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A Study of the Long Term Effects of Anatomical Open Reduction of Patella on Patellofemoral Articular Cartilage in follow up Arthroscopy

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Abstract: Anatomical open reduction is the choice treatment method in patellar fractures and the sole approach to study the cartilage surface healing is arthroscopy. This study is to evaluate the cartilage healing, long after the complete union of the fractures and the long term effects of simple transverse patellar fractures with perfect results on patellofemoral cartilage surface. Free of charge standard diagnostic arthroscopy was done on 22 patients whose simple transverse patellar fractures had happened at least 3 years ago with the mean age of 36.4 years. Fractures had happened at least 3 years ago and all cases had excellent union results. The data collected from cartilage surface studies were recorded. No other statistical tests were used except for X2 test to study the relation between clinical and radiological findings and arthroscopies. The elapsed time from the fracture occurrence to the arthroscopy was 39.2 months, at least 36 months. Five patients (22.6%) showed complete cartilage healing in cartilage surface arthroscopy and 10 patients (45.2%) proved to have Grade I chondral lesions. Four patients had Grade II chondral lesions and 3 patients had Grade III chondral lesions along with fibrillation. In 2 patients mirror cartilage lesions were observed in the opposite trochlea. In 3 patients with normal radiological signs, step-off was observed on cartilage surface. There was no relation between clinical signs and radiological characteristics of the patients with the healing on cartilage surface ($p = 0.84$). Having a diagnostic arthroscopy in an appropriate time after fusion, especially during extracting the metal instrument, is effective on evaluating patient's prognosis. Extracting metal instruments along with the simultaneous chondroplasty has low cost and complications, though leading to a decrease in the prevalence of secondary osteoarthritis and probably the eruptive swelling due to the debris released from probable fibrillations.

Key words: Patellofemoral, chondral surface, patellar fracture, intraarticular complications, chondroplasty

INTRODUCTION

About 0.1-1.3% of the skeletal lesions are devoted to patellar fractures (Haklar *et al.*, 2009; Carpenter *et al.*, 1997; Cetik *et al.*, 2007). Open reduction, is the appropriate treatment in these fractures. AO tension (preferably an anatomic) band wiring is the gold standard treatment (Carpenter *et al.*, 1997) though other methods such as using one or two separate screws have been reported successfully (Lefkoe *et al.*, 1995; Kijowski *et al.*, 2006; Harilainen *et al.*, 2005). The aim of the surgical treatment is to reach a stable fixation to provide an early movement of the knee and also to perform on anatomic reduction of the pieces because their irregularity is blamed to be the main reason of post traumatic arthritis affecting patellofemoral joint (Lefkoe *et al.*, 1995; Kijowski *et al.*, 2006; Harilainen *et al.*, 2005; Marya *et al.*, 1987). In spite of anatomic open reduction in external surface, step-off is

often found in the following arthroscopies with the scale of a tenth of a millimeter on cartilage surface (Harilainen *et al.*, 2005; Marya *et al.*, 1987; Marsh *et al.*, 2002). This minor step-displacement is the main cause of post traumatic arthritis which is very common after patellar fractures (Marya *et al.*, 1987). Bone union and cartilage surface healing ratios have been evaluated using arthroscopy in different studies just after the operation or while extracting the metal instrument (Marya *et al.*, 1987; Marsh *et al.*, 2002; Tecklenburg *et al.*, 2006; Tandogan *et al.*, 2002). Clinical and radiological assays have also been done to evaluate the success rate of the surgical treatment of patellar fractures (considering the union and functional results), though there is no case of delayed diagnostic arthroscopy to evaluate the articular surface state in these patients. In our study, we performed diagnostic arthroscopies 3 years after anatomical fixation of simple transverse patellar fractures in which AO



Fig. 1: Lateral view X-ray of a patient with simple transverse patellar fracture

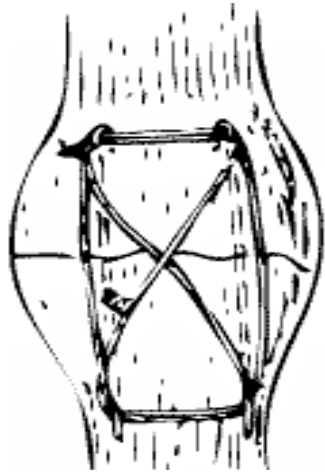


Fig. 2: AO method of patellar fixation

tension band wiring was used. Consent of the patients for the research was achieved and the procedure was done free of charge using regional femoral block which is considered to be the anesthesia method with least complications. The goal of this study was to evaluate the articular cartilage status years after the complete fracture union and the probability of secondary complications to occur in patellofemoral joint in spite of anatomic reduction (Fig. 1, 2).

