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Arthroscopic release of lateral patellar retinaculum for patellofemoral arthrosis

Ning Yi¹, Hang Yuan², Yun-kun Zhang³, Wen-qiang Yang³ and Chao Zhuang^{3*}

Abstract

Background In orthopedics clinic, patellofemoral arthrosis is a special type of osteoarthritis and yet the surgical methods are still debatable.

Methods We retrospectively reviewed 94 patients with knee patellofemoral arthrosis who were underwent knee arthroscopic exploration and debridement only or underwent arthroscopic release of the lateral patellar retinaculum at the same time. LPFA, PTA, PSA as well as WOMAC, Lysholm, Kujala and VAS scores were used to evaluate the clinical outcomes between two groups.

Results All patients were followed up for more than one year. The LPFA and PTA were improved after surgeries. The postoperative Lysholm and Kujala scores of both groups were higher and the postoperative WOMAC and VAS scores were lower than those of preoperatively. There was no significant difference between two groups at 6 months, while at 12 months, observation group were better than those of control group.

Conclusions Arthroscopic release of lateral patellar retinaculum is effective in the treatment of patellofemoral arthrosis.

Keywords Knee arthroscopy, Lateral patellar retinaculum release, Patellofemoral arthrosis

Introduction

Patellofemoral arthrosis is a special type of osteoarthritis in the aged people. Most patients have pathological factors such as high patella, excessive Q angle and dysplasia of medial femoral muscle, resulting in increased patellar load and imbalance of lateral soft tissue [1, 2]. Early stage can be treated by oral anti-inflammatory and analgesic drugs combined with intra-articular injection of sodium

hyaluronate. When conservative treatment fails, surgery can be selected.

In the past, sector drilling decompression of patella or patellar osteotomy performed to alleviate the pain [3]. Due to the large trauma and inability to dynamically observe the degree of improvement in the patellofemoral joint during the release process, it has gradually been phased out. Compared with open surgery, arthroscopy can dynamically and intuitively observe the trajectory of the patella, patellofemoral joint contact pressure, and cartilage degeneration of the affected joint surface, so arthroscopic surgery has high diagnostic accuracy, small tissue damage, low incidence of complications and fast recovery rate [4]. At present, arthroscopic lateral patellar retinaculum release is a feasible surgical method for the treatment of patellofemoral arthrosis. The surgeons can observe the movement track of the patella during

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the operation and the improvement of the postoperative patellofemoral joint surface, restore the normal force line, and reduce the abnormally increased pressure on the outer side of the patellofemoral joint. The operation is minimally invasive which can delay articular cartilage injury and eliminate the cause of pain. It has satisfactory curative effect and rapid recovery, and is easy to be accepted by patients.

In this study, we retrospectively reviewed 94 patients who were underwent knee arthroscopic exploration and debridement only or combined with arthroscopic lateral patellar retinaculum release. The clinical effect was discussed and analyzed.

Patients and methods

Study design

From January 2015 to December 2016, 94 patients with patellofemoral arthrosis were retrospectively reviewed in our study. 47 cases were underwent knee arthroscopic exploration and debridement only (control group), while 47 cases were combined with arthroscopic lateral patellar retinaculum release (observation group). There were 13 males and 34 females in the control group, aged 50–78 years, with an average age of (62.4 ± 2.7) years. The course of disease ranged from 9 to 23 months, with an average disease duration of (1.5 ± 0.3) years. There were 11 males and 36 females in the observation group, aged 45–82 years, with an average age of (60.2 ± 3.4) years. The course of disease ranged from 10 to 25 months, with an average disease duration of (1.6 ± 0.6) years (Table 1). Patients in control group underwent knee arthroscopic exploration and debridement, while patients in observation group underwent knee arthroscopic exploration and debridement combined with lateral patellar retinaculum release. Inclusion criteria [5]: (1) Patients with patellofemoral arthrosis mainly suffered from squatting pain, obvious stairs up and down, no influence on walking and ineffective conservative therapy for more than 3–6 months. (2) Patella was divided into 4 equal parts longitudinally, and the range of pushing in was less than 1/4. (3) Imaging examination showed patellofemoral joint degeneration, joint space narrowing, tibiofemoral joint no

