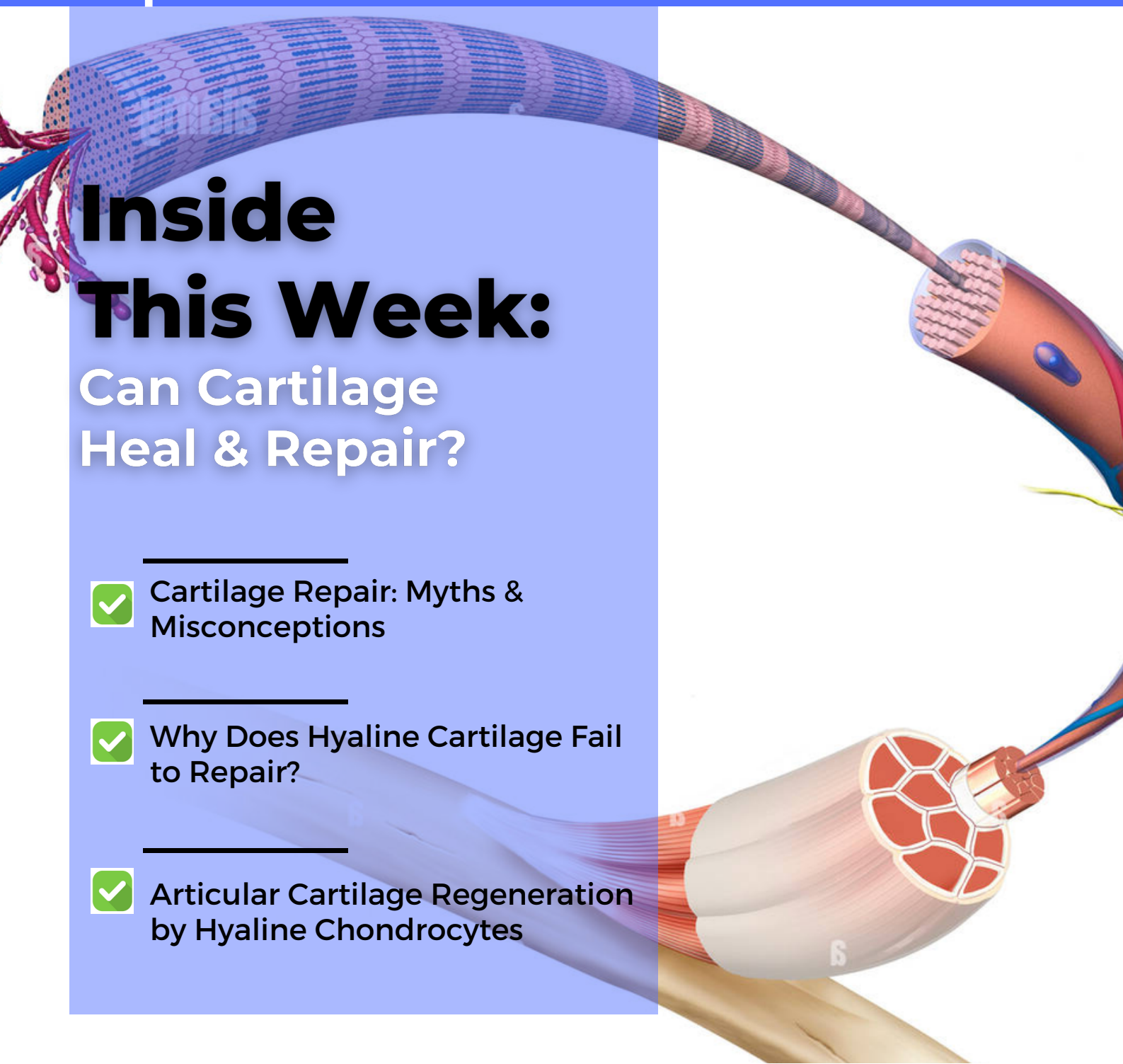
RAPID RESEARCH

@physicaltherapyresearch

September 2023



Inside This Week:

Can Cartilage Heal & Repair?

