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Technical Note

Arthroscopic Single-Layer Hyaluronate-Based Scaffold for Osteochondritis Dissecans of the Glenoid

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Abstract: Osteochondritis dissecans (OCD) of the glenoid is a rare condition occurring primarily in overhead athletes. Symptoms are not specific and consist of pain, worsening range of motion, and decreased sport performance. Radiologic evaluation is crucial for diagnosis and, in particular magnetic resonance imaging, to grade this condition according to the International Cartilage Research Society OCD grading system. International Cartilage Research Society OCD stages II, III, and IV generally require surgical treatment. There's still no consensus on the best procedure, and various techniques have been described, mostly inspired by experience in other joints. This Technical Note describes an arthroscopic technique with a single-layer hyaluronate-based scaffold added to microfractures and fixed with fibrin glue for the treatment of osteochondritis dissecans of the glenoid.

Osteochondritis dissecans (OCD) is a rare acquired joint condition characterized by damage of the subchondral bone from a suspected ischemic cause with a secondary possible focal disruption with osteonecrotic evolution. It occurs primarily in young overhead athletes (e.g., those who participate in tennis, badminton, cricket, baseball, volleyball, weightlifting, gymnastics) between 6 and 20 years of age after a joint injury or a long period of sport activity, usually after repetitive overuse.[1]

Because of a lack of cartilage innervation and vascularization, symptoms are nonspecific and characterized by pain and crepitus and appear only when the innervated subchondral bone is damaged. Spontaneous healing is absent or very slow, with possible evolution toward a degenerative condition.

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Convex articular surfaces are generally involved, such as femoral condyles (especially the posterolateral part of the medial condyle), talar dome, and humeral head. Therefore, the most typically affected joints are the knee (75% of cases), the ankle, and the elbow: the shoulder represents approximately 1.6% cases of OCD. The humeral head is more involved than the glenoid, which conversely presents a concave, non–weight-bearing articular surface.[2]

The etiology of OCD is poorly understood and plausibly multifactorial. Reduced blood flow attributable to vascular disruption from repetitive trauma is probably the main cause. Another important factor is represented by the particular relationship between the humerus and the glenoid in the overhead arm position: this implies an increased mechanical load from compressive forces across the glenohumeral joint accentuated by repetitive microtrauma.[2] In particular, it has been hypothesized, at least in baseball players, that the humeral head is pushed posteriorly by the anterior band of the inferior glenohumeral ligament; this determines, over time, a compressive force on the glenoid that may lead to the onset of OCD.[3] Moreover, a genetic component could be present, predisposing certain individuals to a greater possibility of developing the disease.

Recent studies have evaluated the progressive joint damage stages (from I to IV) according to the International Cartilage Research Society (ICRS) OCD grading on the basis of magnetic resonance imaging (MRI).[2] It was demonstrated that, despite the different concave

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shape of the glenoid, its OCD follows the same progression over the time of the convex weight-bearing articular surfaces and needs, likewise, the same grade-specific management.

Patients with IRCS OCD stage I and some with OCD stage II present with a stable shoulder and can undergo conservative treatment. Unstable or advanced glenoid OCD stages, characterized by disruption of the articular cartilage and the presence of separated fragments as loose bodies, require surgical treatment. Moreover, this is indicated when the conservative approaches fail, especially because of long-standing pain and joint range of motion worsening.

Proposed surgical treatments include arthroscopic drilling, microfractures, debridement of the unstable osteochondral fragments, and fixation with suture anchor or autogenous osteochondral plugs, platelet-rich plasma, and gel-like sodium hyaluronate.[4,5] There is not yet consensus regarding the ideal technique. In this Technical Note, we describe an arthroscopic procedure with a single-layer hyaluronate-based scaffold for the treatment of OCD of the glenoid.

Patient Evaluation

Patient evaluation must comprise anamnesis investigation for age, sport activity, appearance, span, and eventual worsening of the symptoms. Clinical evaluation must consider the passive and active range of motion, the strength of the rotator cuff muscles, and the presence of shoulder instability (both anterior and posterior). Pain and grade of disability are investigated with dedicated patient-reported outcome measures (e.g., Numeric Rating Scale, Constant-Murley score, American Shoulder and Elbow Surgeons score, etc.).

Imaging

Standard radiographs are usually unhelpful for the diagnosis of OCD and may just show signs of associated conditions such as Hill-Sachs and bony Bankart lesion in case of anterior instability or osteophytes for arthritis development. In contrast, MRI is crucial for the diagnosis and planning management of glenoid OCD: all axial, coronal, and sagittal axes are important to evaluate the width and the depth of the lesion. Both T1- and T2-weighted images are useful. The lesion appears as an intensity alteration or complete absence of articular chondral layer (Fig 1 A-C).