MATERIALS NAD METHODS

Diagnostic arthroscopy of knee including the study of patellofemoral joint (PFJ) was done on 22 patients in

2008. All the patients had the patellar fixation surgery using the standard fixation method, AO tension band wiring, at least 3 years ago (Rabalais *et al.*, 2008). All the fractures were simple transverse without comminution. It was explained to all the patients that this was a research project and that the procedures are diagnostic and non invasive. A written consent was obtained based on the questionnaire of the research ethics committee. Regional femoral block was used as the anesthesia method to have the least complications and invasive characteristics. Patients were not charged for any of the procedures (though therapeutic patellar sharing was done in some cases). Seventeen of the patients were male and 5 were female with the mean age of 36.4 years. All the patients over 50 were omitted from the research to avoid the probability of pre-existing degenerative changes as a confounding factor. The affected knees were right knee in 13 cases and left in 9 cases. The lesion mechanisms were falling on the bent knee (Flexed) in 12 cases and vehicle accidents in 16 cases. All the cases of inferior segment avulsion, combination and all the cases of complications such as non union or loss of stability during treatment were eliminated from the study (Fig. 1). All the patients had normal Range of Motion (ROM). The elapsed time was approximately 39.2 months (36-44 months) from the primary surgery to the arthroscopy. Patients had no instability (ligament lesion) while examining and none had the signs of meniscus rupture clinically before surgery. Magnetic Resonance Imaging (MRI) was not requested for any of the patients due to economical considerations. After diagnostic arthroscopy, fibrillation shaving of cartilage lesions was done in 17 patients and partial meniscectomy was done in 2 patients. Arthroscopy was performed using Ausculap 30° standard scope via dual antromedial and antrolateral portal and thorough trochlear groove examination. A third superolateral portal was used for a thorough patellofemoral joint examination. Superomedial route was not used in any of the patients even those needing chondroplasty (Rabalais *et al.*, 2008). Observed chondral lesions in arthroscopy were evaluated using Outerbridge classification (Table 1). The χ^2 -test was used to compare the clinical and radiological findings with arthroscopic findings.

Table 1: Outerbridge classification for cartilage surface

Grade	Classification
0	Normal
I	Cartilage softening and swelling
II	A defect with an average thickness and a notch less than 1.5 cm wide, not reaching subchondral bone
III	A notch reaching the subchondral bone and a diameter more than 1.5 cm
IV	Visible subchondral bone

RESULTS

Five patients (22.6%) had complete healing on articular cartilage in patellar surface. Irregularities on cartilage surface were observed in 10 patients (45.2%). Grade II cartilage lesions were reported in 4 patients (Fig. 3). Grade III cartilage lesions along with fibrillation (Fig. 4) were seen in 3 patients (Fig. 3). Cartilage lesions on the trochlea opposite the patella were detected in 2 patients. Articular surface displacement was observed in X-ray of none of the patients after union whereas, obvious step-off was observed in arthroscopy of 3 patients. The first patient was a 31 years old woman with a millimeter step-off accompanying a Grade II patellar cartilage lesion. The second patient was a 35 year old man who had a 2 mm cartilage displacement and a Grade III cartilage lesion. The third patient was a 40 year old man

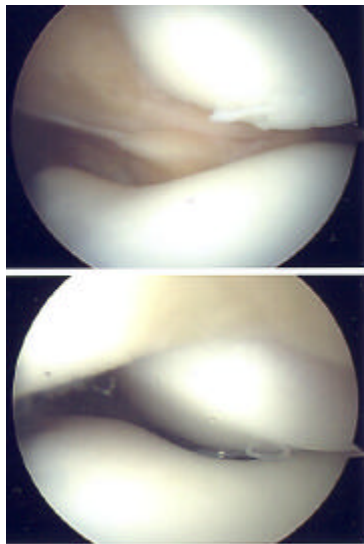


Fig. 3: Grade III cartilage surface and a trochlear lesion

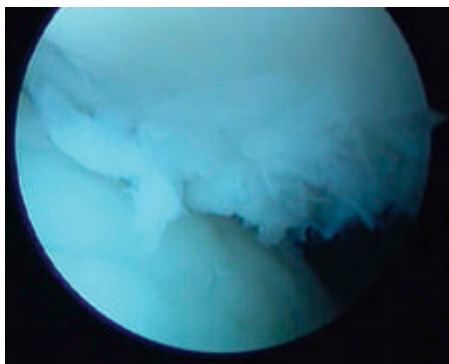


Fig. 4: Obvious fibrillation after patellar fracture

Table 2: The results of surgery in 22 patients by arthroscopy

No	Age	Step-off (mm)	Patellar cartilage lesion severity	Trochlear cartilage lesion
1	23	1	3	-
2	48	-	0	-
3	47	-	1	-
4	50	-	1	-
5	56	-	2	-
6	44	-	1	-
7	52	-	0	-
8	28	-	0	-
9	43	-	1	-
10	38	-	1	-
11	34	-	1	-
12	41	-	1	-
13	28	-	0	-
14	57	2	3	-
15	24	-	1	-
16	46	-	1	-
17	26	-	1	-
18	30	-	2	+
19	31	-	2	-
20	27	-	2	-
21	29	3	3	+
22	39	-	0	-

