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IAS NEWSLETTER

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Management of focal patella full-thickness chondral lesion with osteochondral autograft technique

EXPERTS OPINE

Dr Deepak Goyal

Algorithm for cartilage repair

Variables to be considered before finalising treatment:

Age, activity level, aetiology, BMI/smoking, location, size, depth, contained/uncontained lesion & concomitant lesions.

Treatment Algorithm:

Small size lesions(1-2cm):
Microfracture, if high demand then OCT(Osteochondral transplantation)

Medium size lesions(2-4cm):
OCT/ ACI(Autologous Chondrocyte Implantation); if low demand can consider microfracture with caution.

Large lesions(>4cm):
ACI with or without bone grafting or osteochondral allografting depending on surgeons experience & logistics.

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PATELLA HEIGHT CHANGES FOLLOWING ASCENDING AND DESCENDING HIGH TIBIAL OSTEOTOMY

CASE SERIES AND REVIEW

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Abstract:

High tibial osteotomy (HTO) is a popular joint preserving option for medial compartmental osteoarthritis, especially in younger individuals. This procedure is however associated with alterations in the patellar height and tibial slope (TS). In this article, we have described the ascending and descending HTO and evaluated their effect on radiological parameters postoperatively.

Introduction:

High tibial osteotomy was first reported by Jackson in 1958 (1). It failed to gain traction till Coventry reported good results in 1973 (2). Two common concerns associated with the procedure are alterations in the patellar height (PH) and posterior tibial slope (PTS) (3-5). Patella Baja or low-lying patella is a complication of HTO which alters the native knee kinematics and predisposes to patellofemoral arthritis (6,7). The increased posterior tibial slope increases the anteroposterior strain on the anterior cruciate ligament (ACL) and predisposes one to a higher chance of non-contact ACL injuries (8). Also increased posterior chondral pressure leads to increased chance of failure of HTO (9). Another major concern is the technical challenges in future revision to total knee arthroplasty due to these complications (10).

In the more commonly practised ascending or supratubercle HTO, along with the routine axial bone cut, a separate ascending osteotomy exiting behind the patellar tendon in the coronal plane is done (11). Various studies showed a high incidence of patella Baja with this procedure (11-13). To counter this, the descending or infratubercle osteotomy was introduced which left the tibial tuberosity attached to the proximal fragment (13). The decision to perform an ascending or descending opening wedge in our patients was based on the pre-operative Caton-Deschamps Index (CDI). While the ascending HTO was the procedure of choice, a descending HTO was performed in patients with pre-operative low CDI (<1.0).

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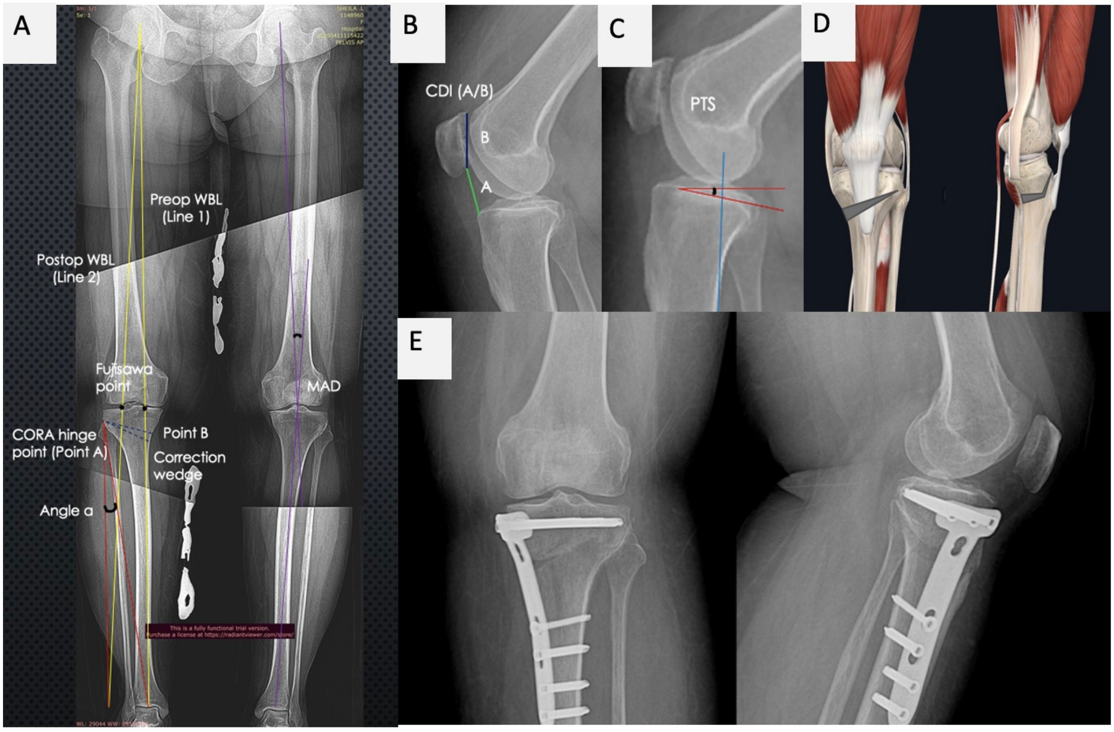

