Treatment of osteochondral defects of the knee
Tratamento dos defeitos osteocondrais do joelho

Mario Ferretti¹, Dan Carai Maia Viola², Reynaldo Jesus-Garcia Filho³

ABSTRACT
Arthroscopy is a surgical technique to treat intra-articular lesions that uses minimal incisions and allows that patients have a prompt recovery with few complications, since the intervention is not very aggressive and uses a sophisticated system of micro-optics and micro instrumentation. Hence, arthroscopy became an elective technique for treating intra-articular lesions and is a very important procedure in orthopedics. There have been several advances in arthroscopy, in the design and improvement of equipment, and in the development of techniques, evolving from joint visualization to merely diagnostic purposes to surgical procedures. The present article approaches arthroscopy explaining the different therapeutic possibilities, using this technique to treat osteochondral diseases of the knee.

Keywords: Arthroscopy; Knee joint/patholgy; Cartilage, articular/pathology

INTRODUCTION
Hyaline cartilages have four layers: superficial, intermediate, deep and calcified. Cartilage lesions may be partial (do not cross the calcified layer) or complete (cross the calcified layer). Cartilage injuries are very common and may be present in 63 to 66% of knee arthoroscopies¹. Osteochondral defects that cross the calcified layer of the cartilage and expose the subchondral bone may be seen in 19.6% of knee arthroscopies¹.

The osteochondral defect usually appears in patients that have a healthy cartilage, it is usually traumatic, presenting after trauma with joint fracture, ligament or meniscal or osteochondral injury alone. Other problems, such as metabolic diseases, congenital disorders and others, may lead to this type of lesion. Osteochondral defects have a poor intrinsic healing response and the defect is filled by fibrocartilaginous tissue. Although some chondral lesions are asymptomatic, they may result in cartilage degeneration and osteoarthritis². Clinical diagnosis alone is difficult, but pain and joint effusion are present. Magnetic resonance imaging is considered gold standard to evaluate cartilage injuries, since it allows a morphologic assessment of the surface, thickness and subchondral bone³. There are many treatment options for the osteochondral defects, which will be now explained.

SURGICAL TREATMENT
Abrasion
Arthroscopic technique of mechanical debridement with a shaver-type device. It was first described as palliative, in an attempt to avoid total knee replacement in osteoarthritis patients. Subchondral bone stimulation

¹ Post-doctorate Student at the Department of Orthopedics and Trauma of Escola Paulista de Medicina of Universidade Federal Paulista – UNIFESP-EPM, São Paulo (SP), Brazil; Researcher of the Integrated Orthopedics Program of Hospital Israelita Albert Einstein – HIAE, São Paulo (SP), Brazil.
² Post-doctorate student; Assistant Physician at the Department of Orthopedics of the Oncologic Orthopedics Sector of Escola Paulista de Medicina of Universidade Federal Paulista – UNIFESP-EPM, São Paulo (SP), Brazil; Researcher of the Integrated Orthopedics Program of Hospital Israelita Albert Einstein – HIAE, São Paulo (SP), Brazil.
³ Post-doctorate degree; Adjunct Professor, Head of the Orthopedics Service and Oncologic Orthopedics Sector of Escola Paulista de Medicina of Universidade Federal Paulista – UNIFESP-EPM, São Paulo (SP), Brazil; Coordinator of the Integrated Orthopedics Program of Hospital Israelita Albert Einstein – HIAE, São Paulo (SP), Brazil.

Corresponding author: Mario Ferretti – Rua da Mata, 109 – apto. 50 – Itaim Bibi – CEP 04531-916 – São Paulo (SP), Brasil – Tel.: 11 3078-7945 – e-mail: marioferetti@uol.com.br

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seems to release mesenchymal cells of the bone marrow. It is not used very much, currently, once the histology of the tissue organized after abrasion shows a tissue which is fibrotic and spongiform in nature, with 22% of type I collagen (fibrotic tissue), 30% of degenerated hyaline cartilage and 28% of fibrocartilage.

**Drilling**

Arthroscopic technique which stimulates the bone marrow, drilling the bone with a Kirschner wire (K-wire). Clinical results are not different from those of abrasion, as a consequence, this technique is seldom used.

