

Osteoarthritis (OA) is a complex multifactorial disease affecting a whole joint, and as of yet has no cure. Principal treatment is control of inflammation and pain. Viscosupplementation is a medical procedure during which lubricating fluid is injected into a joint. Chi2Gel is developing an innovative viscosupplement from Chitosan-Hyaluronate hybrid, benefiting from both natural Chitosan and Hyaluronate in one injectable formulation. This hybrid has demonstrated superior results in pre-clinical studies compared to Hyaluronate based gels. The company is looking for strategic partners to jointly develop its novel patented technology.

**Chi2Gel Ltd at a glance**

Founded 2008, 2010-2012 at OHV Incubator

**Product:**

Chi2Knee™ a viscosupplementation for knee osteoarthritis in Human Health and Animal Health (OA of dogs and horses).

**Opportunity:**

Knee – new generation of viscosupplements that is bringing the documented therapeutic effect of Chitosan together with a good safety profile

**Pipeline:**

Chi2Gel expects to receive a CE in 2018 for Chi2Knee

**Future products** include others articulation OA, Spine, drug delivery, wound dressing

**Founders & Management:**

Shachar Patchornik, MSc, Director, Co-Founder  
 Alain Zeitoun, MD, Co-Founder  
 Dr. Dror Robinson, Orthopedist, Co-Founder  
 Prof. Zvi Nevo, Hyaluronate expert, Co-Founder  
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**Viscosupplementation for knee osteoarthritis**

It is expected that the OA population will grow significantly as a result of an increasing elderly population and levels of obesity, which have reached epidemic proportions in the Western world. Complications related to the use of NSAIDs has stimulated the need for alternative non-pharmaceutical products for OA such as viscosupplements. To date less than 14% of the eligible patients are treated by HA intra-articular injections in the USA. Low market penetration rate indicates the need for novel intra-articular injection.

Based on these data, it is assumed that the total viscosupplementation market for human usage could reach 1.8 billion US\$ sales by 2017 from estimated 1.5 billion US\$ worldwide in 2010.

Cross-linked Hyaluronate is approved as medical device for several applications in orthopedics such as viscosupplement for knee OA and others synovial joints pain. New entrants in this market have focused on increasing the intra-articular half-life of the Hyaluronate, thus reducing the number of injections from 3 to 1 via heavy chemical cross-linking, thus increasing the total molecular weight of the injected product to increase intra-articular half-life, with mixed results from an efficacy or safety point of view.



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**Unmet needs in the Viscosupplementation market**

While many new treatments for traumatic OA in young patients are in development (requiring open knee surgery), no new treatment has been made available that could relieve pain in OA patients and help delay the need for total knee replacement for advanced osteoarthritis

In addition, three issues are faced today by the pharma companies marketing these products:

1. New data challenging HA only efficacy (thus slowing down of their marketing uptake)
2. Frequent reimbursement challenge in the EU driven by these efficacy issues
3. Increased competition that drive for novel and more effective intra-articular injections.

**Chi2Knee™ – the new generation of viscosupplements for OA**

Chi2Knee hybrid hydrogel represents a breakthrough liquid composition of Chitosans and Hyaluronate that transforms into a gel scaffold after injection into the body.

Chi2Knee has several unique features: 1) As a shear thinning material it liquefies upon pressure and self-reassemble to gel at rest 2) It slows intra-articular degradation kinetics and increases residence time of the Hyaluronate, and 3) It combines the well-known benefits and safety of both natural Chitosan and Hyaluronate.

**Key differentiators vs. current and future viscosupplements**

- Prolonged intra-articular half-life with a natural cross-linker
- Combines beneficial effects of both Chitosan + Hyaluronate in one product
- Strong differentiation potential in competitive Hyaluronate market
- Chitosan allows coating of the cartilage defects and promotes attachment of growth factors allowing super-clot formation, potentially supporting repair activity of the cartilage
- Chitosan degradation products, glucosamine and acetylglucosamine, are known to support cartilage metabolism but their efficacy in OA as nutraceutical (oral formulation) has been challenged since joint penetration via the oral route seems limited. However, Chi2Knee intra-articular degradation enables high glucosamine concentrations over prolonged time.

**Why Chitosan based hybrid hydrogels?**

- Chitosan has documented therapeutic effect in orthopedic pathologies but requires special formulation to enjoy its effects safely
- Fully biodegradable, its degradation products are naturally present in the human body
- Liquid before its administration, the hydrogel becomes polymerized in contact with human tissues, allowing minimally invasive injection.
- Chitosan not only has beneficial properties in itself but also increases the residence time of the Hyaluronate in the hybrid.