+: Presence of trochlear cartilage lesion; -: Absence of trochlear cartilage lesion

who had a simple transverse fracture yet severely displaced that in spite of having an anatomical replacement had a 2 mm step-off and severe cartilage fibrillation in articular surface arthroscopy. Chondroplasty, using mechanical shaver was used on all three patients. These findings as well as the results in all other patients in arthroscopy are summarized in Table 2. There was no significant relation between clinical signs and radiological characteristics of the patients with the healing on cartilage surface ($p = 0.84$).

DISCUSSION

Nowadays, surgery is the first choice treating patellar displaced fractures. The aim of the treatment in these fractures is to maintain the quadriceps mechanism and reduction of the articular surface (Haklar *et al.*, 2009; Marya *et al.*, 1987; Marsh *et al.*, 2002; Tecklenburg *et al.*, 2006; Tandogan *et al.*, 2002). Stable osteosynthesis and quick mobilization of the patient are essential to prevent the secondary osteoarthritis (Haklar *et al.*, 2009; Kijowski *et al.*, 2006; Marsh *et al.*, 2002; Tecklenburg *et al.*, 2006). Articular surface irregularity is the main cause of post traumatic arthritis in patellofemoral joint (Haklar *et al.*, 2009; Lefkoe *et al.*, 1995; Kijowski *et al.*, 2006; Marya *et al.*, 1987; Marsh *et al.*, 2002). There is a possibility of irregularity in cartilage surface even in the presence of anatomic reduction (Haklar *et al.*, 2009). These cartilage problems are important causes of cartilage fracture related arthritis. In

present study, different degrees of cartilage irregularities were found in diagnostic arthroscopy around the fracture line in most patients after 3 years. Cartilage fibrillation was also observed in a considerable number of the patients which seems to be a part of the fibrocartilage healing process. These cartilage lesions can cause cartilage lesions in the opposite trochlea (2 patients, 10.8%). There were two considerable points. Firstly, cartilage lesions especially those of opposite trochlea might have happened before patellar fracture or they might be irrelevant to it. And secondly, it is interesting that most of the patients with cartilage lesions had no significant clinical signs and complaints in the time of arthroscopy (12 of 17 patients with cartilage lesions were asymptomatic). Three patients had step-off lesions and cartilage displacement in arthroscopy in spite of not having any problem during operation and having a satisfactory anatomic reduction. All these three patients were significantly symptomatic and there were Grade III cartilage lesions or fibrillation in all three cases where as the previous studies suggested that cartilage displacement less than 2 mm is harmless and not a risk factor for the osteoarthritis prevalence increase (Carpenter *et al.*, 1997; Lefkoe *et al.*, 1995; Kijowski *et al.*, 2006; Friemert *et al.*, 2004). The fracture line on the cartilage surface is normally covered with fibro cartilage completely in the cases with anatomic open reduction (Cetik *et al.*, 2007; Marya *et al.*, 1987). Fracture line was not detectable in arthroscopy of 5 patients and healing had occurred perfectly. It can be concluded that having step-off on the cartilage surface and fibrillation is highly probable in case of radiographic displacement after surgery but there is no direct relation between radiographic displacement and cartilage step-off rate. It seems that diagnostic arthroscopy can provide us with valuable information in patients with patellar fractures. It is suggested to do this while extracting the used instrument. Patellar fracture follow up has so far been done clinically and radiologically whereas these methods cannot provide us with any information about patellar surface. Our study showed that there is almost no relation between clinical signs and radiologic characteristics of the patients with the healing on cartilage surface ($p = 0.84$). Although, these patients were clinically asymptomatic and had perfect radiographies, there were obvious lesions even Grade III lesions on the cartilage surface. We suppose that having a diagnostic arthroscopy in an appropriate time after the union, especially while extracting the metal instrument is helpful in evaluating the future prognosis of the patient. Simultaneous

chondroplasty and metal instrument extraction are of low cost and complications and can decrease the symptoms, the secondary osteoarthritis prevalence and repetitive swellings caused the probable fibrillation debris which are common in patellar fractures for many years after healing (Lefkoe *et al.*, 1995; Kijowski *et al.*, 2006).

CONCLUSION

Diagnostic arthroscopy, especially during extracting the metal instrument is effective on evaluating patient's prognosis. Simultaneous extracting of the may decrease the cost and the rate of complications.

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