

# Chondrocyte Sheets

Subjects: Others

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Chondrocyte sheets can be created without using material such as animal-derived collagen by using temperature-responsive culture devices such as thermo-responsive polymer grafted culture dishes, where cells can adhere, proliferate, and form into a sheet. Hyaline cartilage regeneration by autologous chondrocyte sheets has already been demonstrated in clinical research. Chondrocyte sheet transplantation is a novel and promising approach to treating patients who have cartilage defects associated with osteoarthritis.

Keywords: regenerative medicine ; tissue engineering ; hyaline cartilage

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## 1. Introduction

Chondrocyte sheets can be created without using material such as animal-derived collagen by using temperature-responsive culture devices such as thermo-responsive culture dishes<sup>[1][2]</sup>, where cells can adhere, proliferate, and form into a sheet. The sheet can be harvested without enzymatic digestion by lowering the temperature. By using this technology, chondrocyte sheets can be collected and triple-layered and then transplanted onto cartilage lesions while retaining the extracellular matrix and adhesion molecules that are produced by the chondrocytes themselves<sup>[3]</sup>. Because chondrocyte sheets can adhere to the recipient site without sutures, the chondrocytes will remain at the site of implantation.

Chondrocyte sheet transplantation is a promising approach to treating articular cartilage lesions. Articular cartilage regeneration with hyaline cartilage, which is important for joint function, has been demonstrated using partial-thickness and osteochondral defect models of rats, rabbits, and pigs<sup>[3][4][5][6][7]</sup>.

## 2. Treatment in Hyaline Cartilage Regeneration

Treatment with chondrocyte sheets using the patient's own cells has been performed on 20- to 60-year-old patients who had knee joint cartilage damage caused by traumatic or OA degeneration. The articular cartilage was repaired to hyaline cartilage, and the treatment improved the clinical joint condition score<sup>[8]</sup>. These results suggest that cell sheet transplantation could become the definitive treatment for OA-associated articular cartilage lesions.

Based on years of experience with allograft transplantation, it is well known that cartilage tissue is immune tolerant. Allogeneic cartilage fragments are commercially available and have been widely transplanted in the United States<sup>[9]</sup>. It is therefore considered that the use of allogeneic chondrocyte sheets can be an applicable treatment. In considering the application of allogeneic chondrocyte sheets to the treatment of joint disease, the application of chondrocytes obtained from the surgical remains of juvenile polydactyly patients have been investigated. Polydactyly-derived chondrocytes have excellent proliferative capacities that allow them to establish a layered structure and to form sheets that have similar characteristics to autologous chondrocyte sheets, such as the expression of mesenchymal cell surface markers and the production of various cartilage anabolic factors<sup>[10]</sup>. Polydactyly derived chondrocyte sheets have demonstrated the efficacy for osteochondral defects in xenogeneic transplantation model involving immunosuppressant-treated rabbits<sup>[11]</sup>.

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