

Fresh Patellar Allograft and Osteochondral Defects

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ABSTRACT

Introduction: Chondral lesions of the patella are a challenge for the surgeon, mainly in young and active patients. Most patellar chondral defects are superficial injuries and can be managed with joint preservation techniques; however, deep injuries may require other types of management. The objective of this article is to manage osteochondral defects of the patella in young patients, using the technique of fresh allograft from a cadaveric donor. **Materials and methods:** Patients with anterior knee pain, with grade III - IV chondral lesion of the patella and who had or had not undergone some type of medical or surgical management were included. They received a fresh patellar allograft that sought to provide a solution and improvement of the functionality. **Results:** In all cases, recovery of functionality and mobility, absence of pain and integration of the fresh allograft into the recipient area were achieved, without evidence of tissue rejection or infection. **Conclusions:** The advent of fresh osteochondral grafts allows adequate management and evolution of patients, with the aim of favoring joint preservation and avoiding total knee arthroplasty over time.

Key words: Patella; chondral defect; allograft; fresh; joint preservation; viability.

Level of Evidence: IV

Aloinjerto fresco de rótula y defectos osteocondrales

RESUMEN

Introducción: Las lesiones condrales de la rótula son un reto para el cirujano, principalmente en pacientes jóvenes y activos. La mayoría de los defectos condrales de la rótula son lesiones superficiales y pueden ser manejadas con técnicas de preservación articular; sin embargo, las lesiones profundas pueden requerir otro tipo de manejo. El objetivo de este artículo es comunicar el tratamiento de defectos osteocondrales de la rótula en pacientes jóvenes, mediante la técnica de aloinjerto fresco de donante cadavérico. **Materiales y Métodos:** Se seleccionaron pacientes con dolor anterior de rodilla, lesión condral de la rótula grado III-IV y que habían recibido o no algún tipo de manejo médico o quirúrgico. En estos pacientes, se usó un aloinjerto fresco de rótula con el fin de solucionar el cuadro y mejorar la función. **Resultados:** Todos los pacientes recuperaron la función y los arcos de movilidad, y no refirieron dolor. Se comprobó la integración del aloinjerto fresco al área receptora, sin evidencia de rechazos del tejido o infecciones. **Conclusiones:** El uso de aloinjerto fresco de rótula para tratar defectos osteocondrales amplios es una técnica quirúrgica valiosa, fácil de implementar, que no requiere una curva de aprendizaje extensa y que mejora considerablemente el dolor y la función en pacientes jóvenes.

Palabras clave: Rótula; defecto condral; aloinjerto fresco; preservación articular; viabilidad.

Nivel de Evidencia: IV

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INTRODUCTION

Chondral lesions of the patella remain a challenge for the orthopedic surgeon, mainly in young and active patients. Most chondral defects of the patella are superficial lesions that do not involve the subchondral bone and can be managed through arthroscopic joint preservation techniques;^{1,2} however, deep injuries may require other types of management such as osteochondral allograft transplantation, which allows to resolve chondral defects of the patella especially in young patients, and to avoid rapidly progressive osteoarthritis of the joint, reestablish joint biomechanics, ensure joint preservation and subsequently facilitate early rehabilitation.^{1,3}

Although superficial chondral lesions of the patella are more frequent, not only because of the biomechanics of the lesions, but also because of the surface they involve, they cannot be taken lightly and should be treated as soon as possible using arthroscopic joint preservation techniques⁴, since deep lesions hinder the management and evolution of the patient, leading mostly to bipolar lesions, that is, lesions of the patellofemoral compartment.¹

The aim of this article is to show the management of osteochondral defects of the patella in young patients, using the technique of fresh allograft from a cadaveric donor.

MATERIALS AND METHODS

We included patients with anterior knee pain, functional limitations and affected quality of life, who had previously had a nuclear magnetic resonance of the knee with a report of grade III - IV chondral lesion of the patella and had or had not undergone some type of medical or surgical management that sought to provide a solution and improvement to the functionality.

The request for a fresh patella allograft was made to the Tissue Bank of the Region. Once the existence of the graft and its preservation at 37 ° C for a period not exceeding 2 days had been notified, the surgical procedure was scheduled and surgery was performed.

Surgical technique

With the patient in supine decubitus position, a universal knee approach is performed on the joint to be treated. Through a medial parapatellar arthrotomy, the entire patella is exposed, seeking to preserve the integrity of the cartilage and remaining structures of the knee. Once the patella is everted and exposed, measurements of the patellar height and extension of the chondral lesion are taken, in order to confirm the surgical technique to be used and specify the way to prepare the tissue to be transplanted. Subsequently, the recipient patella is resected and the area where the donor tissue will finally be fixed is prepared.

Meanwhile, the allograft is resected according to measurements of the patient's patella (height and size of the lesion) and is preserved until the recipient area is ready. Once the recipient area (patella of the patient) is ready, the subchondral bone block with healthy hyaline cartilage from the donor is transplanted and fixed with headless self-compressing screws in the recipient site of the joint defect, thus seeking a total resurfacing of the patella and the integrity of the donor cartilage.