Fig 1: Ascending High tibial osteotomy A: Pre-operative planning using miniaci method, B: Caton Deschamps index, C: Posterior tibial slope(PTS), D: Concept of biplanar ascending high tibial osteotomy. E: Postoperative radiographs.

Case 1 (Ascending HTO):

A 54-year-old gentleman presented to our OPD with complaints of left knee pain for the past 1 year. The pain was insidious in onset with no night pain / rest pain. There was no history of instability or polyarthralgia with grade 2 von Korff disability. On examination, the patient had varus alignment along with medial joint line tenderness. McMurray's and Lachmann's test were negative with no valgus / varus opening. Knee range of movement was found to be 0-130° with no fixed flexion deformity (FFD). Blood workup was normal and imaging showed early medial joint osteoarthritis with genu varum. MR imaging showed grade II Outerbridge cartilage changes with no meniscal tear and intact ACL/PCL. With the above-mentioned clinical scenario, we went ahead and planned a high tibial osteotomy to offload the medial compartment

Preoperative planning was done using the Miniaci method (Fig 1). The mechanical axis of the lower limb starting from centre of femoral head to centre of ankle joint was drawn (Line 1). Another same length line was drawn from centre of femoral head passing through the Fujisawa point (Line 2). The correction angle α was obtained by connecting line 1 and line 2 to Point A on the lateral tibial cortex just above the fibular head. Another point (Point B) was identified 4cm below the joint line on medial tibial cortex. Then the opening wedge was calculated with the osteotomy starting point at point B, CORA (Center Of Rotation of Angulation) at point A and correction angle α. A biplanar incomplete ascending medial opening wedge osteotomy was performed to achieve the desired correction and fixed with locking plate (Tomofix, Depuy synthes, Germany). Bone grafting was not used in this case as the correction wedge did not exceed 10mm.

Case 2 (Descending HTO):

A 49-year-old woman presented to us with complaints of right knee pain for the past 9 months. Similar to the previous patient, this patient also had pain that was insidious in onset with no history of instability or polyarthralgia and grade 2 von Korff disability. On examination, the patient had varus alignment along with medial joint line tenderness. Other clinical tests were normal with well-preserved knee ROM and no FFD. Investigations including blood tests and imaging modalities were suggestive of medial compartment osteoarthritis (grade 3 Kellgren and Lawrence) with genu varum. However, the patient was found to have low CDI (0.9) and hence the decision to do a descending HTO was made.

Preoperative planning was done as described earlier. Descending medial pen wedge osteotomy with the tibial tuberosity attached to proximal fragment and descending limb of osteotomy exiting below the tibial tuberosity was done. Unfortunately, we did encounter an iatrogenic tibial tuberosity fracture which was fixed with additional two anteroposterior screws.