Indications

The following factors and conditions may lead to a surgical indication: unstable shoulder, advanced glenoid OCD (IRCS stages II, III, and IV), failed conservative approach/worsening of the OCD, and long-standing pain and joint range of motion worsening.

Surgical Technique

Patient Positioning and Surgical Preparation

After receiving an interscalene block with ropivacaine 0.375%, the patient is transported to the operating room. The patient is then placed in the lateral decubitus position on the operating table. After a meticulous clearance assessment of the shoulder and axilla, general anesthesia is administered. The operative extremity is then suspended, with usually 7 to 10 kg of traction applied, between 7% and 10% of the whole-body weight. The shoulder is slightly flexed forward and abducted to approximately 60° to 70°. To ensure aseptic conditions, the arm is prepared with chlorhexidine solution and draped according to standard practices. Anatomical landmarks such as the acromion, coracoid, acromioclavicular joint, coracoacromial ligament, and the primary posterior viewing portal are distinctly marked using a surgical pen. A single dose of antibiotic prophylaxis is administered.

Diagnostic Arthroscopy

A standard posterior viewing portal is established 2 cm inferior and 1 cm medial to the posterolateral border of the acromion. After a careful introduction of the arthroscope into the glenohumeral joint, a comprehensive diagnostic arthroscopy is conducted. By using an "inside-out technique" with a Wissinger rod through the camera-coat, a standard anterior portal is created within the rotator interval, just lateral to the tip of the coracoid. Eventual loose bodies are removed.

When the glenoid chondral lesion is identified, depending on its position, the working portal is established switching from the anterior to posterior portal and/or creating midglenoid portals as necessary. First, nonviable tissue is removed, and the margins are cleaned using a tissue biter and a standard shaver to regularize the cartilage rim and better define the real dimension of the lesion.When the area of the OCD is completely exposed, separately proceed to size a hyaluronate-based scaffold (HYALOFAST; Anika Therapeutics, Inc., Bedford, MA) of the same shape of the lesion.

OCD Treatment

A deep debridement of the lesion with a sharp spoon or curette is then performed, exposing subchondral bone. Some degenerated chondral samples are collected for histologic examination. Microperforations are then applied by drilling the lesion with a 1.26-mm K-wire or using a small dedicated microfracture awl (usually L-shaped), from the articular side to the subchondral bone until it starts bleeding, to enhance growth factors and progenitor cells homing.

The fluid inflow is then stopped and the dry single-layer scaffold previously prepared is inserted in the joint and positioned with a grasper to cover all the area,

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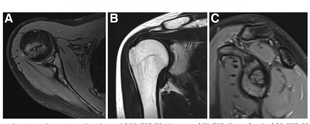

Fig 1. Preoperative magnetic resonance imaging: axial PD-TSE-FS (A), coronal T2-TSE (B), and sagittal PD-TSE-FS (C) plane of the right shoulder. The glenoid OCD lesion appears as a well-defined area of altered intensity in the chondral and subchondral bone. In this young female patient, 22 years old, professional volleyballer, the OCD lesion is an area of 1.1 × 1.3 cm in the posterosuperior surface of the glenoid. (FS, fat-suppressed; OCD, osteochondrosis dissecans; PD, proton density; TSE, turbo spin echo.)

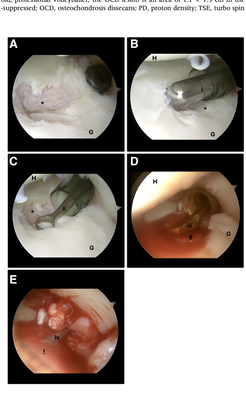

Fig 2. The patient is shown in lateral decubitus, right shoulder. view from posterior portal, 30° scope, midglenoid posterior working portal, intra-articular view. (A) Chondral lesion of the anteroposterior glenoid. (B) Debridement of the lesion to better define dimensions and deepness. Shaver from posterosuperior cannula. (C) Curettage and bleeding of the subchondral bone. Curette from posterosuperior cannula. (D) Introduction and positioning of the hyaline matrix in the chondral defect. Elevator from posterosuperior dry cannula. Dry joint. (E) Hyaline matrix and fibrin glue to cover the chondral defect. Glue-syringe from posterosuperior cannula. Dry joint. * indicates chondral lesion, (i) indicates shaver, (ii) indicates curette, (iii) indicates elevator, (iv) indicates syringe, (#) indicates single-layer hyaluronate-based scaffold, and (†) indicates hyaline matrix and fibrin glue. (G, glenoid; H, humeral head.)