Once the donor tissue has been fixed, joint biomechanics are verified by flexion-extension of the knee, in order to confirm adequate patellar tracking and the absence of friction by the fixation screws. Then, the closure is carried out by planes, ensuring adequate closure of the extensor mechanism of the knee and the absence of areas of possible dehiscence in the postoperative period.

FINDINGS

Three patients who met the inclusion criteria previously described were selected. The osteochondral lesion of the patella was treated with a fresh allograft. The patients are presented below.

A 32-year-old female patient with chronic left knee pain of patellofemoral origin, with limited walking on inclined surfaces. The AP and lateral radiographs of the knee and tangential view of the patella showed arthritic changes of the patella (Figure 1). In January 2018, she underwent a magnetic nuclear resonance of the knee, which showed Grade IV chondral lesion of the patella. Rehabilitation and infiltration with corticosteroids were ordered, but the pain did not improve (Figure 2). She was taken to surgery on February 13th, 2018 for a fresh patellar allograft (Figure 3). The postoperative evolution was satisfactory, she did not present pain nor joint effusion, mobility arches ranged from 0 ° to 100 °, and she did not have gait limitations. The incorporated graft can be observed in the radiograph and CT scan of the patella taken in September 2018 (Figure 4).



Figure 1. Set of preoperative radiographs.

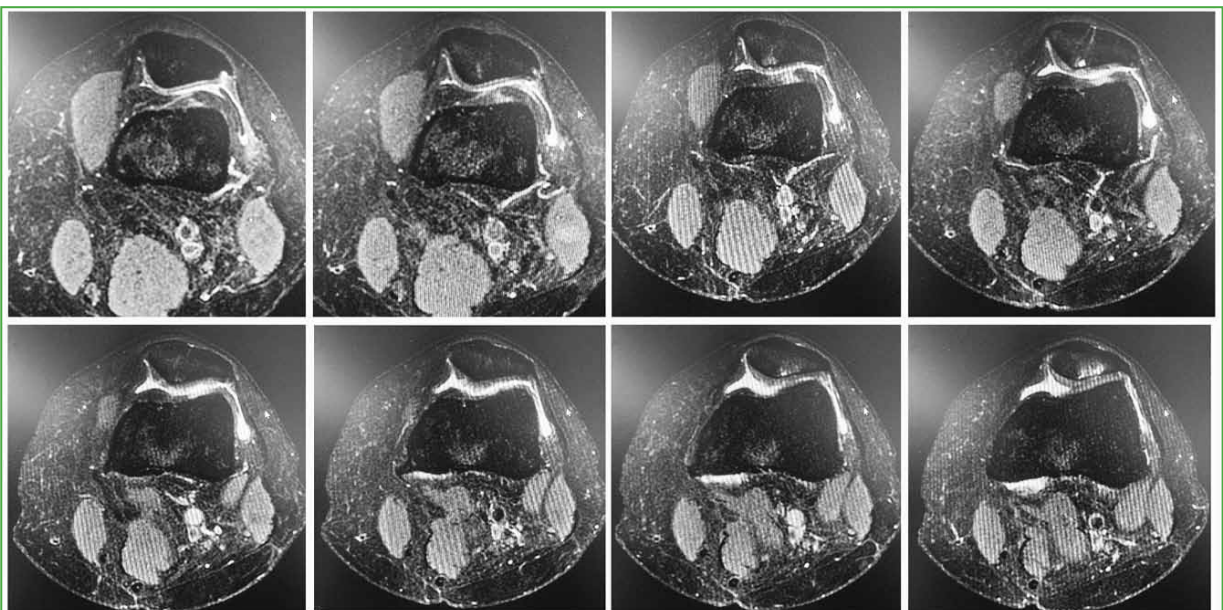


Figure 2. Knee MRI. A grade IV chondral lesion of the patella can be observed.