Pre- and postoperative measurements of the Caton-Deschamps Index (CDI), and the posterior TS was taken in both patients.

Results:

In the ascending osteotomy, the patella height (CDI) decreased from preoperative 1.12 to 0.89 whereas in the descending osteotomy, the CDI only marginally decreased from 0.87 to 0.82. Interestingly, we found that the posterior tibial slope (PTS) did not decrease much in either of the patients (9.1° to 9.6° in ascending osteotomy, 8.3° to 8.7° in descending osteotomy). (Table I)

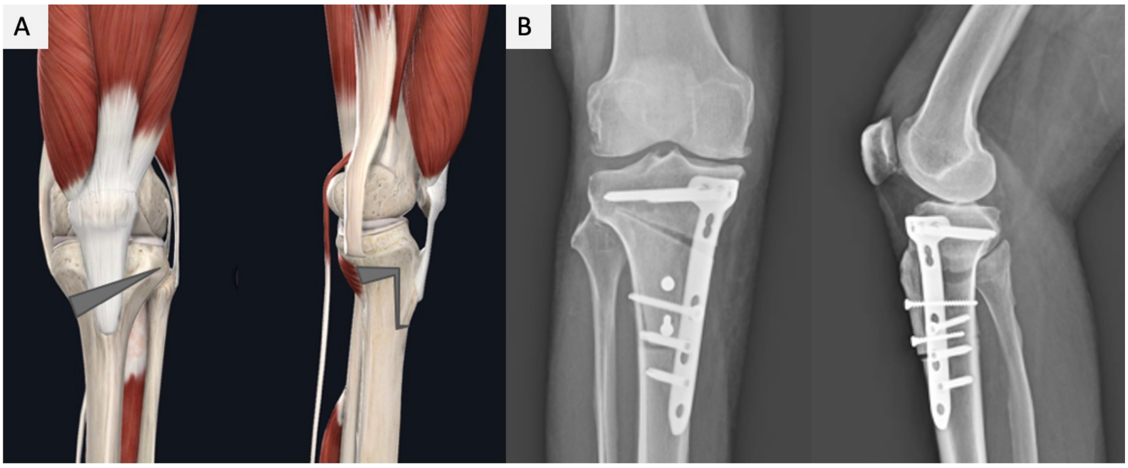

Fig 2: Descending High tibial osteotomy A: Concept B: Post operative radiographs.

Discussion:

HTO initially started out as lateral closing wedge osteotomies but over time, medial open wedge osteotomy has gained popularity due to advantages like technical simplicity, preservation of proximal tibia bone stock, no disruption of the proximal tibiofibular joint, avoidance of peroneal nerve injury, ability to do biplanar osteotomy and less difficult TKA conversion (15-17).
Drawbacks of open wedge osteotomy are need for bone graft and the risk of delayed/non-union at the osteotomy site (18).
The conventional uniplanar medial opening wedge came under scrutiny since it caused significant sagittal and axial plane changes resulting in changes in the patellar height and posterior tibial slope. Various technical modifications have been introduced over the years to counter these complications. Of these, the most important modification was the introduction of the biplanar osteotomy. Lobenhoffer and Agneskirchner described an ascending biplanar osteotomy (11). This procedure showed improved rotational stability but still caused changes in the patellar height probably due to iatrogenic patellar tendon scarring and fibrosis. Gaasbeek et al described the descending medial open wedge osteotomy, potentially circumventing the previous shortcomings (13).

In 2004, ISAKOS (International Society of Arthroscopy, Knee Surgery and Orthopedic Sports Medicine) came out with a patient selection protocol that got widely accepted. The ideal candidate for HTO is a moderately active young individual (40-60 years), non-smoker with BMI <30, moderate pain tolerance capacity, malalignment <15° , tibia bone varus angle >5° , full knee range of movement without ligamentous laxity and near-normal lateral and patellofemoral compartment. Contraindicated in individuals with tricompartmental OA, patellofemoral OA, inflammatory arthritis, knee flexion contraction >5 ° and range of movement <120° .

