MODELS OF CARTILAGE INJURY: IN VITRO AND IN VIVO

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Introduction:
Cartilage injury is one of the most significant factors leading to secondary osteoarthritis. Several studies have demonstrated cartilage matrix damage and chondrocyte death in response to mechanical injury. Recently it has been shown that chondrocytes undergo apoptosis when subjected to mechanical trauma. This study presents several models of cartilage injury ranging from in vitro to in vivo that can be used to study this phenomenon. Validation of these models is provided with clinical data.

Methods:
Full thickness cartilage explants. Full thickness cartilage was harvested from weight bearing portions of adult bovine femoral condyles and 5 mm diameter disks punched out with a dural punch. Explants were allowed to stabilize in Dulbecco’s modified Eagle’s medium (DMEM) supplemented with 10% fetal bovine serum, for 48 hours. Explants were then divided into 2 groups: Load and Control. The Load group underwent a single 500 msec injury load of 30% strain in radially unconfined compression; the Control group were unloaded. At 96 hours after injury, explants underwent histologic examination and the number of apoptotic cells counted using TUNEL.

Discussion:
The results of this study support the hypothesis that mechanical injury induces chondrocyte death in the form of apoptosis. Cartilage from a variety of sources displays a similar response to mechanical injury. Three different modes of injury were modeled in this study. Blunt impact, injury leading to loss of cartilage, and chronic injury due to instability. Three different species were tested, rabbit, bovine and human. In addition, the apoptotic response was seen in experiments ranging from full thickness cartilage to intact joints. These models were finally validated clinically by the observance of significant apoptosis in patients with cartilage lesions associated with trauma. The models may be used to investigate the cellular events leading to apoptosis, subsequent repair and degeneration sequelae and agents that may modulate these phenomenon. Data exists to support that apoptosis can be inhibited in vitro. This opens possibilities of alternative therapeutic approaches to chondroprotection.

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