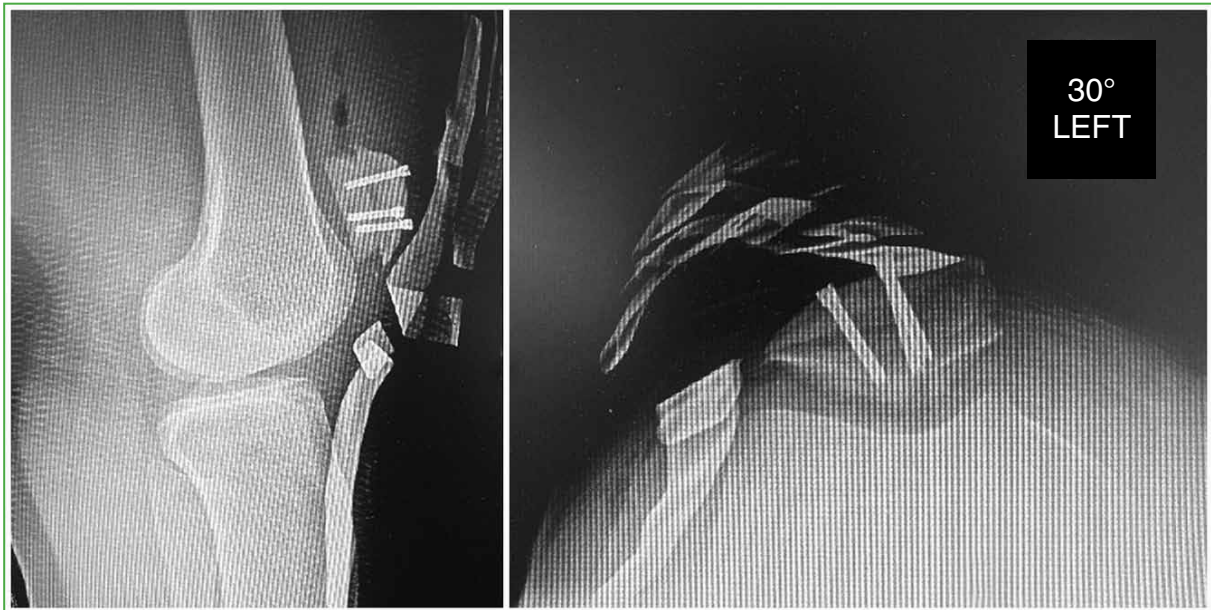


Figure 3. Immediate postoperative radiographs.



Figure 4. Patellar CT-scan, tangent plane and follow-up radiographs.

A 55-year-old female patient, a nurse, with chronic right knee pain of patellofemoral origin, secondary to an osteochondral fracture of the patella after an occupational accident. In February 2017, 2 OATS (osteochondral autograft transfer system) plugs were performed in the patella, with stationary evolution despite complete mobility arches and rehabilitation. In September 2017, she underwent viscosupplementation with Hyaline - Synvisc One, with no improvement in anterior knee pain, persistent limitation of walking on inclined surfaces and presence of permanent crepitus. In October 2017, a direct knee arthro-MRI was performed, showing grade IV chondral lesion of the patella (Figure 5).

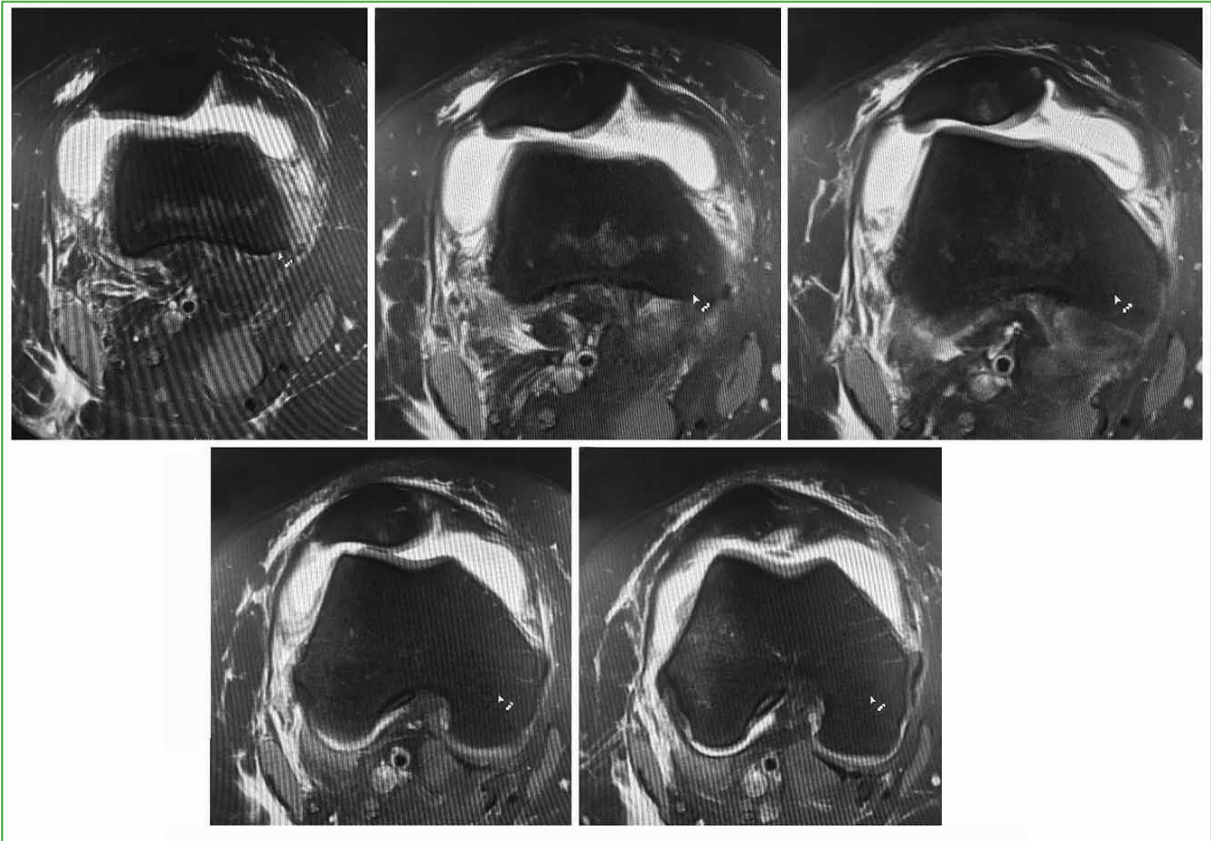


Figure 5. Direct arthro-CT scan of the knee. A grade IV chondral lesion of the patella is detected.

