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Focal articular cartilage defects of the knee: surgical treatment

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Abstract Articular hyaline cartilage has a fundamental role in mechanical load distribution on joints. Injuries of this tissue, which has limited potential to heal, often cause pain and have a serious impact on function. Managing these injuries is a real challenge for the orthopaedic surgeon, then many strategies were proposed to repair such type of lesions for restoring the joint surface and improving patients' symptoms. The authors focused their attention on autologous chondrocyte transplantation and mosaicplasty. A careful literature analysis was performed on these strategies, trying to find the best evidence available on these topics. Our search strategies included: The Cochrane Library, Health Technology Assessment (HTA) Database, MEDLINE, TRIP,

CINAHL, EMBASE, SPORTDiscus. Although the analysed techniques are so popular in orthopaedics, poor scientific evidences are reported in literature and many controversial data exist.

Key words Autologous chondrocyte transplantation • Evidence • Focal cartilage lesion • Knee • Mosaicplasty

Introduction

Articular cartilage defect of the knee is a real challenge for the orthopaedic surgeon. Many strategies have been proposed to repair these lesions by restoring the joint surface and improving patients' symptoms. These methods are effective only in some cases and the improvement in symptoms can be temporary. Moreover, treatment failure can evolve to more serious degenerative disease with a final need of prosthetic surgery.

Articular hyaline cartilage has a fundamental role in mechanical load distribution on joints. Injuries of this tissue, which has limited potential to heal, have a serious impact on

function and often cause pain. Many strategies have been described for managing these injuries, such as debridement and abrasion arthroplasty. Some proposed surgical techniques create a fibrocartilage tissue with less properties of articular hyaline cartilage: microfractures and subchondral drilling ("marrow stimulation techniques"). Current strategies to repair localized articular cartilage defects include autologous osteochondral cylinder transplantation and, as an alternative, in the last few years, autologous chondrocyte implantation (ACI).

Mosaicplasty and autologous osteochondral cylinder transplantation are the most performed techniques. Mosaicplasty is a one-step procedure which consists in transplanting little istochondral cylinders from a non-weight-bearing

femoral area to the region of the focal defect. ACI consists in the implantation of cultured chondrocytes, obtained from a non-weight-bearing femoral condyle region, in the lesioned area. This is a two-step procedure that stimulates the production of a hyaline-like repair tissue. The first step consists in arthroscopically obtaining a small collection of chondrocytes, which will be maintained in culture; the second step is the reimplantation of the chondrocytes through an arthrotomy procedure.

The results of these techniques seem to be promising, but is there evidence in the literature about their real effectiveness?

Materials and methods

We performed a bibliographic search for articles reporting the effectiveness and safety of mosaicplasty and ACI in patients with clinically significant focal cartilage defects of the knee. Using the most representative databases available, we searched for randomized controlled trials (RCTs) comparing these two techniques with other standard treatments. We also considered systematic reviews, meta-analyses and guidelines on the topic.

We searched the following databases: Cochrane Library, Health Technology Assessment (HTA), TRIP, MEDLINE (1966 to January 2004), CINAHL (1982 to January 2004), EMBASE (1980 to January 2004), and SPORTDiscus (1949 to January 2004).

We used the following search terms, selected from the National Library of Medicine's medical subject headings (MeSH): human; cartilage, articular/transplantation; knee injuries/surgery; transplantation, autologous; chondrocytes; knee; knee joint; knee injuries; cell transplantation.

Results

With the described search strategy, we found 1 guideline, 4 systematic reviews and 2 RCTs.

Guideline

“Guidance on the use of autologous cartilage transplantation for full thickness cartilage defects in knee joints” [1].

The guideline is incomplete for lack of specific surgical indications for the techniques. The literature is subject to bias for the weakness of the case series. Moreover, the long-term results are poorly documented.

ACT is not currently recommended for routine primary treatment of articular cartilage defects of the knee. It should only be performed as part of an adequately designed clinical

trial. ACT may also be performed in centers included in clinical trials of this procedure when other treatments for managing articular cartilage defects of the knee have failed.

Systematic reviews

“Effectiveness of autologous chondrocyte transplantation for hyaline cartilage defects in knees: a rapid and systematic review” [2].

There is a weakness of case series in the literature on autologous chondrocyte transplantation (ACT) and comparators. Moreover, there is a poor documentation of long-term results. The cost-effectiveness analysis and the lack of long-term follow-up are limited.

“Autologous chondrocyte transplantation for cartilage defects in the knee joint” [3].

Hyaline cartilage damage is not clear and the natural history is poorly understood. Only a few treatments for managing these lesions have been tested in controlled studies. In the absence of completed controlled trials on ACT, it should be considered as an experimental therapy. Routinely commissioning this technique cannot be recommended.

“Autologous chondrocyte transplantation of the knee” [4].

The available evidence does not permit conclusions about the effect of ACT on health outcomes.

“Autologous cartilage implantation for full thickness articular cartilage defects of the knee” [5].

No information available is from RCTs: no influence in current practice. ACI must be considered as a technology under investigation whose effectiveness is yet to be determined in well-designed clinical trials.

Randomized controlled trials

“Autologous chondrocyte implantation and osteochondral cylinder transplantation in cartilage repair of the knee joint: a prospective, comparative trial” [6].

Both treatments can reduce symptoms. Osteochondral cylinder transplantation (OCT) provides more benefits than autologous chondrocyte implantation. Histologic assessment shows that the defects managed with ACI were primarily filled with fibrocartilage, whereas OCT retained the hyaline characteristics, even if there was a persistent interface between the transplant and the original cartilage. The limitation of this study is the small number of patients and the relatively short follow-up, with no control group.

“A prospective randomized comparison of autologous chondrocyte implantation versus mosaicplasty for osteochondral defects in the knee” [7].

Significant superiority of ACI over mosaicplasty which use is of dubious value. This paper is not considered in the Cochrane review reported previously because it did not meet the inclusion criteria. Moreover, in the Evidence-Based Orthopaedics Section of the Journal of Bone and Joint Surgery, American volume [8], LaPrade, analysing this paper, affirms the need of a minimum follow-up of 5 years concurrently with histologic analysis to determine which technique is best.

Discussion

Although these surgical procedures are popular in orthopaedics, the scientific evidence reported in the literature is weak. No RCT compared different outcomes in alternative techniques for focal cartilage defects of the knee. In particular, no RCT evaluated and compared ACT with

alternative treatments. Moreover, the RCTs came to different and controversial conclusions.

The analysis of published work, in particular the Cochrane review on this topic, emphasizes provisional outcomes and considers ACT an experimental technique that needs to be studied further through well designed clinical trials.

The selection of patients and inclusion criteria for cartilage surgery have an important effect on final results and patient prognosis.

It is not possible at the moment to make a definitive conclusion regarding the clinical effectiveness of these two techniques on the basis of the studies available in the literature. Moreover, we found no information that can influence current practice. It is encouraging that several randomized controlled trials are actually under way, so, even if some time is necessary before they come to conclusion, their final results will help to clarify this situation.

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