Variables	Ascending HTO		Descending HTO	
	Preop	Postop	Preop	Postop
Patella height (CDI)	1.12	0.89	0.87	0.82
Posterior tibial slope (PTS)	9.1°	9.6°	8.3°	8.7°

Table I: Patella height & Posterior tibial slope in our cases.
Abbreviations: CDI: Caton Deschamps index

The original research by Fujisawa et al advocates shifting the mechanical axis laterally to a point 62% of the tibial plateau when measured from the medial tibial joint line (14). This point commonly referred to as the Fujisawa point sits slightly lateral to the lateral slope of the tibial spine and corresponds to a mechanical axis of 3-5° valgus.

We had attempted to compare the effect of ascending and descending HTO on PH and PTS. We found that the PH decreased significantly more in ascending HTO than descending HTO.

The concern of iatrogenic tibial tuberosity fracture in descending HTO was addressed by additionally fixing the fractured tibial tuberosity with lag screws as described in the original descending HTO technique. Other technical adaptations done to reduce PTS changes are intraoperative use of K-wires to monitor tibial slope, ensuring complete osteotomy of the posterior cortex along with adequate soft tissue release and maintaining a 1:2 opening gap ratio of anterior to posterior cortex (11,19,20). The advantages & disadvantages of ascending & descending HTO are summarized in Table II.

Ascending HTO		**Descending HTO**	
Advantages	Disadvantages	Advantages	Disadvantages
Comparatively lesser OR time	Increased risk of iatrogenic patella tendon injury	Doesn't significantly alter either the PH or PTS	Risk of iatrogenic TT fracture
No significant change in PTS noted	Higher chance of patella baja	Decreased risk of PFOA	Needs additional AP bicortical screw to fix iatrogenic TT fracture

Table II: Advantages & disadvantages of ascending & descending HTO
Abbreviations: HTO: high tibial osteotomy, OR: operating, PTS: posterior tibial slope, PH: Patellar height, PFOA: patellofemoral OA, TT: tibial tubercle

Conclusion:

The ascending medial opening wedge HTO compared to the descending HTO significantly lowers the patella height postoperatively. However, we did not observe any noticeable change in the tibial slope in either of the osteotomies.

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MANAGEMENT OF FOCAL PATELLA FULL THICKNESS CHONDRAL LESION WITH OSTEOCHONDRAL AUTOGRAFT TECHNIQUE

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Abstract:

Cartilage lesions of knee account for a significant burden of disease, especially among young individuals with high expectations of symptomatic relief and return to sports. Special concerns exist for patella articular cartilage defects which account for 34.6 % of lesions during routine arthroscopy, especially because this is the thickest articular cartilage and can withstand 6.5 times body weight during activity. lesions and posttraumatic defect. Variables such as lesion size, age, location on articular surface and depth; traumatic versus nontraumatic injury; and muscle strength or balance affect the outcomes. Standardised treatment is difficult owing to this heterogeneity.

Patella chondral lesions which remain symptomatic with conservative treatment often require surgical intervention. We present decision making, surgical management and outcome of a case of focal full-thickness patella chondral lesion with intraarticular loose body treated with osteochondral autograft and pertinent review of literature.

Numerous surgical techniques have been developed to address focal cartilage defects. Cartilage treatment strategies are characterized as palliation (e.g., chondroplasty and debridement), repair (e.g., drilling and microfracture [MF]), or restoration (e.g., autologous chondrocyte implantation [ACI], osteochondral autograft [OAT], and osteochondral allograft [OCA].

Generally, smaller lesions (<2 cm2) are best treated with MF or OAT. OAT has shown trends toward greater longevity and durability as well as improved outcomes in high-demand patients. Intermediate-size lesions (2-4 cm2) have shown fairly equivalent treatment results using either OAT or ACI options. For larger lesions (>4 cm2), ACI or OCA have shown the best results, with OCA being an option for large osteochondritis dissecans

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Case presentation :

A 33-year-old businessman with a desk job, presented to us with left knee anterior knee pain, difficulty climbing up and down stairs, knee bending and squatting. He gives a history of fall from stairs 6 months prior to presentation. He does not give any complaints of instability or locking. Conservative treatment did not relieve his symptoms. For the Right knee he has a history of road traffic accident with a full thickness anterior cruciate ligament injury and medial meniscus tear which was being treated conservatively.