obvious narrowing, symmetrical joint space inside and outside (Fig. 1). Exclusion Criteria: (1) Previous patellar dislocation or subluxation. (2) Any previous knee surgical intervention. (3) Limb mal-alignment: TT-TG distance > 20 mm. (4) Frontal plane lower limb deformities: $15^\circ < \text{Q-Angle} < 22^\circ$. (5) Patella height: < 0.8 Insall-Salvati ratio > 1.2 . (6) Trochlea dysplasia or Patellar dysplasia or genu valgus-varus deformity. The clinical symptoms, signs and imaging examinations of two groups were in accordance with the inclusion criteria, and all the patients underwent arthroscopic knee surgery for the first time.

Surgical technic

AL and AM approaches were used to examine the main structures of the knee joint. The proliferated synovium and patellofemoral articular cartilage were cleared in control group. In observation group, patellofemoral articular cartilage was carefully examined after exploration and clearance of the knee joint cavity. The degree of cartilage wear was evaluated and debridement or chondroplasty were performed before arthroscopic release of the lateral patellar retinaculum (Fig. 2). Arthroscopy was implanted through the AM approach and low temperature plasma knife for arthroscopy was implanted through the AL approach. The synovium was cleared first, and then the lateral patellar retinaculum was incised from the upper to the lower pole 1 cm away from the lateral edge of the patella (Fig. 3). Cut open the synovium, joint capsule, retinaculum, and superficial fascia directly to the subcutaneous tissue until the patella returns to its normal position. Satisfactory release should allow the patella to move inward by more than 1–2 mm and lift it up by more than 50° towards the axis direction [6].

Rehabilitation exercise postoperation

Muscle strength exercise: after anesthesia, patients are encouraged to perform ankle pump exercise and contract the calf muscles. The next day, the patient was instructed to exercise the quadriceps femoris. When the knee joint was straightened, tighten the quadriceps femoris to raise the thigh to the highest, lasting for 5–10 s. The thighs close together and clamp the object to exercise the muscle strength of the medial femoral muscle group. Stand and bend one knee to hook the sandbag to exercise the muscle strength of the posterior femoral muscles. The above exercises are 10 times in each group, 3 groups a day.

Range of motion exercise: hold the knee with both hands and flex the knee actively. Raise the heel, press the sandbag on the knee, and actively extend the knee. The patella was moved up, down, left and right 10 times. The goal is that the knee joint reaches or approaches the normal range within 4–6 weeks.

Table 1 Patient demographics and clinical data for each group

	control group (n = 47)	observation group (n = 47)	p- value
Age	62.4 ± 2.7	60.2 ± 3.4	0.246 ^a
Gender(male/female)	13/34	11/36	0.831 ^b
Body mass index(BMI)	24.78 ± 4.36	25.34 ± 6.03	0.435 ^a
Course of disease	1.5 ± 0.3	1.6 ± 0.6	0.274 ^a
Operation side(left/right)	18/29	21/26	0.734 ^b
MRI rating(I/II/III)	5/32/10	6/33/8	0.546 ^b

