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The Knee



Review

Surgical treatments of cartilage defects of the knee: Systematic review of randomised controlled trials

Brian M Devitt^{a,*}, Stuart W Bell^{a,1}, Kate E Webster^b, Julian A Feller^{a,b}, Tim S Whitehead^a^a OrthoSport Victoria, Richmond, Australia^b School of Allied Health, La Trobe University, Melbourne, Australia

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ABSTRACT

Background: The aim of this systematic review was to identify high quality randomised controlled trials (RCTs) and to provide an update on the most appropriate surgical treatments for knee cartilage defects.

Methods: Two reviewers independently searched three databases for RCTs comparing at least two different treatment techniques for knee cartilage defects. The search strategy used terms mapped to relevant subject headings of MeSH terms. Strict inclusion and exclusion criteria were used to identify studies with patients aged between 18 and 55 years with articular cartilage defects sized between one and 15 cm². Risk of bias was performed using a Coleman Methodology Score. Data extracted included patient demographics, defect characteristics, clinical outcomes, and failure rates.

Results: Ten articles were included (861 patients). Eight studies compared microfracture to other treatment; four to autologous chondrocyte implantation (ACI) or matrix-induced ACI (MACI); three to osteochondral autologous transplantation (OAT); and one to BST-Cargel. Two studies reported better results with OAT than with microfracture and one reported similar results. Two studies reported superior results with cartilage regenerative techniques than with microfracture, and two reported similar results. At 10 years significantly more failures occurred with microfracture compared to OAT and with OAT compared to ACI. Larger lesions (> 4.5 cm²) treated with cartilage regenerative techniques (ACI/MACI) had better outcomes than with microfracture.

Conclusions: Based on the evidence from this systematic review no single treatment can be recommended for the treatment of knee cartilage defects. This highlights the need for further RCTs, preferably patient-blinded, using an appropriate reference treatment or a placebo procedure.

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Contents

1.	Introduction	0
2.	Methods	0
2.1.	Search strategy	0
2.2.	Selection criteria	0
2.3.	Risk of bias	0
2.4.	Data extraction	0

* Corresponding author at: Orthosport Victoria, Epworth Hospital Richmond, Vic 3121, Australia.

E-mail addresses: bdevitt@osv.com.au (B.M. Devitt), drstuartbell@gmail.com (S.W. Bell), k.webster@latrobe.edu.au (K.E. Webster), jfeller@osv.com.au (J.A. Feller), twhitehead@osv.com.au (T.S. Whitehead).¹ Co-first authors.<http://dx.doi.org/10.1016/j.knee.2016.12.002>

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2.5.	Data analysis	0
3.	Results	0
3.1.	Search results	0
3.2.	Patient demographics and cartilage defect characteristics	0
3.3.	Risk of bias	0
3.4.	Primary outcome	0
3.4.1.	Clinical scores	0
3.5.	The effect of cartilage defect size on outcome	0
3.6.	Secondary outcomes	0
3.6.1.	Failure rates	0
3.6.2.	Histological outcomes	0
3.6.3.	Radiological outcomes	0
3.7.	Surgical techniques	0
4.	Discussion	0
5.	Conclusion	0
	Contributions	0
	Role of funding	0
	Competing interest statement	0
	References	0

1. Introduction

The optimal treatment of a full thickness defect of knee articular cartilage in a young symptomatic patient remains controversial and represents a significant challenge for orthopaedic surgeons. Full thickness articular cartilage defects have limited regenerative potential and although the natural history of cartilage defects is not fully understood, it is generally accepted that they have the potential to progress to osteoarthritis [1]. Moreover, it has been reported that patients with isolated symptomatic cartilage defects awaiting treatment have similar quality of life scores compared to patients with knee osteoarthritis awaiting total knee arthroplasty or knee osteotomy, and worse clinical scores than patients awaiting anterior cruciate ligament (ACL) reconstruction [2].

A variety of treatments have been proposed for articular cartilage defects. Microfracture [3], abrasion arthroplasty [4] and subchondral drilling [5] are designed to elicit a repair response with production of fibrocartilage. Osteochondral autologous transplantation (OAT) is a technique that aims to replace the articular cartilage defect with hyaline articular cartilage plugs harvested from elsewhere in the knee [6]. Regenerative techniques aim to stimulate hyaline or hyaline-like cartilage formation. These include autologous chondrocyte implantation (ACI) and matrix-induced autologous chondrocyte implantation (MACI) [7].

Despite an increase in research focus on the treatment techniques available for articular cartilage defects of the knee, there remains no consensus as to the best option [8]. Furthermore, a review found that the vast majority of studies have been of low methodological quality; only nine percent of 194 studies on cartilage treatment were level I randomised controlled trials with the majority (76%) being level IV evidence [9]. In an attempt to evaluate only the highest quality of evidence available, Bekkers et al. [10] carried out a systematic review of level I evidence in 2009. This review could only identify four relevant studies, all published between 2003 and 2008. The authors concluded that smaller lesions should be treated by microfracture or single plug OAT, and that in active patients with large articular cartilage lesions, ACI or OAT resulted in improved outcomes compared to microfracture. In addition, a number of other systematic reviews have been performed concentrating on microfracture [11], OAT [12], ACI [13] and MACI [14]. However, the majority of these reviews included mostly levels II to IV evidence and, unsurprisingly, identified beneficial effects across the whole spectrum of available surgical techniques, thus providing little clarity on the dilemma of which articular cartilage treatment to use.

The aims of this systematic review were to identify high quality randomised controlled trials and to provide an update on the selection of the most appropriate surgical treatments for articular cartilage defects of the knee.

2. Methods

The study was performed as a systematic review of the current literature following the Preferred Reporting Items for Systematic reviews and Meta-analysis (PRISMA) guidelines [15].

2.1. Search strategy

Articles were identified following a search of the electronic medical databases MEDLINE (1947 to 12th February 2015), EMBASE (1947 to 12th February 2015) and the Cochrane central library. The search strategy used terms mapped to relevant subject headings of MeSH terms. The medical databases were searched using three concepts; concept 1 – randomised controlled trials, concept 2 – articles relating to the knee, and concept 3 – the treatment of articular cartilage defects. The search terms in

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