Chondrocytes (Spherox) in the use of Autologous Knee Cartilage Cell Therapy

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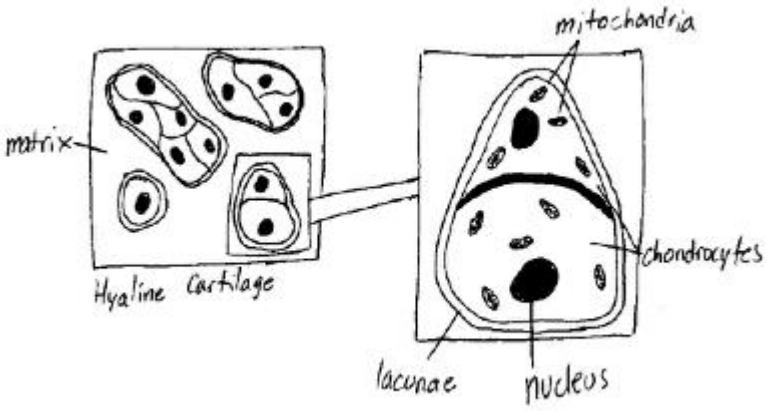
Knee cartilage damage is a very prevalent issue in adults and can occur due to a variety of reasons. The most common causes are injuries from physical activity, degeneration from repetitive overuse and/or old age, and limb malalignment. Osteoarthritis can also cause knee cartilage damage in older adults. The symptoms that one can experience from cartilage defects are inflammation, pain, and locking of the joints; these symptoms can greatly minimize the affected person's motility (1).

Various treatment options exist for cartilage restoration; the type determined for a patient depends on the size of the lesion in the cartilage, the condition of the knee joint and its surrounding ligaments as well as the cause for cartilage defect (1). In Europe, cell therapy, specifically autologous chondrocyte implantation (ACI), is a popular choice for cartilage restoration and has been used for the last forty years (3).

Figure 1

Chondrocyte Cells in Hyaline Cartilage



Note. This figure demonstrates the composition of hyaline cartilage, which is composed of chondrocyte cells. Chondrocytes are cells which can live individually or in isogenous groups. They are located inside lacunae, which are spaces in the extracellular matrix (2).

Chondrocytes are the cells which compose cartilage. They are a distinctive cell in the mammalian body because they are not directly attached to the vascular and nervous systems of the body. The main function of chondrocytes is to produce and support the extracellular matrix, which overall forms the cartilage tissue. There are three different types of cartilage tissues that are dispersed throughout the body to serve different functions (4). Articular cartilage (hyaline cartilage) is the one which is included in the makeup of joints. The cartilage's matrix is what provides cushiony support between bones in joints. Aside from chondrocytes, the extracellular matrix of cartilage contains collagen and proteoglycan; collagen provides cartilage it's elasticity. Proteoglycan is a very large molecule with a negative charge, which is essential for its function. This electronegativity attracts water's positive hydrogens and binds them to the large molecule. The way that proteoglycan arranges water allows it to be the main integrant of cartilage. When joints are articulated, causing pressure to be placed on cartilage, the polarity of water allows for the matrix's flexible durability as well as prevents further pressure to be applied (2).

Autologous chondrocyte implantation (ACI) is a surgical procedure which allows for cartilage repair with the use of the patient's own chondrocytes. The process involves three main steps. First, the affected joint must be examined via biopsy to analyze the extent of the cartilage damage. Second, an aggregate of healthy chondrocytes must be collected and cultured for six to eight weeks. Finally, after the culture of chondrocytes has reached a sufficiently large population for the patient's size in cartilage defect, the chondrocytes are implanted in the defect via open surgery. Within minutes, the cells self-adhere to the bones. Over the following weeks and months, new hyaline cartilage will form in the area thanks to the added chondrocytes (3).

Throughout the years, ACI has changed slightly multiple times in the process involving the implantation of the chondrocytes. The most recent "generation" of ACI is called

Chondrosphere (Spherox). After the cultured chondrocytes reach the desired population size, the cells are “condensed into spheroids (chondrospheres)” before implanting them in the lesioned area of cartilage. The purpose of the spheroids is to minimize the invasive nature of the surgery and facilitate their application. ACI is used to repair cartilage defects in multiple joints in the body, however, Spherox is mainly used for cartilage regeneration in the patella and femoral condyles of the knee for an area of cartilage defect no larger than 10 cm^2 (3).

Chondrocytes are essential cells in the body which provide structure and support to different areas of the body, including joints. They form the articular cartilage which allows for movement and elasticity in joints (4). European medical technology has allowed for the autologous treatment of cartilage defects in patient’s knees. This process allows for healthy cartilage cells (chondrocytes) to be collected, cultured, then implanted into the damaged cartilage area. After some weeks, cartilage tissue is grown (3).

References

1. Krych, A. J., Saris, D. B., Stuart, M. J., & Hacken, B. (2020). Cartilage injury in the knee: assessment and treatment options. *JAAOS-Journal of the American Academy of Orthopaedic Surgeons*, *28*(22), 914-922. http://doi.org/10.5435/JAAOS-D-20-00266
2. Caplan, A. I. (1984). Cartilage. *Scientific American*, *251*(4), 84–97. http://www.jstor.org/stable/24969458
3. Armoiry, X., Cummins, E., Connock, M., Metcalfe, A., Royle, P., Johnston, R., ... & Mistry, H. (2019). Autologous Chondrocyte Implantation with Chondrosphere for Treating Articular Cartilage Defects in the Knee: An Evidence Review Group Perspective of a NICE Single Technology Appraisal. *Pharmacoeconomics*, *37*(7), 879-886. https://doi.org/10.1007/s40273-018-0737-z
4. Archer, C. W., & Francis-West, P. (2003). The chondrocyte. *The international journal of biochemistry & cell biology*, *35*(4), 401-404. https://doi.org/10.1016/S1357-2725(02)00301-1