Given the findings, on March 8th, 2018 it was decided to take the patient to a fresh patellar allograft (**Figure 6**). The postoperative evolution was satisfactory; the patient presented no pain, ranges of motion from 0 ° to 120 °, no joint effusion and free walking without limitation of surfaces. The incorporated allograft can be observed in the radiograph (**Figure 7**) and CT scan of the patella taken in November 2018.

A 33-year-old female patient, with chronic right knee pain of patellofemoral origin since 2015, without improvement after undergoing rehabilitation. In 2011, she underwent bilateral arthroscopic knee chondroplasty, without pain improvement. In 2015, she underwent viscosupplementation with Droyal[®], 3 doses, without improvement of the clinical picture. In October 2018, a nuclear magnetic resonance of the knee was performed, showing a Grade III-IV chondral lesion of the patella (**Figure 8**). On June 13th, 2018, she received a fresh allograft of the patella (**Figure 9**). In the postoperative period she presented flexion limitations, for which arthroscopic adhesion release was performed, achieving mobility arches from 0 ° to 125 °. The patient evolved without pain nor joint effusion, with active motion arches from 0 ° to 100 °. The incorporated graft can be observed in the radiograph (**Figure 10**) and CT scan of the patella taken in November 2018.

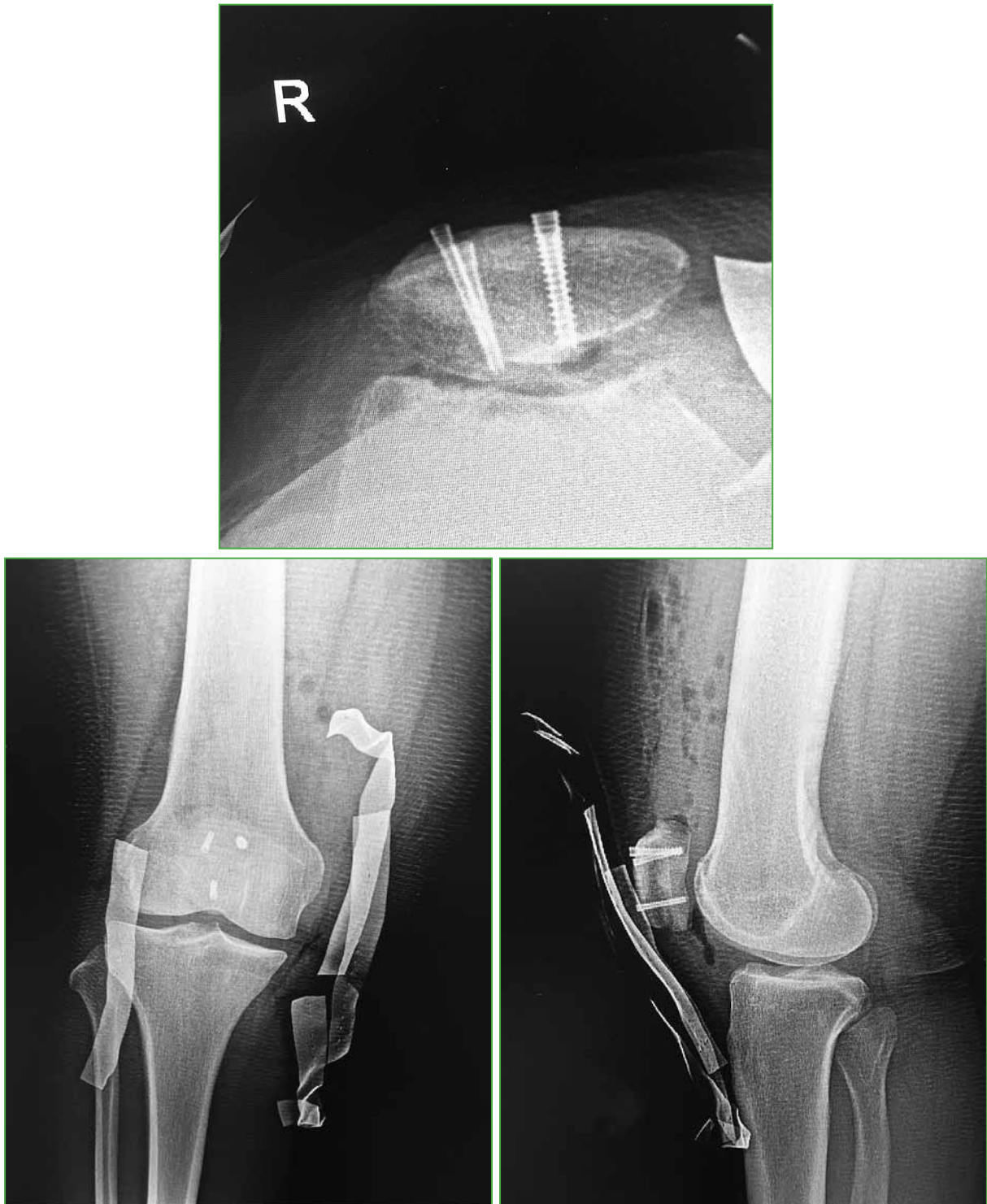


Figure 6. Immediate postoperative radiographs.