^aStudent's *t*-test

^bChi-squared test

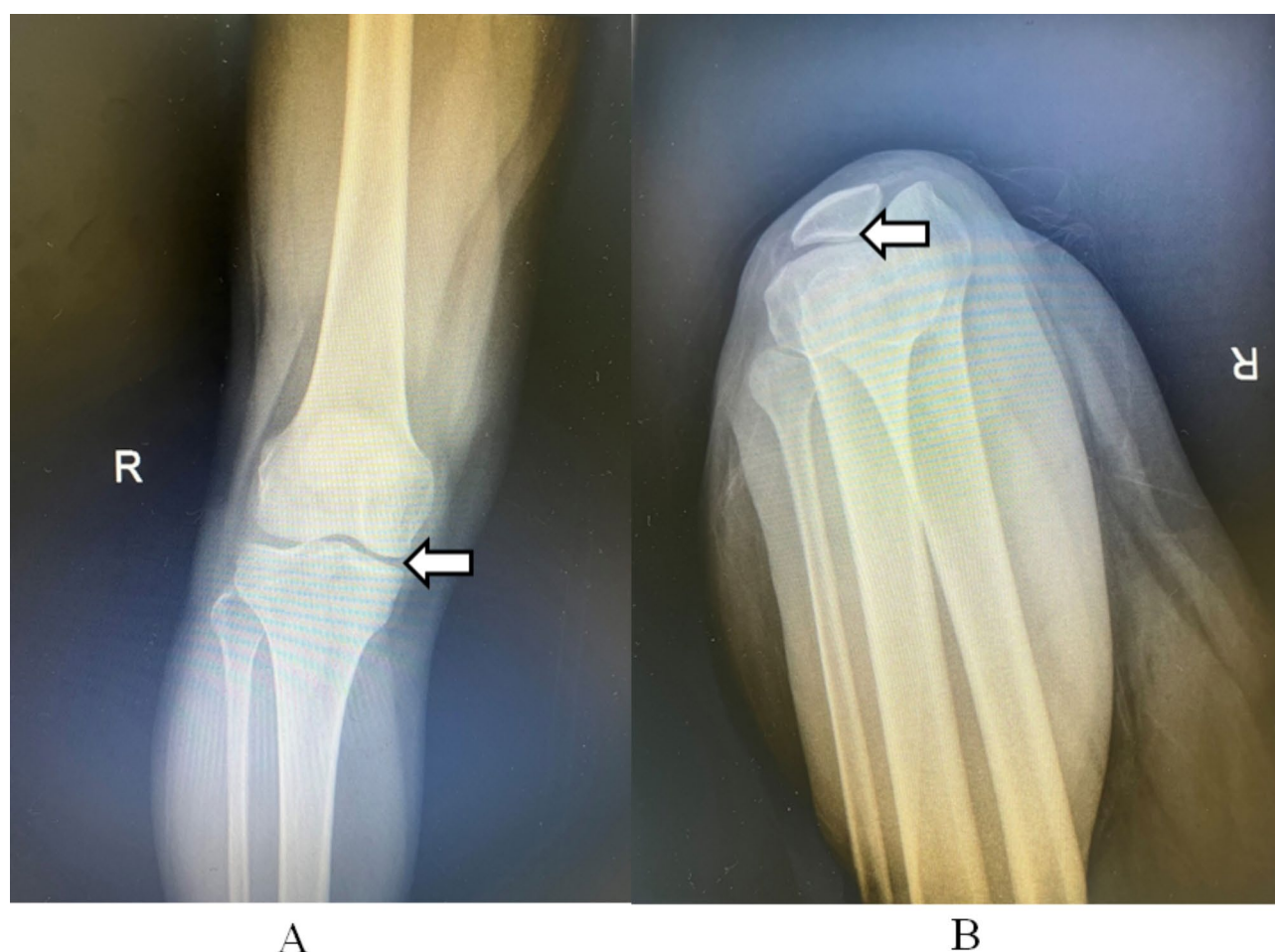


Fig. 1 Anteroposterior radiograph of knee joint and axial radiograph of patella before operation (observation group). **(A)** No obvious degeneration of tibiofemoral articular (Arrow); **(B)** Lateral patellofemoral articular stenosis (Arrow)

Weight bearing and walking: hold the double crutches, touch the ground on the toes for 4 days, touch the ground on the front sole for 4 days, touch the ground on the 3/4 sole (with the heel slightly raised) for 4 days, and touch the ground on the whole sole for 4 days until the crutches are abandoned.

