Novel Chitosan Hydrogels for the treatment of osteoarthritis: Mechanical support, Lubrication and Prevention of Cartilage degradation in a rabbit Model of osteoarthritis

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BACKGROUND

Chitosan, a glucosamine polysaccharide, is a good candidate for viscosupplementation in OA joints. Herein, we report the physico-chemical properties and the effects of an innovative chitosan hydrogels in the rabbit anterior cruciate ligament model ACLT model of OA.

METHODS

The ability to absorb shocks at walk frequency, the lubrication (viscosity at rest), and the biodegradation kinetics of animal-free ultrapure chitosan hydrogels - Vegetech inside™ - (Synolyne Pharma, Belgium) were evaluated using a mechanical compression equipment (Instron, US) and the Discovery Hybrid DHR-2 rheometer (TA Instruments, US). The properties were compared with those measured in synovial fluids and in hyaluronan viscosupplements. In addition, the chitosan hydrogels were mixed with patient synovial fluid (in a 1:1 ratio, v/v), and the ex vivo rheological properties of the mix were characterized.

OA was surgically induced by the transection of the anterior cruciate ligament (ACLT) in female HYLAR albino rabbits. One week after surgery, animals were randomly divided into 2 groups. One group (n=9) was injected intra-articularly (right knee) with saline solution (control) and the other group (n=10) with a chitosan hydrogel (Synolyne Pharma, Belgium). X-rays from the right knee were performed at the time of sacrifice and scored with the Kellgren and Lawrence (K&L) scale. Animals were euthanized 9 weeks after surgery and a macroscopic evaluation of cartilage was done. Histological sections of cartilage areas and of synovial membrane were evaluated according to the OARSI histopathology initiative.

RESULTS

Chitosan hydrogel improves the lubrication and shock absorption capacity of OA SF.

Based on the reduction of Kellgren & Lawrence scale, chitosan hydrogel prevents significantly the development of OA.

The injection of chitosan hydrogel improves significantly the structure of cartilage.

Chitosan hydrogel reduces also significantly the synovial membrane inflammation.

CONCLUSIONS

These results are confirming the high potential of the mono-dose viscosupplementation with non crosslinked chitosan hydrogels specifically designed to protect cartilage and decrease the symptoms associated with OA.