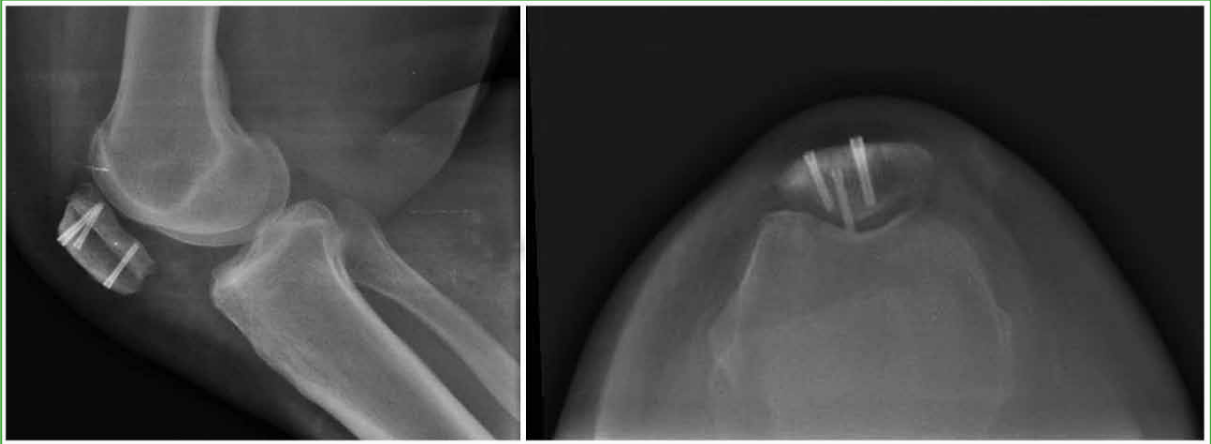


Figure 7. Postoperative radiograph (November 2018). Incorporated allograft.

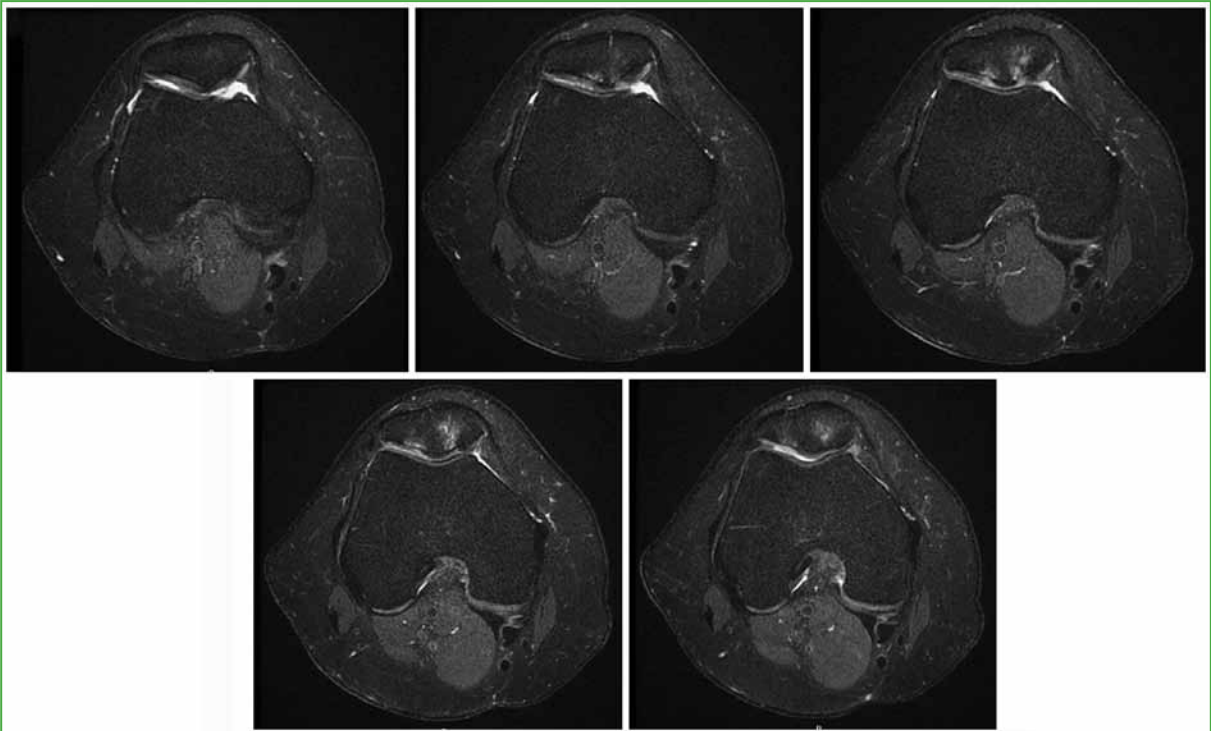


Figure 8. Knee MRI. A grade III-IV chondral lesion of the patella can be observed.