Crutches abandon criteria: there is no obvious swelling and the knee joint activity is basically normal. There is no pain when walking.

Cold compress: in the whole rehabilitation exercise stage, cold compress immediately after each exercise, 10–15 min each time.

Data recording

Knee function was evaluated by WOMAC, Lysholm and Kujala scores. Lateral patellofemoral angle (LPFA), patellar tilt angle (PTA) and patella sulcus angle (PSA) were measured before operation, 6 months and 12 months after operation. The degree of pain was judged by visual analogue scale (VAS).

Statistical analysis

SPSS 22.0 software was used for statistical analysis. The measurement data were represented as means \pm SD, t-test was used for inter-group comparison of WOMAC score, Lysholm score, Kujala score and VAS, analysis of variance was used for intra-group comparison, and chi-square test was used for counting data. Significantly difference were considered when $P < 0.05$.

Results

All patients were followed up for more than one year. The patients recovered well postoperatively, and the pain was relieved. The time of postoperative limb swelling in the observation group was longer than that in the control group. The swelling was obvious within 1 week and relieved significantly after 2 weeks. 8 patients had local hematoma after operation, of which 5 cases were not treated and the hematoma could be absorbed after 2 weeks. The symptom of other 3 cases relieved after local puncture and compression bandage. X-ray 12 months postoperatively in observation group showed slight

