New alginate-chitosan hydrogel to repair cartilage

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**Osteoarthritis**

**The joint**

**Normal**
- Articular cartilage
- Capsule
- Synovial membrane
- Subchondral bone

**Osteoarthritic**
- Capsule fibrosis
- Synovial membrane inflammation
- Osteophyte
- Cartilage degradation
- Sclerosis subchondral bone
Osteoarthritis

Articular cartilage once destroyed, is not repaired

New biomaterial

OA cartilage pathology

Normal articular cartilage
Safranin O stain

Surface intact

Vertical fissures

Erosion

Denudation

(1) OARSI histopathology grade
The biomaterial

Paris mushrooms

Brown algae

CHITOSAN
D glucosamine
N-acetyl-D-glucosamine

Patented

Alginate-chitosan beads

ALGINATE
mannuronic acid
guluronic acid

Patented

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The effects of alginate-chitosan biomaterial on human osteoarthritic chondrocytes
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Methods

28 days of culture

Calcium chloride solution

Alginate-chitosan solution

Or

Alginate solution

Culture medium (LDH, IL-6, IL-8, NO, MMP-3)

Cell extract (Aggrecan, AP)

OA cartilage after replacement surgery

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The effects of alginate-chitosan biomaterial on human osteoarthritic chondrocytes

**Results**

Aggrecan, MMP-3, IL-6, IL-8, NO and AP production of chondrocyte in AC beads. Results were represented as % by production of chondrocytes in A beads. Results were expressed as mean ± SEM of 3 independent experiments (n=9). Statistical significance in comparison to the control: A vs AC: *** p < 0.001; ** p < 0.01

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**Methods**

New-Zealand rabbit, white, red-eyes

An osteochondral defect was done in both with an implant drill on the femoral condyle

Control rabbit: Defect was filled only by chitosan hydrogel

Test rabbit: Defect was filled by alginate-chitosan beads included in a chitosan hydrogel
Preliminary study of the behavior of this biomaterial to the rabbit

Methods

Osteochondral defect
Results

Control rabbit: defect + hydrogel

Test rabbit: defect + beads + hydrogel

After a month:
➤ Beads were still in the defect
➤ No signs of inflammation or infection
Summary

The *in vitro* tests highlighted beneficial and surprising effects of the alginate-chitosan beads on human OA chondrocytes. They were anti-inflammatory, anti-catabolic, not cytotoxic and promoting the synthesis of cartilage specific matrix component. The preliminary *in vivo* tests performed in the rabbit showed that the alginate-chitosan beads were well tolerated, being perfectly and easily integrated into an osteo-cartilaginous lesion and that it remained fixed in the lesion without additional suture.