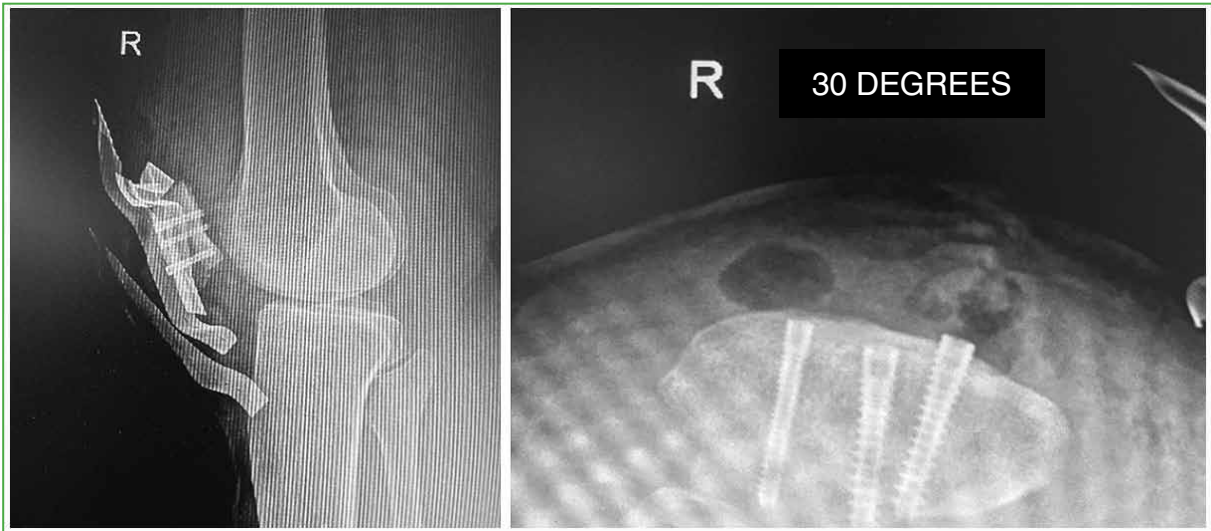


Figure 9. Immediate postoperative radiographs.



Figure 10. Postoperative lateral radiograph of the knee. The incorporated allograft can be observed.

In all cases, the procedure was performed using a universal knee approach, medial parapatellar arthrotomy and exposure of the patella, taking measurements such as height and extension of the lesion, resection of the recipient area, preparation of the donor area according to the measures taken, and transplantation and fixation of a blockage of subchondral bone with healthy hyaline cartilage (Figures 11-13).

In the postoperative period, despite the fact that the evolution and early mobility was different in each case, the recovery of functionality, mobility arches, absence of pain and integration of the fresh allograft into the recipient area were achieved, without evidence of tissue rejection or infections.