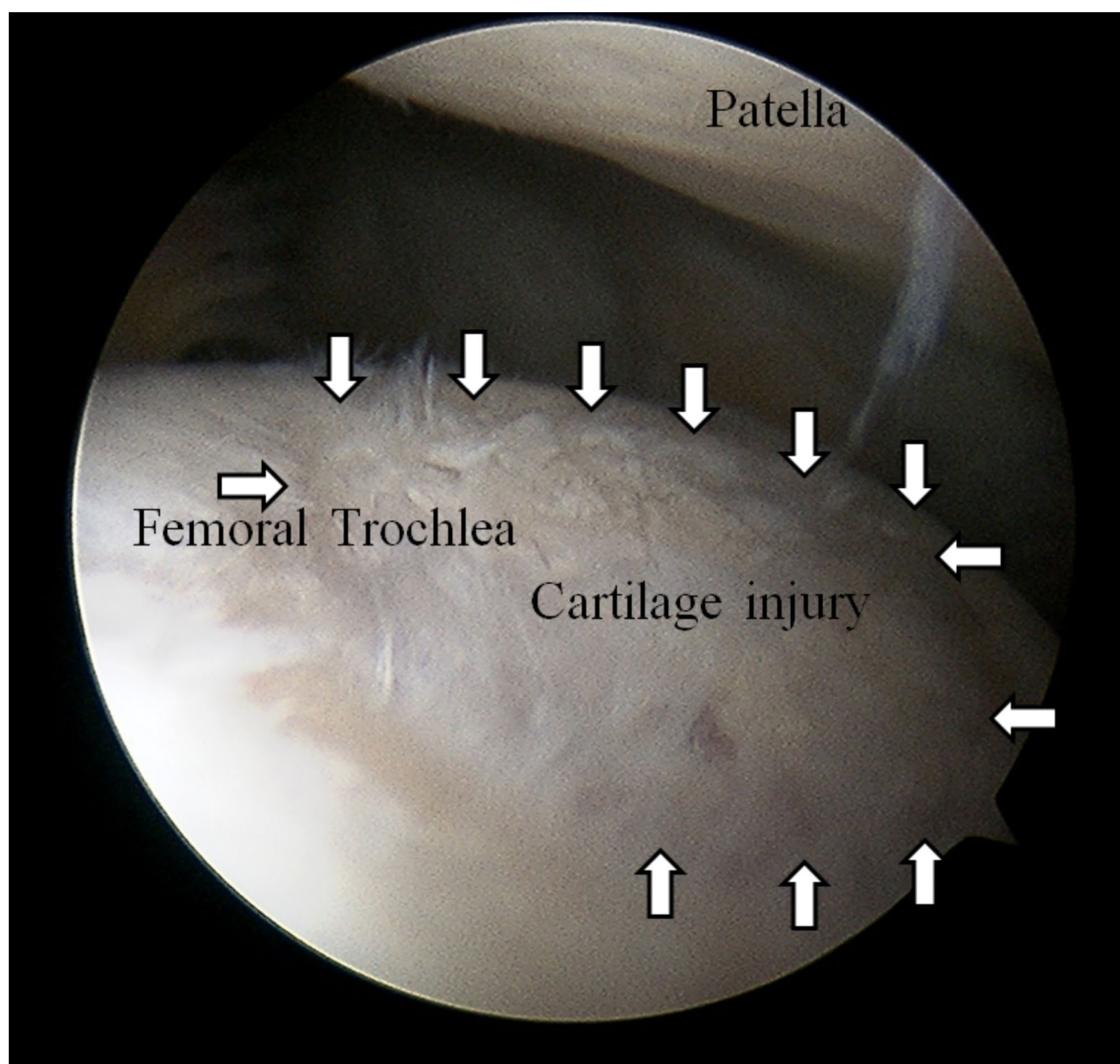


Fig. 2 Intraoperative arthroscopic findings(observation group). Patellofemoral articular cartilage was obviously worn (Arrow)

degeneration of tibiofemoral articular but no obvious stenosis of lateral patellofemoral articular (Fig. 4). The postoperative Lysholm and Kujala scores of two groups were significantly higher and the WOMAC and VAS scores were significantly lower than those preoperatively. There was no significant difference between two groups at 6 months among the four scores, while at 12 months, the observation group were better than those of control group (Table 2). The LPFA and PTA were improved in both groups postoperatively and there was no significant difference in the first 6 months, but 12 months postoperative follow up showed better clinical outcomes in observation group. There was no significant difference of PSA during follow up in two groups (Table 3).

Discussion

Patellofemoral arthrosis represents the degeneration of patellofemoral compartment. In the early stage, due to the abnormal anatomical alignment of patellofemoral joint, the force arm of quadriceps femoris is unbalanced, the lateral support belt of patella is too tight, and the patellar motion trajectory is abnormal during knee flexion and extension. The patella tilts, and the stress on the inner and outer articular surfaces of the patella is unbalanced, which increases the stress on the outer patella and forms high pressure of lateral patellofemoral [7, 8]. Patients often have the symptoms of lateral patellofemoral compression pain due to the overload of the lateral