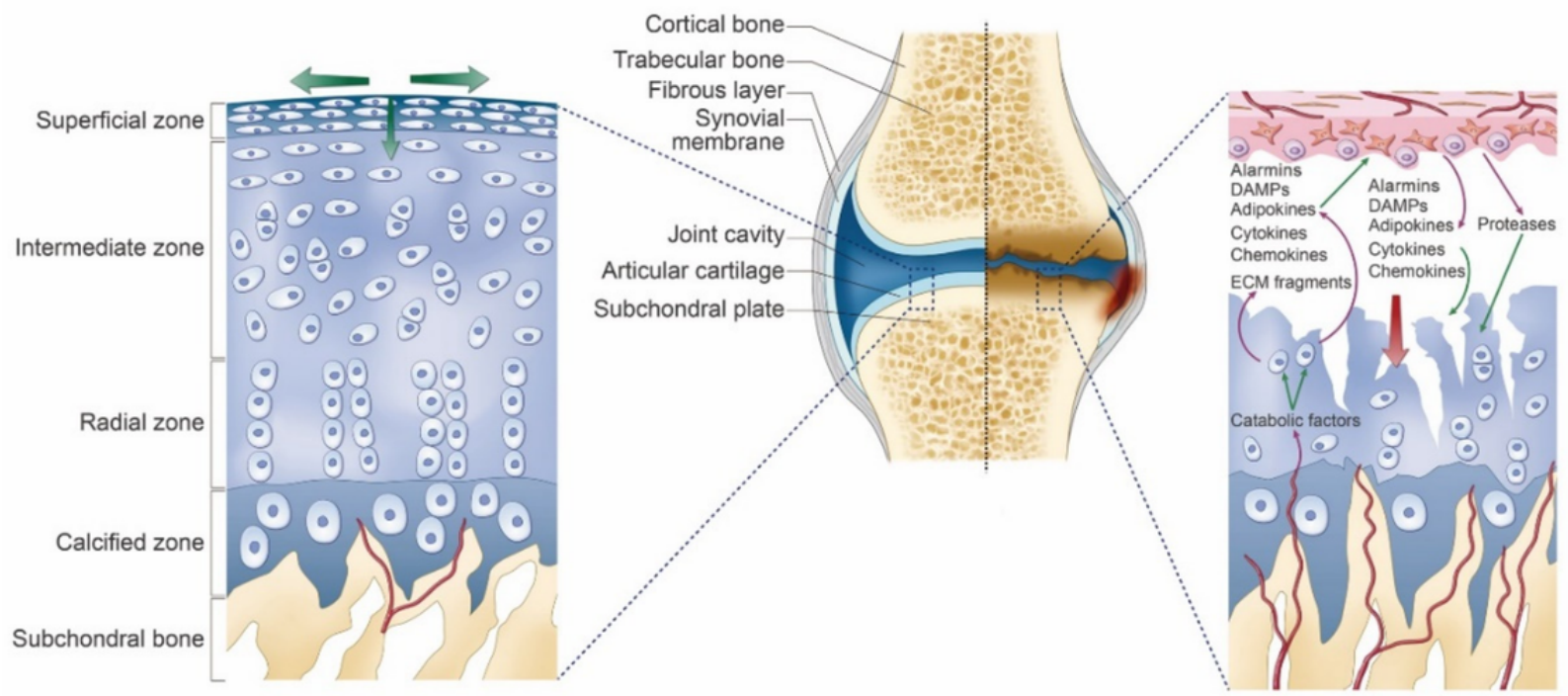
- Cartilage Repair: Myths & Misconceptions
- Why Does Hyaline Cartilage Fail to Repair?
- Articular Cartilage Regeneration by Hyaline Chondrocytes

CARTILAGE REPAIR: MYTHS & MISCONCEPTIONS

SEPTEMBER 2023

Click for Full Text (Hunziker et al. 2015)

This review discussed the major scientific and practical hurdles that need to be overcome for successful articular-cartilage repair



KEY FINDINGS

Articular cartilage (AC) is a highly specialized tissue and lesions seldom heal, or heal only partially under certain biological conditions.

AC lesions penetrate the subchondral bone and bone-marrow spaces and release **blood bearing chondroprogenitor cells and fibrin** (which acts as the supportive scaffold of a blood clot), causing a limited healing response.

Treatment strategies aim to create spontaneous repair reaction.
[Autografting, allografting, implantation, etc]

Although none are particularly successful, and a recent trend has shifted towards tissue-engineering.
[Matrix scaffold, Cells, & Signalling molecules (growth factors or genes)]

MAIN TAKEAWAYS

Healthcare is still a long way from achieving the goal of cartilage regeneration.