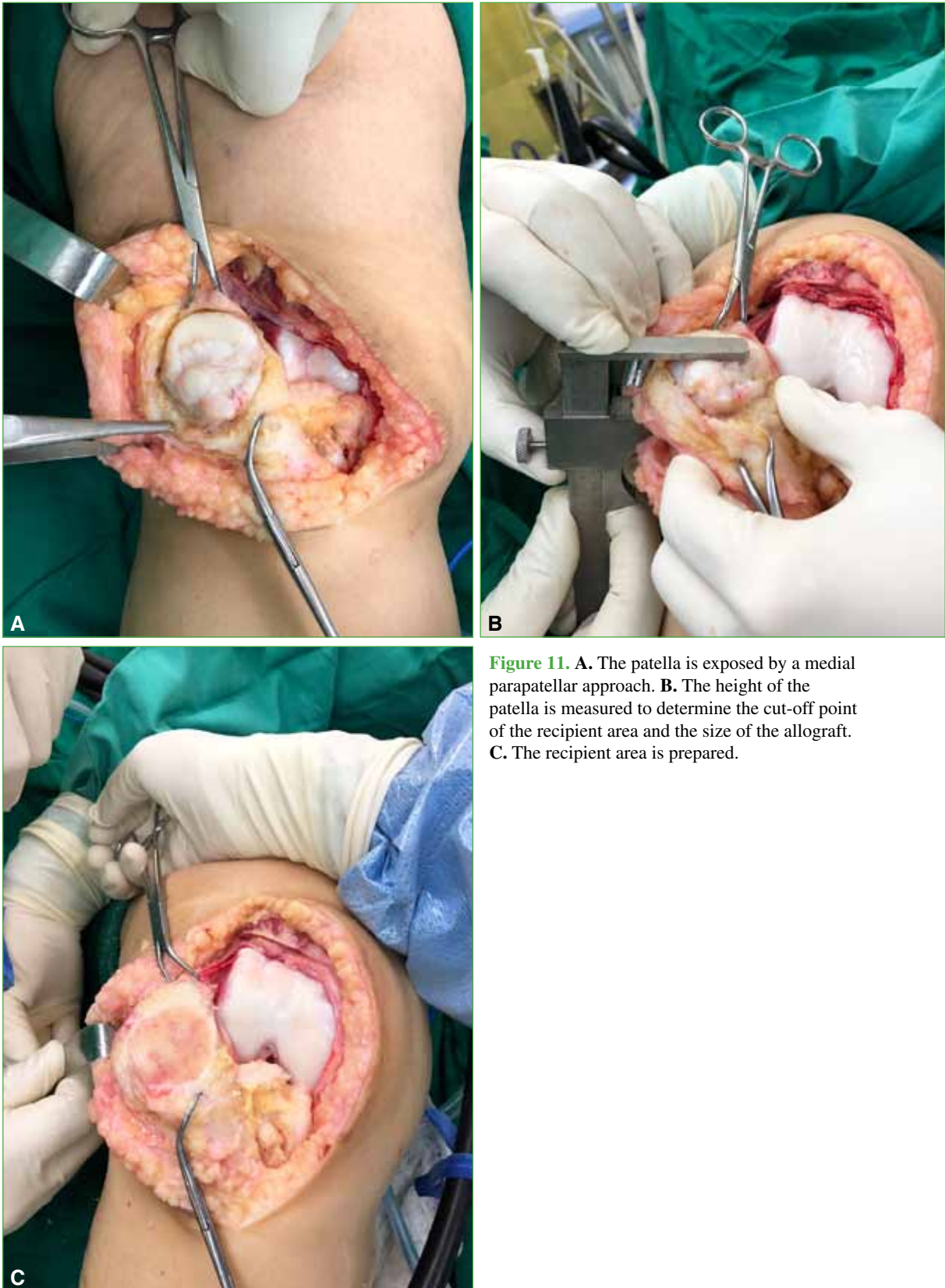


Figure 11. **A.** The patella is exposed by a medial parapatellar approach. **B.** The height of the patella is measured to determine the cut-off point of the recipient area and the size of the allograft. **C.** The recipient area is prepared.