On clinical examination, no significant gait alteration was noted. Normal lower limb alignment, grade I effusion, Range of motion complete with terminal discomfort on flexion. No obvious J sign, no abnormal patella translation and no generalised laxity was noted.

Special tests such as Mc Murray, anterior drawer and Lachman were negative. He had tenderness on the lateral patella facet, mild foot pronation was also noted. His knee X-rays did not show any significant abnormality, no patella baja or alta was noted. his CD index ratio was within the normal range.

MRI left knee showed a focal full-thickness cartilage lesion overlying lateral patella facet measuring 10x8 mm in size(Fig 1). A corresponding loose body lying in the femoral intercondylar fossa superior and medial to PCL insertion site.

We planned on performing arthroscopic loose body removal with an open OATS procedure for the patella in this patient.

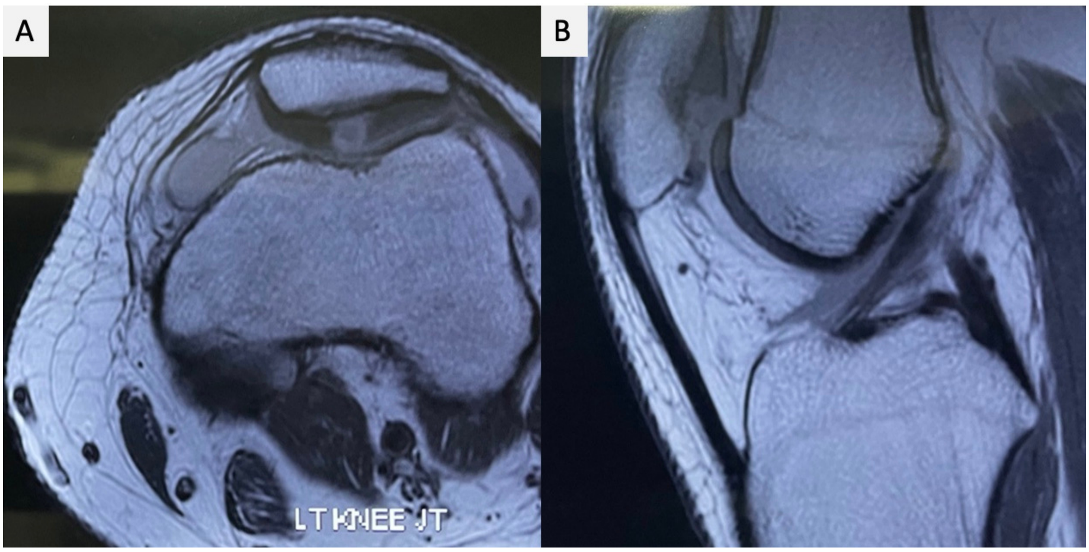

Fig 1: Pre-operative MRI: Axial Cuts(A) & Sagittal cuts(B) showing focal full-thickness cartilage loss at the lateral patella facet measuring 10x8 mm.

