

Evaluating Outcome Following Cartilage Procedures

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Summary

Many factors influence the evaluation of outcome following cartilage procedures. The outcome is influenced by the patient, the nature of the lesion, the procedure performed, and the outcome measure utilized. All of these factors must be independently considered in great detail to appropriately evaluate any treatment or procedure for a cartilage lesion. Each of these is reviewed in this chapter.

Key Words: Cartilage; outcome; surgery; evaluation; scale; prognosis.

There are many factors that influence the evaluation of outcome following cartilage procedures. The outcome is influenced by the patient, the nature of the lesion, the procedure performed, and the outcome measure utilized. All of these factors must be independently considered in great detail to appropriately evaluate any treatment or procedure for a cartilage lesion. In this chapter, each of these factors are considered separately to present an organized approach to evaluating the outcome for a patient who has undergone a cartilage regenerative or restorative procedure.

THE PATIENT

Many factors must be considered when evaluating the patient. These factors will have a large effect on the outcome of treatment and must be documented in detail. Patient age as well as the height and weight of the patient have an effect on the outcome. The patient's occupation will also affect outcome because of the inherent relationship with activity level. Patient gender should also be considered.

The duration of symptoms is very important. A patient who has 2 days of pain is very different from an individual who has been in pain chronically for over 2 years. Therefore, an estimation of the duration of symptoms should be determined. In many cases, the patient has sustained trauma in the past; such a history is relevant and should be described in detail regarding the mechanism. When the patient has been injured, the mechanism should be determined.

There are other issues relating to the patient that can also affect outcome. These include prior operations on the knee or other conditions relating to the knee or site of cartilage repair. *Other medical problems such as diabetes or heart disease may limit the patient in his or her activity or ability to heal.* Medications should also be tracked. If the patient is treated as part of a worker's compensation claim, this has been documented to adversely affect outcome following orthopedic surgery. The surgeon should document whether the patient is in this category.

Perhaps one of the most important prognostic factors following cartilage surgery is the patient's activity level. This is a critical variable because with a decreased level of activity

many patients can tolerate significant knee pathology. Often, patients with symptomatic cartilage lesions will significantly modify their activities to reduce knee symptoms associated with the lesion. The measurement of patient activity is complex and can be difficult. The Tegner rating scale evaluates patients based on their participation in various sports (1). Although this scale has been used extensively in the past, it has limitations with respect to patients who do not participate in the specific sports measured by the scale. Therefore, individuals who are active but do not participate in one of the sports evaluated in this rating scale may be incorrectly rated as having a lower activity level.

A rating scale that measures patients' activity independent of specific sports is desirable. One such scale has been published that was developed with patient input regarding activities that are important and difficult for them to perform (2). This rating scale asks patients four questions about the frequency with which they perform four activities: running, cutting (changing directions while running), decelerating (coming to a quick stop while running), and pivoting (turning the body with the foot planted, etc.). This scale has been evaluated for reliability and validity in separate groups of patients (2). The use of activity rating scales is recommended in tracking clinical outcomes of cartilage repair procedures.

THE LESION

The characteristics of the cartilage lesion that is repaired have an important impact on the outcome after treatment. These characteristics should be documented in detail prior to surgery to allow an accurate evaluation of the results in light of what was actually treated. Lesion size, location, and character (i.e., whether the lesion involves only cartilage or cartilage plus bone) should also be determined because lesions involving subchondral bone generally require a more involved reconstruction.

The diagnosis will also have an important effect on treatment in many cases. Avascular necrosis leading to a cartilage problem will affect underlying subchondral bone and may be related to systemic health problems. Osteochondritis dissecans also involves the underlying subchondral bone and will often lead to large defects.

The alignment of the lower extremity can also affect outcome depending on the location of the lesion. Alignment is ideally evaluated radiographically using three foot-standing x-rays to determine the anatomical alignment and the mechanical axis. Other intra-articular problems must also be assessed. In general, if the opposing cartilage surface is degenerative, the patient would be diagnosed with arthritis, and cartilage resurfacing may not be appropriate. Therefore, the articular surface opposing the cartilage injury site as well as the articular surfaces elsewhere in the knee must be evaluated.

THE CARTILAGE REPAIR PROCEDURE

When evaluating the results of surgery, there are several factors that should be considered in addition to the actual type of operation performed. The indication for surgery should be documented. In general, the indication for surgery of this type is pain. However, if the indication is not pain and the surgeon is performing the operation to avoid future problems in the knee, this should be explicitly indicated. Prior procedures should also be documented. The postoperative rehabilitation may have an important influence on the outcome. Factors such as use of continuous passive motion, weight bearing and strengthening exercises, as well as the timing of their incorporation can affect the result of the procedure.

Clearly, the operating surgeon is critical in determining the clinical outcome following cartilage repair procedures. When considering cartilage repair procedures, the clinician should honestly assess his or her expertise regarding the specific surgery that is planned. Some methods, autologous chondrocyte implantation, for instance, are technically demanding, and poor technical execution can have a direct bearing on outcome and the need for subsequent procedures.

EVALUATION OF OUTCOME

Objective

There are several objective measures of outcome, such as physical examination, imaging, and tissue biopsy. Although these are generally important to the surgeon, they may not be of any relevance to the patient. Patients are generally more concerned with their symptoms and function. Nevertheless, objective measures are important and often give critical information.

