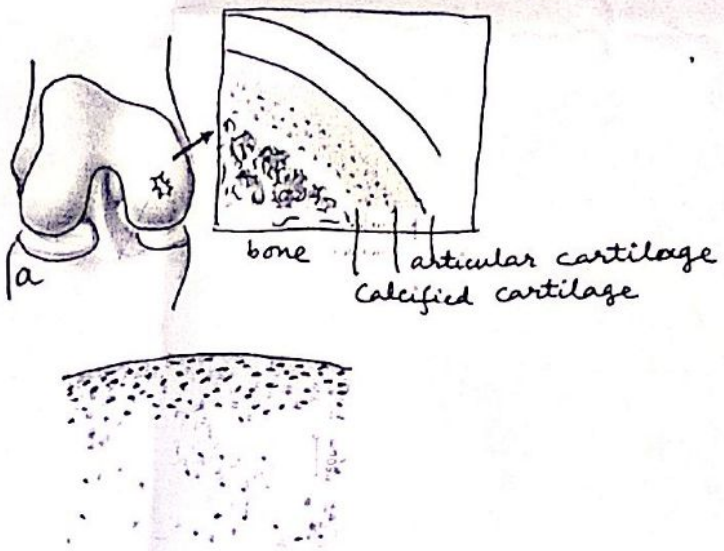
TTL746 Minor 2 Open book quiz

1. In our knee joint both ends of the bones are covered by a 4 mm-thick layer of non-vascular articular cartilage. Traumatic injury can lead to the defects as shown in Fig a. Fig b is showing that the articular cartilage is attached to calcified cartilage, which in turn is attached to the underlying bone. The chondrocytes in articular cartilage are surrounded by dense extracellular matrix consisting of type II collagen and proteoglycan (aggrecan).



A research study found that such defects may fill with a reparative tissue. Many cells in this reparative tissue were found to contain α-smooth muscle actin (SMA; dark stain in Fig. c). From our wound healing lectures we know that these SMA-containing cells can contract. The sources of the cells responsible for the reparative tissue are as yet uncertain.

a) To what extent do you think that the contractile cells in the reparative tissue in the defect in articular cartilage result in wound closure, compared to closure of skin wounds (*i.e.*, which factors determine the extent to which contractile cells can close a wound)?

b) In class we have learnt that collagen sponge-like porous scaffold can help in treating skin wounds. What are the potential benefits of implanting a collagen sponge-like scaffold (alone without cells) into the articular cartilage defect, based on the approach taken for treating skin wounds?

c) An approach to the treatment of the defect in Fig. a is to engineer a cartilage disk of the same dimensions of the defect and then to implant the disk and suture it to the surrounding articular cartilage. Briefly discuss two of the challenging issues that need to be addressed in this approach.

d) Instead of porous sponge-like scaffold, if we use Direct-write rapid prototyped scaffold (you have seen this machine in our lab) of same % porosity, what might be the advantage?

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2. What types of signals might a stem cell get from its environment to induce it to differentiate into a certain cell types? 5

3. Give a brief overview of cellular adhesion mechanism on a scaffold. If we add RDG instead of RGD will it help in cell adhesion? Explain why. 5