To achieve optimal cartilage-repair results, minimally three sets of growth-factor-stimulated “activities” need to be embraced in the applied cocktail of signalling agents.

2 novel growth-factor-based therapeutic strategies are now at the conceptual stage of development:

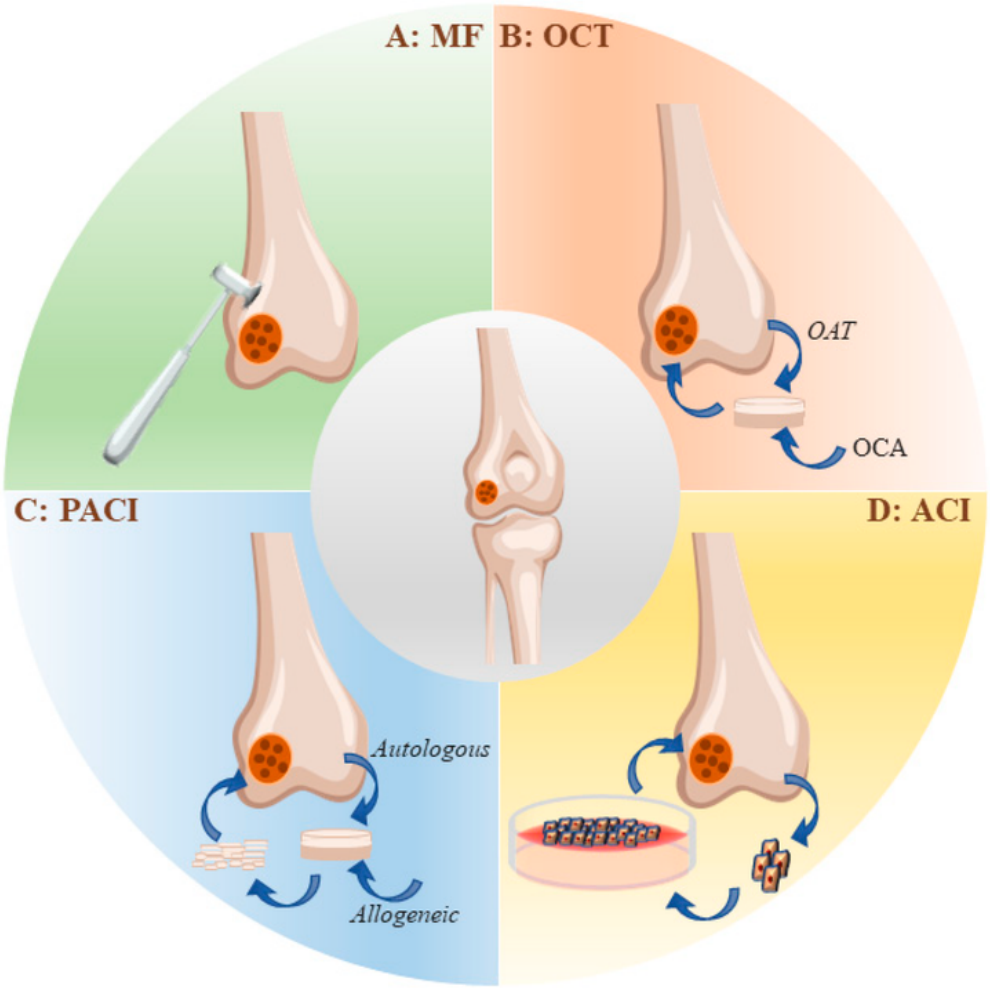
1. Recruit cells with chondrogenic potential from synovial fluid.
2. Injection into the defect site of MSCs that have been transfected with genes encoding the factors necessary for chondroprogenitor commitment.

WHY DOES HYALINE CARTILAGE FAIL TO REPAIR?

SEPTEMBER 2023

Click for Full Text (Armiento et al. 2019)

This review reported the challenges of hyaline cartilage regeneration and discussed cartilage-targeting therapeutic delivery and emerging technologies and strategies for regeneration.



KEY FINDINGS

Once damaged, articular cartilage has a limited potential to repair and is often mechanically inferior fibrocartilage.

Cartilage composition is regulated by chondrocytes in response to chemical and mechanical extracellular changes.

Cartilage turnover is the result of a fine balance between catabolic and anabolic processes.

An imbalance results in the loss of cartilage matrix, and is a hallmark of cartilage defects, injuries and degeneration.