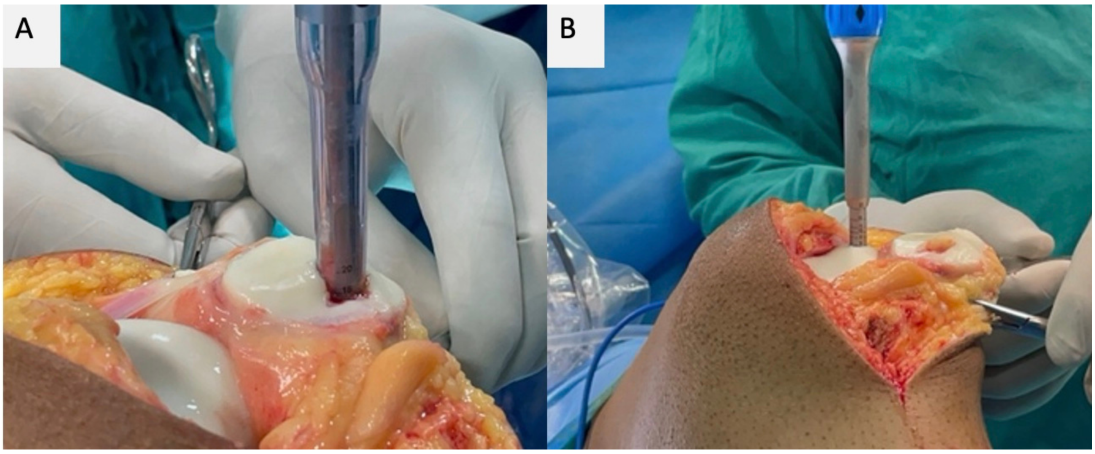

Fig 2: Intraoperative images. A: Graft recipient site prepared with 6mm drill with drill guide placed perpendicular to the articular surface to a depth of 16 mm. B. Graft harvested from the superolateral edge of lateral femoral condyle above the sulcus terminalis to a depth of 15 mm.

Surgical technique :

The procedure was performed under spinal anaesthesia, with the patient supine on the operating table. Tourniquet was applied. Using standard arthroscopy portals diagnostic arthroscopy evaluation of the knee joint confirmed our MRI findings, which revealed a grade IV Outerbridge chondral lesion. Loose body removal done. An open arthrotomy was performed using a standard medial parapatellar approach and the patella everted. The patella osteochondral lesion was debrided till stable chondral edges. The size of the lesion was noted to be 12 mm x 12 mm in size. We used a 6mm Depuy COR instrumentation set for this procedure.

The graft recipient site was sequentially prepared with 6 mm reamer while placing the drill guide perpendicular to the articular surface to a depth of 16 mm.

Donor plugs were harvested from the non-weight bearing periphery of the lateral femoral condyle above the sulcus terminalis. The 6 mm wide graft harvester was positioned perpendicular to the chondral surface, impacted to a depth of 15 mm and then carefully removed twisting the harvester clockwise and counterclockwise 180 degrees to disengage the graft(Fig 2). The harvester doubles up as a delivery guide when it is pressed on to the graft off loader and the harvester tip is disengaged. The osteochondral plug was then transferred to the recipient site using the delivery guide with the aid of a tamp. A distance of 2 mm was kept between adjacent grafts(Fig 3). Care was taken to keep the graft surface flush to the adjacent cartilage and avoid keep the graft proud. Closure was performed in layers.

Post operatively cryotherapy and CPM was initiated. During the post op rehabilitation patient was given a Knee ROM brace locked in extension

