Arthritis of the 1st MPJ is a very common occurrence due to the large amount of pressure and wear that this joint incurs during the course of a lifetime. The 1st MPJ is composed of two joint axes, the transverse and the vertical. The transverse axis is dominant and provides for dorsiflexory and plantarflexory joint motion while the vertical axis allows for abduction and adduction movements. During the propulsive stage of gait the transfer of weight, as well as the ground reactive forces, culminate at this joint. As the great toe grips the floor for stability, the 1st MPJ dorsiflexes to allow for the foot to push off and take a step forward. Over time, excessive mechanical loads, abnormalities in biomechanics or structure, and/or traumatic incidents to the joint can lead to increased wear and tear of this region resulting in a condition commonly referred to as hallux limitus or hallux rigidus.

Patients usually complain of inflammation around the joint most commonly characterized by redness and swelling. Other common complaints are acute or chronic pain and eventually limitation of joint motion. As this condition progresses the joint space begins to narrow due to cartilaginous erosions and bone spurring becomes prevalent around the joint. Sclerosis of the periarticular bone can also be noted upon radiographic evaluation.

Standard conservative treatment measures such as custom orthotics, rigid soled shoes, NSAIDs, and physical therapy may aid in easing symptoms. When pain and limitation persist, surgical treatment can then be a way to cor-

A new product, BioCartilage® (Arthrex Inc., Naples, FL) is now available to aid in the repair of cartilaginous wear found within the 1st MPJ.

BioCartilage Use in the 1st MPJ

BY WINDY COLE, DPM

This new product can aid in the treatment of early chondral degeneration.

BioCartilage: Micronized Cartilage Matrix

BioCartilage is comprised of the key components found in native articular cartilage. Type II collagen, proteoglycans and cartilage growth factors are essential biologically active constituent parts of this product. BioCartilage serves as a scaffold of sorts.

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New Concepts and Studies

“New Concepts” is a forum for the presentation of (1) new technologies and products which have been the subject of clinical study, and (2) new studies involving existing products. Readers should be aware that Podiatry Management does not specifically endorse any of the technologies, concepts, or products being discussed.
that signals autologous cell migration and cellular interactions. Scientific evidence supports the premise of introducing dehydrated cartilage into cartilaginous defects. Studies have shown that the scaffold created by the native articular extracellular matrix promotes growth and chondrogenic differentiation via direct cell-matrix interactions. When a porous cartilage matrix was applied to focal cartilaginous defects after a marrow stimulation procedure had been performed in a rabbit model it was noted that the treatment group exhibited a significant increase in type II collagen as opposed to the control microfracture group which displayed primarily type I collagen typical of fibrocartilage. An early design of BioCartilage was studied within an osteochondral baboon model and was able to show induction of chondrogenic reparative tissue similar to hyaline cartilage.

The source of BioCartilage is allo-graft cartilage. The graft material is subjected to a gentle dehydration process and then it is micronized to a very small consistent particle size of 100-300 microns. The size of the graft particles allows for the product to be easily transformed into an injectable form once mixed with autologous blood or platelet rich plasma. The small particular size also increases the surface area of the product, thus increasing the number of attachment sites available to progenitor cells propagated from the patient’s bone marrow. BioCartilage is aseptically processed and packaged. The product can be stored in a room temperature environment for up to 5 years.

Preparation of the Chondral Defect

The 1st MPJ is incised utilizing a standard dorsal approach. Atraumatic surgical technique is employed as the incision is carried through to the capsular layer of the joint. Once the 1st metatarsal head is clearly dissected from the soft tissue attachments, the cartilage deficits can be visualized. A cheilectomy or osteotomy when warranted would be performed at this time (Figure 1).

After completion of any adjunctive procedures, the chondral defect is then carefully resected with a burr from the metatarsal head. Irrigation is utilized during this step in order to minimize heat injury to the bone. The burr is used to create a deficit that penetrates into the underlying subchondral bone. It is imperative to create a stable border with vertical margins. A scalpel or curette can be utilized to obtain this effect (Figure 2).

Bone marrow stimulation of the subchondral bone is then achieved by utilizing a 6.0 K-wire to perform standard microfracture drilling (Figure 3).

BioCartilage Application

The BioCartilage matrix is then mixed in the Arthrex Mixing and Delivery System with either autologous blood or platelet rich plasma in a 1:1 ratio. The graft product is thoroughly mixed by using the mixing element contained within the syringe. The product is then dispensed into the created deficit within the metatarsal head (Figure 4). The BioCartilage is then smoothed with an elevator or similar surgical instrument. It is imperative that the graft material is slightly recessed compared to the surrounding articular cartilage as to not create an area that may impinge and impede joint range of motion (Figure 5).

A fibrin product is then applied atop the BioCartilage. Care is taken to cover the defect, but not to protrude proudly into the joint space. The fibrin should be allowed to sit undisturbed for at least 5 minutes in order for the product to completely dry (Figure 6).

Standard closure techniques and surgical dressings are then applied. In this particular case, a 4 inch Orthoglass splint was applied with the ankle at 90 degrees to aid in immobilization of the joint.

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Engaging the initial post-operative healing phase. Initial immobilization is recommended to maximize the ability of the marrow elements to form a clot within the BioCartilage. Passive range of motion exercises were begun 1 week post-operatively. Gradual active range of motion was then progressively initiated 2 weeks post-op. Once radiographic evidence of incorporation of the BioCartilage product was noted and edema of the soft tissue has resolved, the patient was transitioned into a supportive athletic shoe. If any adjunctive osteotomy procedure was performed the standard rehab and post-op protocol should be followed.

Conclusion
BioCartilage was designed as an inexpensive method of augmenting the traditional microfracture technique. It is easy and reproducible. By stimulating the body’s progenitor cells from within the bone marrow it is now possible to propagate naturally occurring hyaline cartilage to fill these commonly occurring chondral deficits instead of less desirable fibrocartilage previously produced by microfracturing alone. In this particular case, the patient achieved full resolution of all pain symptoms. The range of motion around the 1st MPJ was anatomic and greatly improved in both dorsiflexion and plantarflexion from pre-operative levels. The patient now has no limitations in activity or footwear.

The BioCartilage micronized cartilage matrix appears to be an exciting new product able to aid in the treatment of early chondral degeneration of the 1st MPJ. With the advent of these new and exciting biologic products, joint destructive procedures such as fusion or replacement can be delayed or possibly replaced with more functional joint sparing techniques. Allowing patients to resume their normal activities of daily living without pain translates into improved patient satisfaction and quality of life. PM

References

Dr. Cole resides and practices in Streetsboro, Ohio. She is board certified in foot surgery by the American Board of Podiatric Surgery. She has a special interest in biological surgical products and wound care.

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