Raman Spectroscopy: a novel method for the detection of molecular changes in osteoarthritis

Introduction

Osteoarthritis (OA) is a common, debilitating disease of joints involving degeneration of cartilage and bone. It has been suggested that subtle changes in the molecular structure of subchondral bone may precede morphological changes in the osteoarthritis joint [1]. There are two arguments for the mechanical initiation of osteoarthritis:

1) An increase in the subchondral bone stiffness due to an increased load on the joint [2].
2) A softening of the bone due to change in the biochemistry of the bone towards homotrimeric collagen [1, 3, 4].

Using the new Raman technology of spatially offset Raman spectroscopy (SORS) it is possible to obtain chemical composition of materials several millimetres beneath a surface. Therefore SORS can be usefully employed to measure bone beneath cartilage making SORS a robust and minimally invasive method suitable for use in clinical contexts.

The aim of our study is to explore the hypothesis: abnormal molecular changes in subchondral bone in osteoarthritis can be detected with Raman spectroscopy.

Materials and Methods

Samples were acquired (ethics approval was obtained) ex vivo from 20 human tibial plateaus that in so many cases could be attributed to osteoarthritis (Fig. 2). Fig 2: Bone mineral density results of the medial and lateral sides of the samples was both denser and thicker than that of the lateral side.

Results

pQCT results revealed that the subchondral bone of the medial side of the samples was both denser and thicker than that of the lateral side.

Discussion

This work therefore, so far, supports the theory proposed by Radin; the bone comprises of the same material rather than Bailey’s suggestion that the bone softens due to biochemical changes to the collagen.

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References