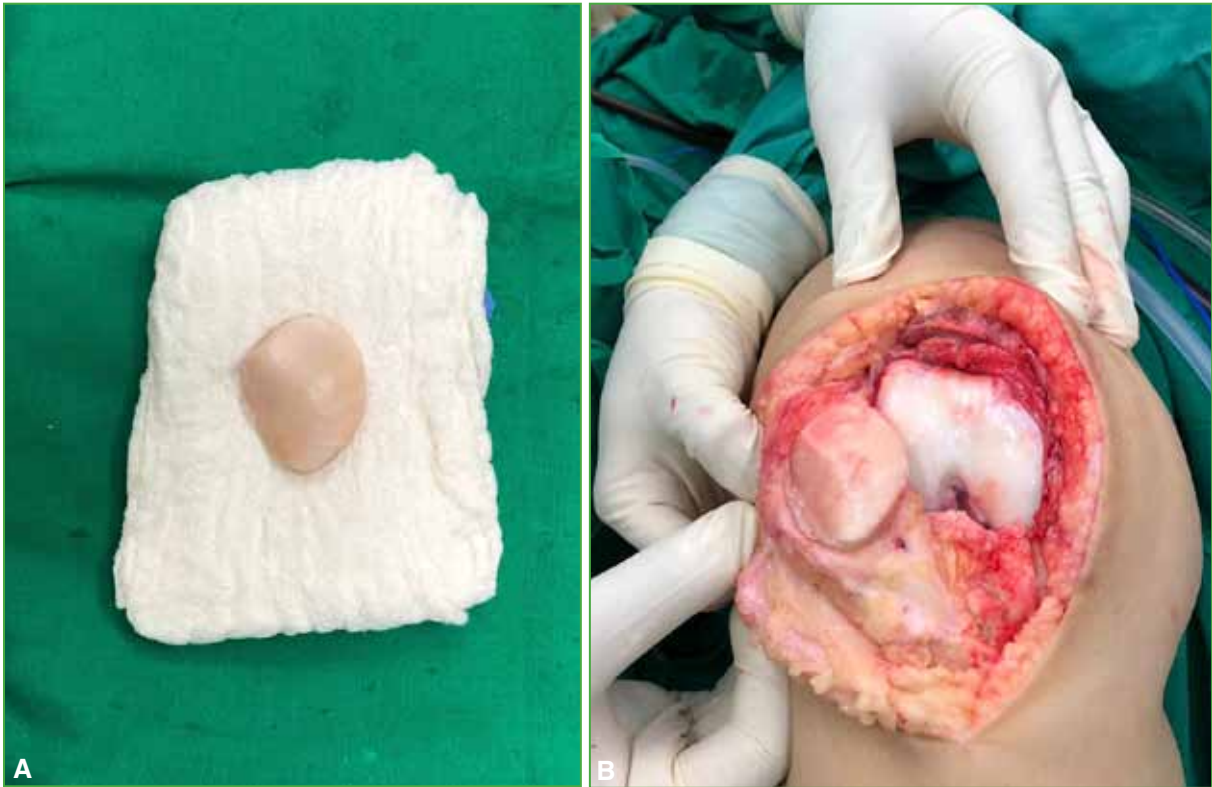


Figure 12. A. The allograft is prepared keeping the necessary thickness for the recipient area. B. Allograft positioning in the recipient area.



Figure 13. A. Fixation of the allograft with headless self-compression screws, preserving the height of the patient's previous patella. B. Fluoroscopic verification of allograft fixation.

DISCUSSION

In recent years, the principles and techniques for the treatment of chondral injuries have evolved, with a wide variety of possibilities at hand that allow joint preservation, such as subchondral perforations, chondroplasty (superficial abrasion), microfractures, mosaicplasty and the implantation of autologous chondrocytes.^{1,2} However, the vast majority of these techniques are based on healing through the formation of fibrocartilage, which is biologically and biomechanically inferior to native hyaline cartilage (type II collagen).²

Due to the limitations of the other techniques, for 30 years the number of cases of patients treated with osteochondral allografts^{2,5}, whether fresh or frozen, has been increasing. This treatment is indicated for patients with grade III-IV lesions according to the ICRS (*International Cartilage Regeneration & Joint Preservation Society*) and who have not responded favorably to other cartilage resurfacing techniques; as well as for patients with large chondral lesions that may or may not be associated with bone loss, and/or patients who do not want to undergo a knee replacement.²⁻⁴ For this reason, the implementation of techniques that seek to preserve the joint, improve joint biomechanics and relieve pain is of special importance.

The clinical results of this procedure are satisfactory, reaching a success rate of over 75% and showing improvement in functional follow-up scales such as IKDC (International Knee Documentation Committee) and Kujala (specific questionnaire to evaluate anterior knee pain).^{2-4,6,7} Approximately 25% of patients may require a revision or total knee replacement within 2 to 5 years after the procedure.^{1,4,8}

There are multiple factors that influence the outcome of an osteochondral allograft, which may be related to the patient, the graft or the surgical technique used, since an adequate viability of chondrocytes and the biomechanical properties of the extracellular matrix of cartilage must be preserved.^{6,7,9,10} For this reason, the use of fresh allografts (mostly preserved at 37 ° C for periods no longer than 3 weeks) is preferred over frozen ones, since storage at temperatures of 4 ° C for more than 28 days decreases cell viability, which can interfere with the subsequent integration of the graft.^{6,9}

The procedure consists of exposing the entire patella—from an approach similar to that of a total knee arthroplasty (medial parapatellar arthrotomy)—and then taking measurements of the patellar height and extension of the chondral lesion, resecting the allograft according to the measurements of the patella of the patient (height and size of the lesion), transplanting and fixing a block of subchondral bone with healthy hyaline cartilage at the joint defect donor site, looking for a total resurfacing of the patella (Figures 11 and 12).¹¹ The transplant can be unipolar (a single transplanted surface, in this case only the patella)¹² or bipolar (two articular surfaces, patella and trochlea).¹ Unipolar transplantation is more frequent, as we present it in this study, because—as is known—there has been an increase in the use of patellofemoral arthroplasties for the management of bipolar osteochondral defects (patella and trochlea).

Two main techniques are currently described for fresh osteochondral grafting based on the size of the chondral lesion: the dowel or press-fit technique, for small lesions (less than 5 cm²) and medium lesions (5 to 10 cm²) and the bone block technique, for large lesions (greater than 10 cm²) or that involve more than 75% of the articular surface.^{4,5,13-15} The latter is the technique used in our patients because they had osteochondral lesions that involved more than 75% of the articular surface. Due to this, it is necessary to assess the size and location of the chondral lesion, since the surgical planning and the method of fixation of the graft using anchors or headless self-compression screws will depend on this (Figure 13).

Taking this into account, the use of fresh patellar allograft for the management of osteochondral defects that involve more than 75% of the articular surface, is a very valuable surgical technique, easy to implement, that does not require an extensive learning curve and that considerably improves pain and functionality in young patients, with functionality and life expectancy much greater than that of patients whose only alternative is total knee replacement.

CONCLUSIONS

Although the management of large patellar defects is a challenge for the orthopedist, the advent of fresh osteochondral grafts allows adequate management and evolution of patients, with the aim of favoring joint preservation and avoiding total knee arthroplasty over time. Therefore, fresh patellar allograft transplantation is a useful surgical technique for osteochondral patellar defects in young patients.

Conflict of interests: Authors declare they do not have any conflict of interests.

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