

## Systematic Review

# Treatment of Chondral Defects in the Athlete's Knee

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**Purpose:** To determine which surgical technique(s) has improved outcomes and enables athletes to return to their preinjury level of sports and which patient and defect factors significantly affect outcomes after cartilage repair or restoration. **Methods:** We conducted a search of multiple medical databases, evaluating studies of articular cartilage repair in athletes. **Results:** We identified 11 studies for inclusion (658 subjects). Only 1 randomized clinical trial was identified. All other studies were prospective cohorts, case-control studies, or case series reporting results after either microfracture or autologous chondrocyte implantation (ACI) or osteoarticular transplantation (OATS). Eight different clinical outcomes measures were used. Better clinical outcomes were observed after ACI and OATS versus microfracture. Results after microfracture tended to deteriorate with time. The overall rate of return to preinjury level of sports was 66%. The timing of return to the preinjury level of sports was fastest after OATS and slowest after ACI. Defect size of less than 2 cm<sup>2</sup>, preoperative duration of symptoms of less than 18 months, no prior surgical treatment, younger patient age, and higher preinjury and postsurgical level of sports all correlated with improved outcomes after cartilage repair, especially ACI. Results after microfracture were worse with larger defects. The rate of return to sports was generally lower after microfracture versus ACI or OATS, and if a patient was able to return to sports, performance was diminished as well. **Conclusions:** Management of chondral defects in the athlete is complex and multifactorial. There is little high-level evidence to support one procedure over another, although good short-term and midterm outcomes with a fair rate of return to preinjury level of sports can be achieved with cartilage repair and restoration in the athlete. **Level of Evidence:** Level IV, systematic review.

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Although the natural history of focal articular cartilage injury in the knee is not completely understood, it is known that articular cartilage has little inherent capacity for healing.<sup>1</sup> Athletes place a high demand on the knee and are at risk for the develop-

ment of early osteoarthritis.<sup>2-6</sup> The incidence and prevalence of focal chondral defects in an athletic population, as well as the proportion of defects that are symptomatic, are unknown. Nevertheless, both acute traumatic injury and chronic repetitive damage to the articular cartilage are increasingly recognized in the athletic population.<sup>7,8</sup> Because of the increased stress placed on an athlete's knee joint, a biomechanically durable tissue is desired after cartilage repair or restoration. Ideally, surgical treatment of symptomatic defects would allow this challenging group of patients to return to sports at their pre-symptom level. The purpose of this study was to review the literature systematically to determine which articular cartilage surgery techniques improve clinical outcomes and enable athletes to return to their preinjury level of sports and which patient and defect factors significantly affect outcomes after cartilage repair or restoration.

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## METHODS

A systematic review of the literature was performed, including Level I to IV studies based on criteria established by the Oxford Centre for Evidence-Based Medicine.<sup>9</sup> A search was performed by use of the following databases: MEDLINE, Embase, CINAHL (Cumulative Index to Nursing and Allied Health Literature), PubMed, SPORTDiscus, and Cochrane Collaboration of Systematic Reviews. The search was performed on October 23, 2009, and repeated on October 24, 2009, to ensure accuracy. Search key words included the following: knee, articular cartilage, chondral, defect, lesion, athlete, sport(s), treatment, debridement, lavage, chondroplasty, microfracture, autologous chondrocyte implantation (ACI), osteochondral autograft, allograft, mosaicplasty, and osteoarticular transplantation (OATS). All studies identified were independently reviewed by all 4 authors and checked for potentially inclusive references. In the event of disagreement over whether an article should be included, the corresponding author made the final determination. The heterogeneity of identified studies precluded performance of a meta-analysis, with specific attention paid to different athletic populations, different inclusion criteria, different assessments and classifications of defects, different treatments and techniques, and different outcome measures; thus a systematic review was performed.

Inclusion criteria included the following:

- English language
- Human subjects
- Between years 1981-2009
- Randomized controlled trials, prospective cohort studies, case-control studies, and case series
- Results of studies describing the treatment of partial- and full-thickness chondral defects in the knee joints of athletes
- Results of studies with a minimum follow-up of 12 months

Exclusion criteria included the following:

- Non-English language
- Basic science or animal studies
- Expert opinion, Level V evidence studies
- Surgical technique articles
- Results of studies in nonathlete populations
- Results of studies with less than 12 months of follow-up
- Different studies including identical subject populations, unless evaluating different data parameters

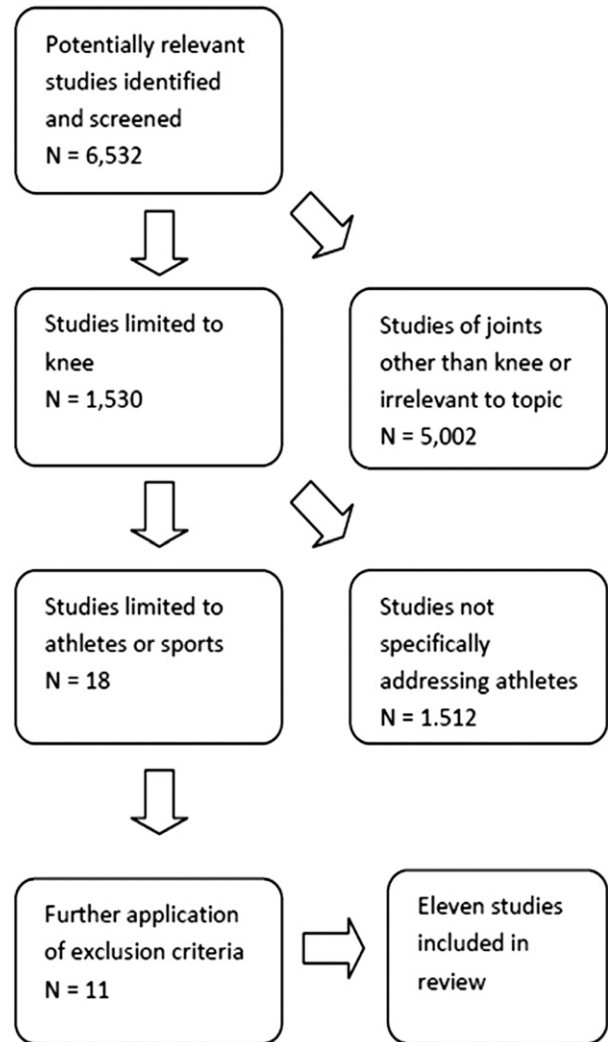


FIGURE 1. Systematic review search algorithm. After application of all inclusion and exclusion criteria, 11 studies were identified for review.

- Results of studies on articular cartilage repair or restoration in joints other than the knee
- Results of studies on articular cartilage repair or restoration in osteoarthritis

Initial search of all databases used yielded 6,532 citations. Figure 1 shows the application of the inclusion and exclusion criteria. Limitation to the knee joint yielded 1,530 citations. Further limitation to athlete or sport(s) yielded 18 citations. Two studies were excluded because they reported on results of subjects with osteoarthritis.<sup>10,11</sup> One study was written in Spanish and excluded.<sup>12</sup> Two studies were review articles with expert opinion and were excluded.<sup>8,13</sup>

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