**Microfracture**

This is another arthroscopic technique that stimulates the bone marrow, through bone perforation, using special tools for it with a tapered tip. In microfracture, the first step is to cautiously make curettage of the osteochondral defect to remove the remaining of the calcified layer of the cartilage and, then, the level of the defect to make it uniform. Next, the bone is perforated with the tapered tool from the borders of the lesion to the center, leaving 3 to 5 mm between perforations. It is important to mention that in microfractures the perforations penetrate about 3 mm. The intention of this technique is to form a clot of mesenchymal cells from the bone marrow, which will render a fibrocartilagenous repair. Due to the easiness of the technique, low cost and good results, it has been widely used. The ideal indication is for defects smaller than 2 cm², but the symptoms can be improved in defects as big as 4 cm². The best prognosis is found in younger patients with the defect in femoral condyles. Less promising prognosis are seen in patients with a long lasting history and high body mass index.

**Mosaicplasty**

Autologous osteochondral transplantation or mosaicplasty is a technique, in which one or many osteochondral cylinders are removed from a non-weight bearing area (less important for the knee joint) to the area of the osteochondral defect (weight bearing area). The objective of mosaicplasty is to profit from the good healing of bone against bone to facilitate cartilage healing. The author who created the technique suggests its use for defects measuring from 1 to 4 cm². But, the larger the defect is, the larger the donor site, limits the indication for larger defects. In spite of the good results demonstrated by Hangody and Füles, in patients older than 50 years, the success rate decreases significantly. Other limitations of this technique are that between the osteochondral cylinders transferred, empty areas with no cartilage repair remain. Another issue is the viability of the chondrocytes from a non-weight bearing area, transferred to a weight bearing area. Although the technique can be performed through arthroscopy, the geometry of the cartilage in the osteochondral defect is not always the same of the donor site. To achieve the ideal geometry in larger defects is a challenge for the surgeon, more so when done through arthroscopy.

**Autologous chondrocyte implantation – first generation**

Since 1994, when Brittberg et al. published the first article on chondrocyte implantation for osteochondral defects, this area has evolved. Autologous chondrocyte implantation (ACI) for osteochondral defects is performed in two surgical stages. The first stage is an arthroscopic biopsy of a healthy portion of the cartilage. From this specimen, the chondrocytes are cultivated in the laboratory and, after the expansion of the number of chondrocytes in the laboratory, an open surgery is conducted to implant these chondrocytes. The defect is prepared, the borders leveled and a periosteum cover is sutured to contain the chondrocytes in the defect.

The indications for ACI are: lesions larger than 2 cm² and smaller than 12 cm², and for patients who remain in pain after mosaicoplasty or microfracture. In isolated injuries, the success rate equals 92%, for multiple lesions it is of 67%, in osteochondritis dissecans of 89%, in the patella, 65%, and 75% in lesions associated to reconstruction of the anterior cruciate ligament. Some limitations to the use of this technique are: two-stage surgery, periostium hypertrophy (symptomatic in 13% of patients) and high cost.

**ACI – second generation**

The second generation of ACI has advantages when compared to the first one, since it does not use periosteum, thus avoiding an extra excision in the leg to remove the periosteum, and, even more important, it avoids periosteum hypertrophy, which may be symptomatic. Also, the second generation of ACI uses a matrix in which the chondrocytes are cultivated. Such matrix has constituents of the cartilage extracellular matrix. The matrix available in Europe are made by MACI (Genzyme Biosurgery, Cambridge, MA), which has swine collagen type I/III and the chondrocytes are cultivated for three to four days before implantation; Chondro-Gide (Geistlich Biomaterials, Switzerland), similar to MACI; ChondroCelect (Tigenix Inc, Leuven, Belgium), which has a genetic marker that stimulates chondrocytes’ expansion. Hyalograft C (Fidia Advanced Biopolymers, Abano Terme, Italy) is a three-dimensional hyaluronic acid matrix, which allows...
chondrocytes growth and their phenotype persistence when cultivated in the matrix. The hydrophilic feature of this matrix renders possible its adherence to the osteochondral defect, and, thus it can be done totally through arthroscopy, avoiding arthrotomy.

**Autologous osteochondral transplantation**

Autologous osteochondral transplantation from cadavers is also an option for the treatment of osteochondral defects, similar to mosaicoplasty but reserved for larger defects. The advantage is that it can be done with one single osteochondral cylinder, but the disadvantages of allogenous transplantation are the possibility of rejection, failure in bone grafting and the chondrocytes being non-viable.

**REFERENCES**