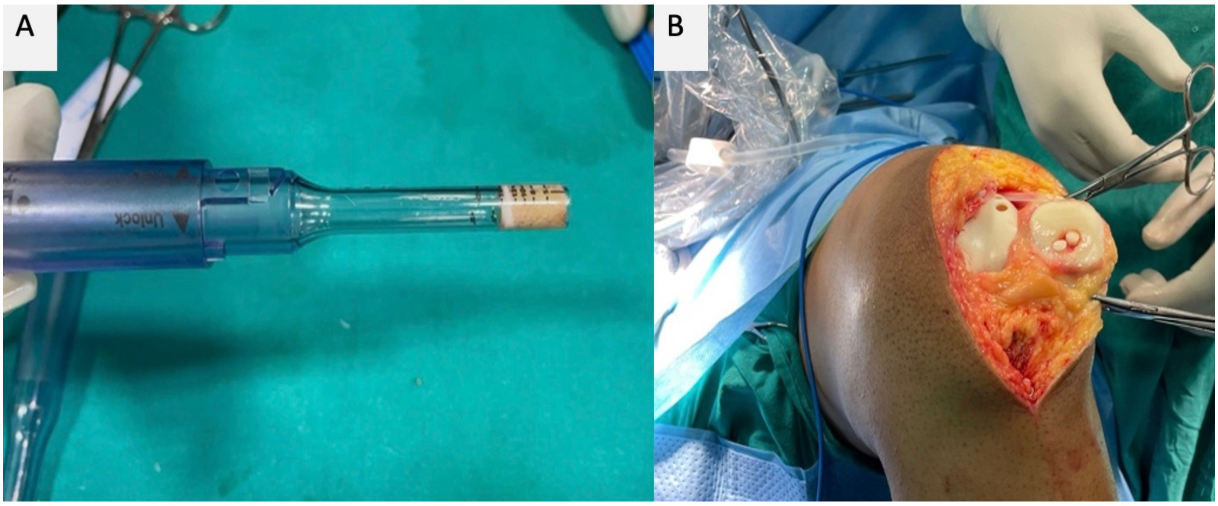

Fig 3: Intraoperative images. A: Graft harvester/ delivery guide with a cylindrical bone plug of 15 mm depth. B: Final placement of both the osteochondral plugs onto the chondral lesions spaced 2mm apart.

during walking; after three to four weeks of exercise on a stationary bicycle, progressive muscular strengthening and sensorimotor training and stretching were instituted. The patient was allowed to partially bear weight on the involved lower extremity for two to three weeks, and running was allowed after four to six months. High-functional-demand sports were allowed after six months.

On the last follow up 6 months postoperatively patient was painless, regained full range of motion and was able to perform all activities of daily living.

Review of literature

The study by Nho et al(1) showed that the IKDC score and the Knee Outcome Survey significantly improved between preoperative evaluation and final follow-up, with no difference in SF-36 scores.

Their study also revealed that patients who received OAT as an isolated procedure presented better outcomes than patients who had other associated procedures.

Astur et al (2) compared these scores within their sample between the size of the lesion (>2 or <2 cm), location of the lesions (lateral facet, medial facet, or both), and number of OATs used. No differences were reported in functional outcomes regarding defect size. In contrast, better outcomes were seen in patients with an isolated lateral facet lesion

Furthermore, the Lysholm score showed better outcomes in patients who had 1 OAT compared with patients who required more than 1 OAT.

Astur et al (3) routinely studied their patients with knee MRI at 6 and 12 months after surgery, using T2-relaxation time mapping sequences to evaluate osteochondral bone plug integration.

This study showed that at 6 months, 83% of the plugs had complete osseous integration, increasing to 100% at 12 months

Figueroa et al (4) assessed return to sports directly through an open question at follow-up regarding variations in activity level due to knee symptoms; no validated score was used in this study. All patients who were analyzed reported a preoperative amateur level of sports, and none of them reported any sport activity level limitation due to knee pain at final follow-up.

Hangody et al (5) in 2010, revealing that functional scores tend to be worse in comparison with other compartments in the knee. OAT tends to deliver good and excellent outcomes in the knee, demonstrating that outcomes tend to be better in the femur compared with the patellofemoral compartment (91% vs 74%).

Gudas et al (6) showed 96% good and excellent results in OAT, whereas microfracture had 52% good and excellent results in an athletic population; better outcomes have been demonstrated in an athletic population similar to the population.

A systematic review by Lynch et al (7) found that in comparison with microfracture or autologous chondrocyte implantation, OAT had better clinical results with a better rate of return to sports and maintenance of preoperative sports activity level.

Koh et al (8) demonstrated that misalignment of only 0.5 mm (above native cartilage) increases contact pressure on the plug's cartilage by 50%. Thus, one of the most important factors that may determine the success rate of OAT is the correct placement of the bone plug

Conclusion:

This procedure significantly improves patient-related functional outcomes including Lysholm, IKDC, Kujala and Tegner scores. Based on current evidence OAT should be offered to patients with high-grade patella chondral defects who remain symptomatic with most patients reporting excellent functional outcomes after 2 years. MRI should be conducted at 12 months follow up to assess plug integration and cartilage integrity.

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