Patients Over Age 40 with Cam-Type Femoroacetabular Impingement Demonstrate Increased Cell Activity in Articular Chondrocytes

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Disclosure Information

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Materials and Methods

- Cartilage biopsies were obtained from 26 donors with FAI who underwent hip arthroscopy for debridement of CAM lesions.
- Quantitative real time polymerase chain reaction [qRT=PCR] was performed to assess gene expression of markers for extracellular matrix (ECM) synthesis, inflammation and cellular activity.
Purpose

To compare the cell activity and histological appearance of articular chondrocytes harvested from patients with FAI and examine the relationship of patient age.
Materials and Methods

- Cartilage biopsies were obtained from 26 donors with FAI who underwent hip arthroscopy for debridement of CAM lesions.
- Quantitative real time polymerase chain reaction [qRT-PCR] was performed to assess gene expression of markers for extracellular matrix (ECM) synthesis, inflammation and cellular activity.
Materials and Methods

• Specimens were separated into two groups based on the degree of positive red staining by using safranin O/ fast green staining.

• The age of the donors and alpha angle were then compared and divided into 2 groups: above and below 40 years old.

• Student T-test was used to compare between groups. P < 0.05 was considered significant. Standard deviation was used to indicate variation within groups.
Results

Figure 1. Patient age of the senescent cell activity group is significantly younger ($p = 0.005$, mean $= 32.3$, SD $= 7.0$ years) than the active cell activity group (mean $= 42.1$, SD $= 10.8$ years). No differences on genders or alpha angles.
**Results**

**Figure 2.** In the safranin O positive group, there was minimal PCNA staining (A). In the safranin O negative group, PCNA positive cells were distributed mostly at the surface and through the tissue (B). Both FAI samples all had less MMP3 positive staining than normal. Safranin O positive samples had only positive MMP3 stained nuclei in the superficial layer, while safranin O negative samples had MMP3 staining throughout the matrix (C).
Figure 3. No significant safranin O staining is seen in chondrocytes from patients below age 40 (A, B). Safranin O staining seen in the matrix of patients greater than age 40 (C,D) indicating increased cell proliferation.
Results

• Red positive staining of safranin O was seen in the extracellular matrix or surrounding the cells.

• Chondrocytes derived from FAI cartilage in donors younger than 40 years old (mean =32.3 years old, SD=7.0 years) had significantly less positive staining (p=0.005) than donors greater than age 40 (mean=42.1 years old, SD=10.8). There was no significant difference between alpha angles of the two groups (p = 0.04).

• In the safranin O negative group, proliferating cell nuclear antigen (PCNA) positively stained cells were seen distributed in the tissue, more so in the area close to the surface. In the safranin O positive group, most of the cell did not show positive PCNA staining.

• Safranin O negative samples have positive MMP3 matrix staining, while safranin O positive samples had only superficial areas stained with positive color.
Discussion

• Cartilage in cam-type FAI is molecularly and morphologically different between age groups above and below 40 years old. Older donors had more safranin O positive stained area, which means more proteoglycan in the extracellular matrix.

• The differences between the two groups have no relation with alpha angle and gender.

• The specimens with safranin O negative staining had positive PCNA staining in the nuclei, more MMP3 (cartilage tissue remodeling) and type II collagen (cartilage tissue building) in the extracellular matrix than safranin O positive specimens. This indicates the safranin O negative specimens contained more young cells.
Discussion

• Based on the histological study, we concluded that FAI tissue is a piece of cartilage-like tissue with cell biological activity maintained at a low developing speed. No obvious inflammation situation was seen in the tissue.

• Our study did not see PCNA staining in the specimens with strong safranin O staining. This indicated the cells were not proliferating. This is obviously different from arthritis cartilage.

• A greater understanding of the molecular difference between cartilage in younger and older patients with FAI may improve their surgical management for the future development of novel treatments that attenuate disease progression of osteoarthritis.
References