Studies utilizing monolayer expanded medicinal signalling cells (MSCs), report induction of type X collagen and hypertrophy, a phenotype associated with endochondral bone formation, inferior collagen I/II fibrocartilage.

MAIN TAKEAWAYS

Articular cartilage is a stiff, elastic and low friction tissue. To date, there is no industrial material able to reproduce these mechanical properties.

The basic biochemistry of cartilage is not well understood, which is a major hurdle in understanding the repair process.

New developments in scaffold design, clinical translation and delivery of therapeutic molecules are promising.

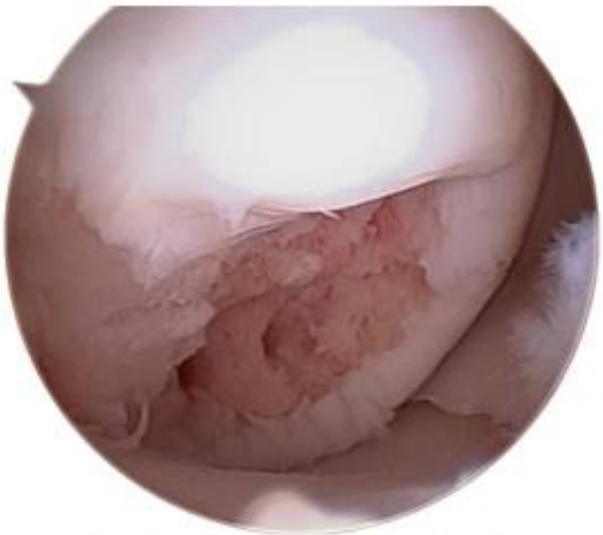
New delivery mechanisms are being developed and they offer new hope in targeted therapeutic delivery.

ARTICULAR CARTILAGE REGENERATION BY HYALINE CHONDROCYTES

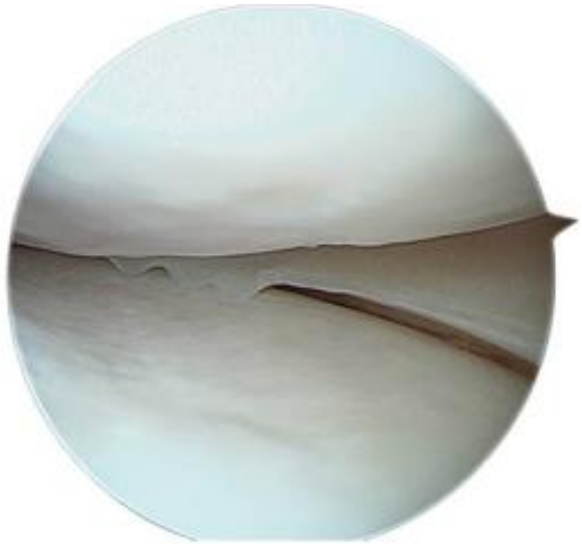
SEPTEMBER 2023

Click for Full Text (Canonici et al. 2023)

This study described the application of regenerative therapy to damaged articular cartilage in an athletic horse, with a 2-year follow-up of the clinical performance and rehabilitation up to the return to racing.



Articular cartilage lesions before surgery



Same cartilage 6 months post-op

KEY FINDINGS

3-year-old female thoroughbred affected by a chronic chip fracture of the right Antebrachiocarpal joint, appx 12 mm × 7 mm × 6 mm in size.

Cell therapy was performed with autologous Chondrocytes (CCs) isolated from the tracheal cartilage of the horse.

Articular cartilage recovery was evaluated in morphology and cellular disposition and the extracellular matrix's biochemical composition (type II collagen, Coll II) up to 2-years after surgery.

Findings at 2-year follow-up:
Extremely satisfactory clinical and anatomical results.
Biopsies and histological examination carried out at 8, 13 and 24 months from the implant showed formation of new cartilaginous tissue, with notable presence of type II collagen, typical of hyaline cartilage, and by the high cellularity of CCs in clusters immersed in an abundant extracellular matrix.

MAIN TAKEAWAYS

Cell therapy with CCs isolated from the tracheal cartilage of the hyaline type is demonstrated to be a valid alternative to traditional healing for the treatment of articular cartilage lesions in horses, with possible extensions of similar treatments to other animals, most notably in humans.

Further, clinical cases would strengthen this technique's validity and help optimize and standardize the therapeutic protocol.

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