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Evidence for the Degradation of Type XI Collagen by Bovine Intervertebral Disc- and Articular Cartilage Extracts

Vladimír Podrazký, Jitka Štovíčková, Jana Novotná and Karel Trnavský

Institute of Rheumatology, Prague, Czech Republic

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Summary: Bovine intervertebral disc- and articular cartilage extracts contain a metalloproteinase system capable of degrading type XI collagen. The collagen-degrading activity is rather low in unmodified extracts but increases considerably on metalloproteinase activation. The similartiy between intervertebral disc and articular cartilage in their patterns of (casein-degrading) metalloproteinases and type XI and type II collagen degradation is believed to suggest a similarity in the events underlying the degradative disorders of articular cartilage and intervertebral disc.

Key terms: Intervertebral disc, articular cartilage, type XI collagen, collagen-degrading activity.

The matrix of cartilage contains a variety of fibrillar and amorphous macromolecular substances. The most abundant fibrillar component is collagen type II which forms a three-dimensional network of fibers thought to be responsible for the mechanical strength of cartilage. Apart from this major collagen type, several other collagens participate in the cartilage matrix structure. Of special interest is type XI collagen described originally as 1α, 2α, 3α collagen[1]. Type XI collagen resembles type II collagen in that it is a fiber-forming collagen composed of three subunits which, however, differ from each other[2]. Unlike type I, II, or III collagens which are cleaved by mammalian collagenase in a specific manner yielding two characteristic 3/4 and 1/4 fragments[3], type XI collagen is resistant to this enzyme. On the other hand, it is hydrolysed by gelatinases giving rise to a number of peptides[4].

Type XI collagen is supposed to be present within type II collagen fibrils[5]. Other authors have already shown the preferential location of type XI collagen at the chondrocytes surface as well as its ability to interact with cartilage proteoglycans[6]. These observations suggest that type XI collagen may play an important role in the architecture of the cartilage collagen fibers and thus in the organisation of cartilage matrix itself[7]. In terms of this, cleavage of collagen type XI may be an important factor in diseases afflicting connective tissue. It has been shown that matrix of chondrocytes treated with interleukin-1 does not contain type XI collagen[8], which may be attributed to the stimulation of the biosynthesis of collagen-degrading

Enzymes:
Collagenase, matrix metalloproteinase 1 (EC 3.4.24.7);
Gelatinases, type IV collagenases, matrix metalloproteinase 2 (EC 3.4.24.24) and matrix metalloproteinase 9 (EC 3.4.24.35);
Stromelysin, matrix metalloproteinase 3 (EC 3.4.24.17);
Trypsin (EC 3.4.21.4).

Abbreviations:
ID, Intervertebral disc; AC, articular cartilage; APMA, aminophenylmercuric acetate.