Infographic

How to Manage Cartilage Injuries?

Jorge Chahla, M.D., Ph.D., Jonathan Stone, M.D., and Bert R. Mandelbaum, M.D.

Abstract: Although small cartilage injuries are commonly found in knee arthroscopy procedures, significant chondral and osteochondral injuries are relatively infrequent. Incidence of cartilage injury rises when considering traumatic origin, especially when approaching significant ligamentous or meniscal pathology. Options for restoration span the gamut from benign neglect to open procedures that restore both cartilage and subchondral bone. The best choice of procedure largely depends on lesion size, depth, and location. Smaller lesions isolated to cartilage <2 cm^2 can be treated with marrow stimulation techniques such as microfracture with or without biologic options (bone marrow aspirate concentrate or platelet-rich plasma with or without cartilage precursors or scaffolds). Microfracture alone in larger lesions has been reported to be less durable and it is therefore not recommended for larger lesions. Smaller lesions <2 cm^2 that include a subchondral injury can be treated with osteochondral autograft implantation, in which a core of cartilage and bone is transferred from a relative non-weightbearing surface to the lesion. Larger osteochondral lesions >2 cm^2 are better treated with osteochondral allograft transplantation, where osteochondral cores from a size-matched, fresh cadaver are matched to the patient's lesion. This option may require multiple cores to be placed in a "snowman" pattern; however, recent literature demonstrated that a single plug might produce better outcomes. Alternatively, for large chondral-only lesions, a resurfacing procedure may be chosen that may include biologic options. Autologous chondrocyte implantation (ACI), currently in its third iteration (matrix ACI [MACI]), is an excellent choice with good long-term durability. In addition, MACI may be used for chondral lesions in the patellofemoral joint where matching the native joint topology may be more difficult. If the patient has an underlying bone marrow lesion but an intact cartilage cap that appears healthy on arthroscopic examination, one may consider a core decompression and injection with biologics such as BMAC and bony scaffold with fibrin glue (also known as *bioplasty*). It is also critical that the surgeon address any concomitant knee pathology that would compromise cartilage restoration. This includes addressing malalignment with distal femoral, proximal tibial, or tibial tubercle osteotomy, significant meniscal deficiency with meniscal transplant, and any instability from lack of cruciate or collateral ligaments with ligament reconstruction.

Bibliography

Astur DC, de Freitas EV, Cabral PB, et al. Evaluation and management of subchondral calcium phosphate injection technique to treat bone marrow lesion. *Cartilage* 2018:1947603518770249.

Beck PR, Thomas AL, Farr J, Lewis PB, Cole BJ. Trochlear contact pressures after anteromedialization of the tibial tubercle. *Am J Sports Med* 2005; 33:1710-1715.

Brophy RH, Zeltser D, Wright RW, Flanigan D. Anterior cruciate ligament reconstruction and concomitant articular cartilage injury: incidence and treatment. *Arthroscopy* 2010; 26:112-120.

Campbell AB, Pineda M, Harris JD, Flanigan DC. Return to sport after articular cartilage repair in athletes' knees: A systematic review. *Arthroscopy* 2016; 32:651-668 e651.

Cotter EJ, Hannon CP, Christian DR, et al. Clinical outcomes of multifocal osteochondral allograft transplantation of the knee: an analysis of overlapping grafts and multifocal lesions. *Am J Sports Med.* 2018;46:2884-2893.

Cvetanovich GL, Riboh JC, Tilton AK, Cole BJ. Autologous chondrocyte implantation improves knee-specific functional outcomes and health-related

From Rush University Medical Center, Chicago, Illinois, U.S.A.

The authors reports the following potential conflicts of interest or sources of funding: J.C. reports personal fees from Arthrex, personal fees from Smith and Nephew, personal fees from CONMED, outside the submitted work; B.R.M. reports personal fees from Arthrex, personal fees from Depuy, personal fees from Exactech, outside the submitted work. Full ICMJE author disclosure forms are available for this article online, as supplementary material.

Received August 13, 2019; accepted August 14, 2019.

Address correspondence to Jorge Chahla, M.D., Ph.D., Rush University Medical Center, 1611 West Harrison St, Chicago, IL 60612, U.S.A. E-mail: jachahla@msn.com

0749-8063/191000/$36.00

https://doi.org/10.1016/j.arthro.2019.08.021

quality of life in adolescent patients. *Am J Sports Med* 2017; 45:70-76.

Ebert JR, Fallon M, Wood DJ, Janes GC. A prospective clinical and radiological evaluation at 5 years after arthroscopic matrix-induced autologous chondrocyte implantation. *Am J Sports Med* 2017; 45:59-69.

