

# The Early Osteoarthritic Knee

## Implications for Cartilage Repair

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### KEYWORDS

- Knee • Articular cartilage • Osteoarthritis • Cartilage defect • Bone marrow lesion
- Extracellular matrix • Body mass index

### KEY POINTS

- Patients with early knee osteoarthritis (OA) are more likely to have inferior long-term outcomes or earlier graft failure.
- Cartilage repair procedures are more likely to fail in the early OA knee due to a chronic synovial and chondrogenic process, which is confounded by persistent muscle weakness and altered pain processing for those with increased preoperative symptom duration.
- Pain, radiographic changes, patient-reported outcomes (PROs), and macroscopic changes on arthroscopic evaluation or MRI can assist clinicians in identifying the early OA knee to both aid in clinical decision making and create realistic postoperative expectations for patients.

### INTRODUCTION

Patients with early OA have been reported to have inferior outcomes with an increased prevalence of early failure after cartilage procedures.<sup>1</sup> Both after osteochondral allograft and after cell-based (autologous chondrocyte implantation [ACI]) procedures, the worst performing groups with regard to survival of the original graft are patients with early OA.<sup>1,2</sup> The underlying reasons for this failure are unknown and likely multifactorial in nature. The purpose of this review is to identify (1) the underlying factors associated with poorer results following cartilage repair for this subset of patients and (2) methods to better identify patients with early OA, which often is difficult in the clinical setting.

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## WHY ARE PATIENTS WITH EARLY OSTEOARTHRITIS MORE LIKELY TO FAIL CARTILAGE PROCEDURES?

It is no secret that patients with early OA have worse outcome scores overall and are expected to fail earlier. The underlying reasons for failure in this group have not been established; however, the etiology is likely multifactorial and includes the duration of symptoms, muscular weakness, and chronic synovial and chondrogenic inflammation.

### *Duration of Symptoms*

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Accepting that chronic inflammation is a feature of early OA, it is clinically relevant to record the earliest onset of symptoms. In particular, joint swelling is the clinical correlate to significant joint inflammation. Several reports in recent years have pointed out the importance of duration of clinical symptoms, such as recurrent effusions and pain prior to chondral repair.<sup>3,4</sup> Symptoms exhibited for more than 1 year are associated with overall worse patient-related outcomes after chondral repair regardless if a cell-based technique or a chondral plug transfer is performed, and this finding has been demonstrated by both adolescent and adult patients.<sup>3,5,6</sup>

There are multiple factors as to why the duration of preoperative symptoms may negatively influence postoperative outcome, and the factors are likely not mutually exclusive. First, as is discussed, longer duration of symptoms is likely associated with the joint being in a state of synovial and chondrogenic inflammatory state for a longer period of time. As such, longer duration of symptoms has been associated with worse arthroscopic International Cartilage Repair Society (ICRS) grades, which are indicative of more extensive chondral changes.<sup>7</sup> Second, the longer that pain is present during the preoperative period, the more likely central nervous system adaptations are to occur.<sup>8</sup> As such, prolonged symptom duration prior to surgical intervention may promote the creation of a cycle of chronic pain that coincides with progressive chondral changes. Patients respond to OA-related pain differently, and different pain phenotypes have been identified.<sup>9,10</sup> Some patients demonstrate characteristics of pain centralization, including lower pain thresholds and self-reports of severe pain despite mild radiographic changes whereas some patients' response is exactly the opposite manner with low pain sensitivity and more efficient descending inhibition despite the presence of progressive radiographic changes.<sup>9,10</sup> Patients with altered pain processing may then be at greater risk of persistent postoperative pain, and future studies are necessary to determine if adjunctive pain neuroscience education or other psychological or behavioral science interventions can improve postoperative outcomes for this at-risk subset of patients.<sup>11</sup>

### *Muscular Weakness*

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Additionally, presence of severe preoperative muscular atrophy and deconditioning has been reported to persist postoperatively.<sup>12–16</sup> Both eccentric and concentric quadriceps strength before chondral repair procedures are reduced by a 20% to 30% compared with the opposite leg.<sup>12–16</sup> Unfortunately, after chondral repair procedures, this weakness is amplified over the course of the first postoperative year.<sup>13</sup> Patients undergoing tibiofemoral ACL procedures drop to 50% of their preoperative strength at 6 months after surgery and only regain their preoperative eccentric and concentric quadriceps strength at 1 year after surgery.<sup>13</sup> Furthermore, Loken and colleagues<sup>15</sup> reported marked strength deficits at mean 7 years after ACL. This is of significant concern for the progression of OA because the protective muscular envelope dysfunction is unable to reduce contact load in these individuals. This severe lack of strength recovery may partially be influenced by

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