

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INTRODUCTION

The meniscus and cruciate ligaments play important roles in weight-bearing and stability of the knee joint. In a cruciate ligament and meniscus deficient knee joint, the kinematics is altered with a subsequent weight-bearing tibiofemoral engagement of articular cartilage beneath the meniscus being a highly-likely, yet abnormal situation. While many knees like this exist due to injury or surgery, there has been little or no discerning studies performed on the mechanical properties of the articular cartilage beneath the meniscus. In this study therefore, mechanical properties are determined for the articular cartilage directly beneath the meniscus to determine if its properties are similar to that found in the exposed articular cartilage on the tibia when the meniscus is intact.

METHODS

Cartilage indentation mechanical testing following closely the protocol of previous established methods [Lyyra T et al 1999, Mak AF 1997] was applied on twelve tibia cadaver articular cartilage sites where the meniscus was removed. Stiffness coefficients was obtained and compared with that from previous studies where measurements were taken from the exposed articular cartilage with intact meniscus [Lyyra T et al 1999]. This basically involved loading the cartilage in axial compression at a constant load of 0.5N, with the use of a 1-mm diameter indenter, attached to a 500N load cell of an INSTRON 5543 materials testing system. The small size of the indenter minimizes the influence of the stiff underlying bone on the registered force [Mak AF 1997]. The three categories of tibiae specimens tested included normal tibiae and those with signs of osteoarthritis (OA) i.e. showing cartilage damage and degeneration. The types of tibiae tested were 1. Normal and 2. those with OA and with normal meniscus and 3. those with OA but with associated meniscus damage.

RESULTS

Figure (2) shows the stiffness and a comparison of the three types of tibia cartilage tested: 1. Normal, 2. signs of OA with intact meniscus, 3. signs of OA with damaged meniscus. For the normal specimen, the articular cartilage is stiffer in the exposed regions compared to the unexposed cartilage beneath the meniscus.

SUMMARY

The stiffness values obtained in this study for the normal articular cartilage in the exposed regions are similar to those obtained previously [Lyyra T et al 1999]. Unfortunately little data is available from previous literature for comparison of the articular cartilage properties beneath the meniscus obtained in the current study, which shows properties to be less than that in the exposed region. The data presented here may be useful for future work in this area.

REFERENCES