Getgood A, Gelber J, Gortz S, De Young A, Bugbee W. Combined osteochondral allograft and meniscal allograft transplantation: A survivorship analysis. *Knee Surg Sports Traumatol Arthrosc* 2015; 23:946-953.

Gudas R, Gudaite A, Pocius A, et al. Ten-year follow-up of a prospective, randomized clinical study of mosaic osteochondral autologous transplantation versus microfracture for the treatment of osteochondral defects in the knee joint of athletes. *Am J Sports Med* 2012; 40:2499-2508.

Gudas R, Kalesinskas RJ, Kimtys V, et al. A prospective randomized clinical study of mosaic osteochondral autologous transplantation versus microfracture for the treatment of osteochondral defects in the knee joint in young athletes. *Arthroscopy* 2005; 21:1066-1075.

Kahlenberg CA, Nwachukwu BU, Hamid KS, Steinhaus ME, Williams RJ, 3rd. Analysis of outcomes for high tibial osteotomies performed with cartilage restoration techniques. *Arthroscopy* 2017; 33:486-492.

Krych AJ, Harnly HW, Rodeo SA, Williams RJ 3rd. Activity levels are higher after osteochondral autograft transfer mosaicplasty than after microfracture for articular cartilage defects of the knee: A retrospective comparative study. *J Bone Joint Surg Am* 2012; 94:971-978.

Mandelbaum B, Browne JE, Fu F, et al. Treatment outcomes of autologous chondrocyte implantation for full-thickness articular cartilage defects of the trochlea. *Am J Sports Med* 2007; 35:915-921.

Mithoefer K, Hambly K, Della Villa S, Silvers H, Mandelbaum BR. Return to sports participation after articular cartilage repair in the knee: Scientific evidence. *Am J Sports Med* 2009; 37(Suppl 1):167S-176S.

Mithoefer K, Williams RJ 3rd, Warren RF, Wickiewicz TL, Marx RG. High-impact athletics after knee articular cartilage repair: A prospective evaluation of the microfracture technique. *Am J Sports Med* 2006; 34:1413-1418.

Nawaz SZ, Bentley G, Briggs TW, et al. Autologous chondrocyte implantation in the knee: mid-term to long-term results. *J Bone Joint Surg Am.* 2014; 96:824-830.

Oussedik S, Tsitskaris K, Parker D. Treatment of articular cartilage lesions of the knee by microfracture or autologous chondrocyte implantation: a systematic review. *Arthroscopy.* 2015; 31:732-744.

How to Manage Cartilage Injuries?

Arthroscopy
The Journal of Arthroscopic and Related Surgery

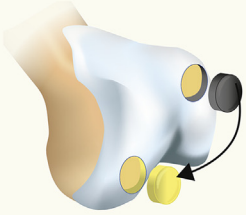
DEFECT SIZE

<2 cm²

Chondral lesion

Marrow stimulation plus biologics

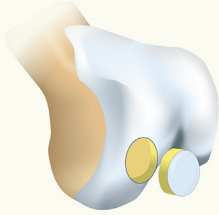
Chondral or Osteochondral lesion



Osteochondral autograft

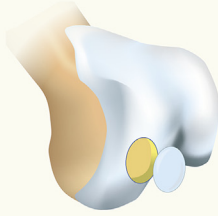
>2 cm²

Osteochondral lesion



Osteochondral allograft

Chondral lesion



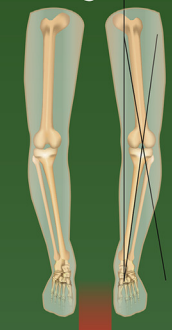
Scaffold and biological resurfacing

SUBCHONDRAL LESION WITH INTACT CARTILAGE

Core decompression and biologics injection

ADDRESS COMORBIDITIES

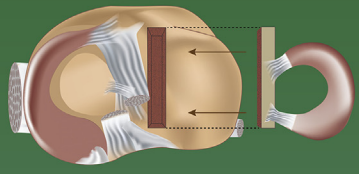
Malalignment



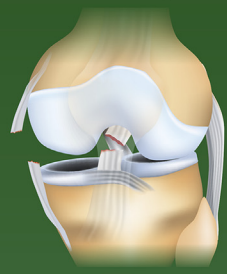
Osteotomy

Meniscus deficiency

Transplant



Instability



Ligament repair/ reconstruction

Jorge Chahla, MD, PhD, Jonathan Stone, MD and Bert R. Mandelbaum, MD

https://www.arthroscopyjournal.org/

CEDARS-SINAI KERLAN-JOBE INSTITUTE

MIDWEST ORTHOPAEDICS at RUSH SPORTS MEDICINE & SHOULDER