

What's in My Bag?



Featuring Brian Cole, M.D.

*Orthopedics, Department of Anatomy & Cell Biology
Section Head, Cartilage Restoration Center at Rush
Division of Sports Medicine
Rush University Medical Center*

BioCartilage

Q. Why do you feel it is important to augment the microfracture procedure?

A. Several new technologies have focused on improving the outcomes of microfracture beyond what we have seen in the literature. Unfortunately, the regulatory burden that non-allograft and biologic therapies must overcome has virtually halted the emergence of new solutions for cartilage repair. There are more than 125,000 microfracture procedures performed annually, yet the results remain mixed and often, short-lived. Thus, harnessing the relative simplicity of microfracture and promoting stem cell recruitment with the addition of a bioactive scaffold provides a legitimate opportunity to improve outcomes for our patients.

Q. What intrigued you about utilizing a technology that doesn't contain live cells and instead functions purely as a scaffold?

A. Microfracture, when technically well performed, has profound potential. The technique requires that we create vertical walls surrounding the defect in an effort to help the defect better "shoulder the load."

Completely eliminating the calcified layer is also critical to promote the development of adherent, robust fibrocartilagenous repair tissue. Atraumatic perforations created by the Power Pick minimize the "fracture" component (and the associated negative impact that otherwise occurs with the biology of fracture healing with stiffening of the subchondral plate), provide anchor points for fibrocartilage repair tissue, and access to mesenchymal stem cells (MSCs) within the bone marrow. BioCartilage is a conductive scaffold with natural cartilage proteins native to articular cartilage with the added advantage of an inductive effect through active proteins and the addition of PRP. Ample *in vitro* and early *in vivo* evidence exists supporting the positive effects of these substrates both individually and collectively.

Q. When would you utilize BioCartilage over other types of cartilage procedures?

A. The optimal sized defect treated first-line with microfracture typically includes small to medium-sized defects. BioCartilage as an adjunct to microfracture makes intuitive sense given the variable results of microfracture alone. Osteochondral allograft transplantation remains an excellent option when the subchondral bone is involved especially for larger defects.

Q. Do you come across lesions that you didn't expect to treat where BioCartilage has been utilized?

A. Before BioCartilage, there were really no "off-the-shelf" options to treat cartilage defects. Clinicians should always be aware of the possibility that a cartilage defect will be appreciated at the time of arthroscopy and that it might be determined to be the source of the patients symptoms, despite it not being objectively appreciated from pre-operative assessments (i.e., MRI, prior surgical findings, etc). Thus, having a relatively low-cost arthroscopic option with an extended shelf-life (5 years) is appealing, as long as the patient is adequately consented pre-operatively.

Treatment of Trochlear Defect with BioCartilage



Debride defect to a stable border



Perform bone marrow stimulation procedure



Apply BioCartilage into the prepared defect



Drip fibrin over the BioCartilage material



Allow fibrin to set before closing

Treatment of Tibial Plateau Defect with BioCartilage



Debride defect to a stable border



Utilize PowerPick for marrow stimulation



Injection of BioCartilage into the prepared defect



Level BioCartilage to where it is slightly recessed



Apply fibrin and allow to set

Q. When performing a BioCartilage procedure, are there any technique pearls you really focus on?

- A. Our experience in large animal studies and initial clinical utilization of BioCartilage has helped to identify several pearls. A #15 scalpel is used to delineate the defect in the initial preparation of the vertical wall. A small ring curette and arthroscopic basket is useful for further delineation. It is critical to violate and remove the calcified layer without macroscopically disrupting the subchondral plate. The objective is to get the bone to “pink up” following complete preparation. An arthroscopic shaver on forward or reverse is also useful for this purpose. Switching portals to better access different portions of the lesion is important. I prefer the Power Pick over standard arthroscopic awls as it creates a uniform diameter hole that is less atraumatic and minimizes crack propagation at the edges of the hole. When mixing the micronized allograft cartilage with PRP, we recommend a 1:1 ratio. However, if the paste is too dry or difficult to eject from the delivery needle, it is occasionally helpful to add a very small amount of additional PRP to improve the handling properties. The bed of the defect should be as dry as possible; using a cannula to pass neuropatties or Q tip type swabs along the base of the defect to dry it is helpful. Placing the patient in some degree of Trendelenburg during positioning can eliminate the effects of gravity. It is best to underfill the defect slightly to avoid contact with opposing surfaces. Prior to fibrin glue placement, it is helpful to dry the surrounding native articular cartilage edges. Finally, when applying the fibrin glue, only add enough to the construct to make it flush with the surrounding articular surface rather than leaving it proud. Wait a full 5 to 7 minutes before ranging the joint. Use a sharp instrument (scalpel, basket hand instrument) to get rid of excess fibrin that is not relevant to the final construct.

Q. When you use BioCartilage, does your post-op rehab protocol change?

- A. I generally follow standard protocols described for microfracture surgery. I will, however, place the patient in a knee immobilizer locked in extension and wait a few days before beginning CPM to allow MSC's and bone marrow elements to fully infiltrate the BioCartilage mixture and form a stable, resilient clot. Notably, I recommend heel touch weightbearing for most tibiofemoral lesions without the use of a brace. For patellofemoral lesions, I allow full weight-bearing in a brace. I encourage CPM if available for a total of 6 hours per day for at least 6 weeks. I restrict higher degrees of flexion initially for patellofemoral lesions, but allow full range for tibiofemoral lesions. Total weight-bearing protection for tibiofemoral lesions ranges from 6–8 weeks.

Q. It is understood that this product is very new with limited longer term clinical follow up. Can you comment on the outcomes you have seen so far with the patients you have treated?

- A. Admittedly, the clinical follow-up is short with most of our initial patients at between 6 and 12 months post-operatively. The postoperative MRIs have been interesting with most defects showing complete retention of the mixture at approximately 1 month postoperative evaluation. The other finding is that the subchondral bone has considerably less edema than what we traditionally see following microfracture alone. It is possible that some of these findings are due to use of the Power Pick device rather than standard microfracture awls. I have had no adverse events in my patients to date. Clinically, they are doing as well or better than our microfracture patients have done and further clinical follow-up with direct comparisons of these techniques will elucidate the specific differences. Notably, early results from our equine study suggests improved macroscopic appearance for defects treated with BioCartilage compared to microfracture alone. We remain optimistic and feel that there is essentially no downside to this methodology and hope that it will result in improved clinical outcomes for our patients.