Physical exam is a routine part of follow-up after surgery. For cartilage procedures about the knee, physical exam includes an evaluation of gait, pain on palpation, effusion, range of motion, and stability of the knee. Imaging is also an important part of the evaluation. Radiographs can demonstrate the progression of degenerative disease such as osteophytes, subchondral sclerosis, subchondral cysts, and joint space narrowing. Change in alignment may also be related to degenerative osteoarthritis. However, degenerative changes in the knee often occur over a prolonged period of time, and in the shorter term radiographs may not be relevant.

Magnetic resonance imaging (MRI) has been used as a noninvasive method to evaluate cartilage and cartilage repair (3,4). Because of the direct multiplanar capability and the soft tissue contrast with MRI, the morphology of the cartilage can be assessed accurately. There are cartilage-sensitive sequences that allow the tissue to be distinguished from adjacent joint fluid as well as subchondral bone. The signal characteristics of the cartilage can then be determined to reflect its histopathological state. MRI is currently evolving, and in the present as well as the future, it is an important tool to evaluate cartilage repair in a noninvasive manner.

An evaluation of the repair tissue itself is useful to determine the quality. Routine histology as well as immunohistochemical evaluation have been performed (5,6). Although the information gained by biopsy is valuable, many patients will not consent to this procedure. Despite the potential lack of patient interest in this approach, some authors have been able to evaluate patients with this methodology (7).

Patient-Oriented Outcomes

Issues such as pain and function are of paramount importance to patients who are recovering from cartilage procedures. Symptoms and disabilities are generally evaluated using validated rating scales. There are many that have been published for use in this patient population (8,9). The goal of using rating scales to measure patient outcome is to evaluate concepts that are critical to patients and to do so in a time-efficient manner. Therefore, relatively shorter questionnaires are preferred to limit responder burden.

It is ideal to obtain both a measure of region-specific function as well as an overall measure of health. The latter is usually evaluated using a generic health status instrument such as the Short Form (SF)-36. The SF-36 is a 36-item questionnaire that measures general health (10–12). Its use has been encouraged in conjunction with knee-specific instruments for studies

of patients with an injury of the anterior cruciate ligament (ACL) (13). The SF-36 has both a physical component and a mental component summary scale that can be derived from the 36 questions. This instrument is relatively heavily weighted for lower extremity function and is therefore particularly useful for cartilage patients.

Of the available knee rating scales, several are discussed with respect to their usefulness for this patient population. The modified Lysholm scale (1) is an eight-item questionnaire that was initially designed to evaluate patients after knee ligament surgery. It has 25 points attributed to knee stability, 25 to pain, 15 to locking, 10 each to swelling and stair climbing, and 5 each to limp, use of support, and squatting. It has been used extensively for clinical research studies mainly for the ACL. However, it has been evaluated and found acceptable for chondral disorders of the knee (14).

The activities of daily living (ADL) scale of the knee outcome survey is a useful instrument for cartilage patients, and we have distributed this questionnaire to evaluate patients at our institution (15). It was developed based on a review of relevant instruments with clinician input. It is designed for patients with disorders of the knee ranging from ACL injury to osteoarthritis. Therefore, it is generally applicable to most cartilage patients. The questions range from relatively simple basic functions to more advanced activity. It has been found to have excellent psychometric properties (9).

The International Knee Documentation Committee developed a rating scale for objective parameters related to knee function. These parameters include effusion, motion, ligament laxity, crepitus, harvest site pathology, radiographic findings, and one-leg-hop tests. Patients were given a grade of normal, nearly normal, abnormal, or severely abnormal for each. The lowest grade for a given group is the patient's final grade. The International Knee Documentation Committee has subsequently developed a questionnaire relating to subjective factors (16). Although this questionnaire has not specifically been validated for patients with articular cartilage disorders, it is likely that it is a useful instrument.

The knee injury and osteoarthritis outcome score (KOOS) was developed using input from patients who underwent meniscal surgery in the past (17). Five separate scores are calculated for pain, symptoms, ADLs, sport and recreational function, and knee-related quality of life. This scale is useful because the Western Ontario and McMaster University's (WOMAC) osteoarthritis index is incorporated into the KOOS (18). The WOMAC involves 24 questions, with 5 relating to pain, 2 to stiffness, and 17 to difficulty with ADLs. The WOMAC is mainly for patients with lower extremity osteoarthritis and therefore can be useful for patients with cartilage disease. The KOOS is a wide-ranging scale because it not only applies to patients with degenerative disease, but also has questions about sport participation. This makes it an attractive alternative for evaluating outcome following cartilage procedures.

The measurement of activity as a prognostic variable was discussed regarding patient factors. It is worthwhile to mention that this is a critical prognostic variable, and any investigator who chooses to evaluate outcome following cartilage procedures should choose an appropriate measure to evaluate this concept (2).

CONCLUSION

In conclusion, there are a number of factors that affect outcome following cartilage surgery. The evidence available to support cartilage repair surgery is somewhat limited at the present time. However, there have been recent randomized controlled trials specifically

comparing different treatment strategies. Surgeons who treat these lesions must be aware of the literature available and how the investigators elected to evaluate the outcome of their patients.

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