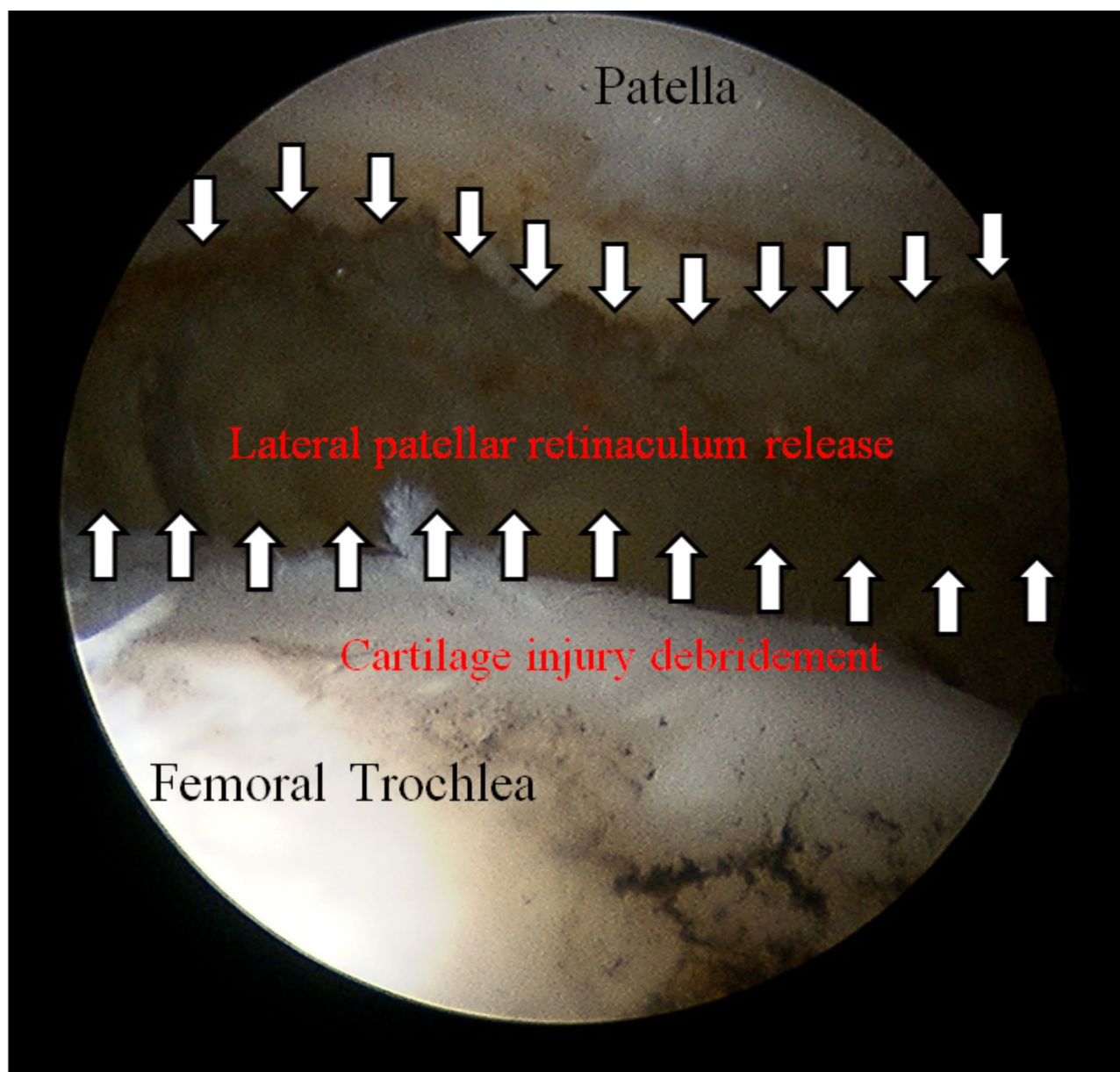


Fig. 3 Intraoperative operation completed (observation group). Release of lateral patellar retinaculum under arthroscopy (Arrow)

cartilage surface of the patella and the over tightness of lateral retinaculum. The pain is aggravated after knee flexion, squatting and descending stairs, which affects the normal activities of patients [9]. For patients with mild symptoms at the initial stage of the disease, conservative treatment should be adopted first to alleviate clinical symptoms and delay the progress of the disease. The commonly used conservative treatments include activity restriction, non steroidal anti-inflammatory and analgesic drugs, intra-articular injection, physical therapy, rehabilitation training, etc. If the curative effect is not ideal or the disease progresses, surgical treatment can be recommended [10, 11]. At present, arthroscopic lateral patellar

retinaculum release is a feasible surgical method for the treatment of patellofemoral arthrosis. The surgeons can observe the movement track of the patella during the operation and the improvement of the postoperative patellofemoral joint surface, restore the normal force line, and reduce the abnormally increased pressure on the outer side of the patellofemoral joint. The operation is minimally invasive which can delay articular cartilage injury and eliminate the cause of pain [12]. It has satisfactory curative effect and rapid recovery, and is easy to be accepted by patients.

In the past, some scholars have successfully alleviated the pain of patellofemoral joint by performing

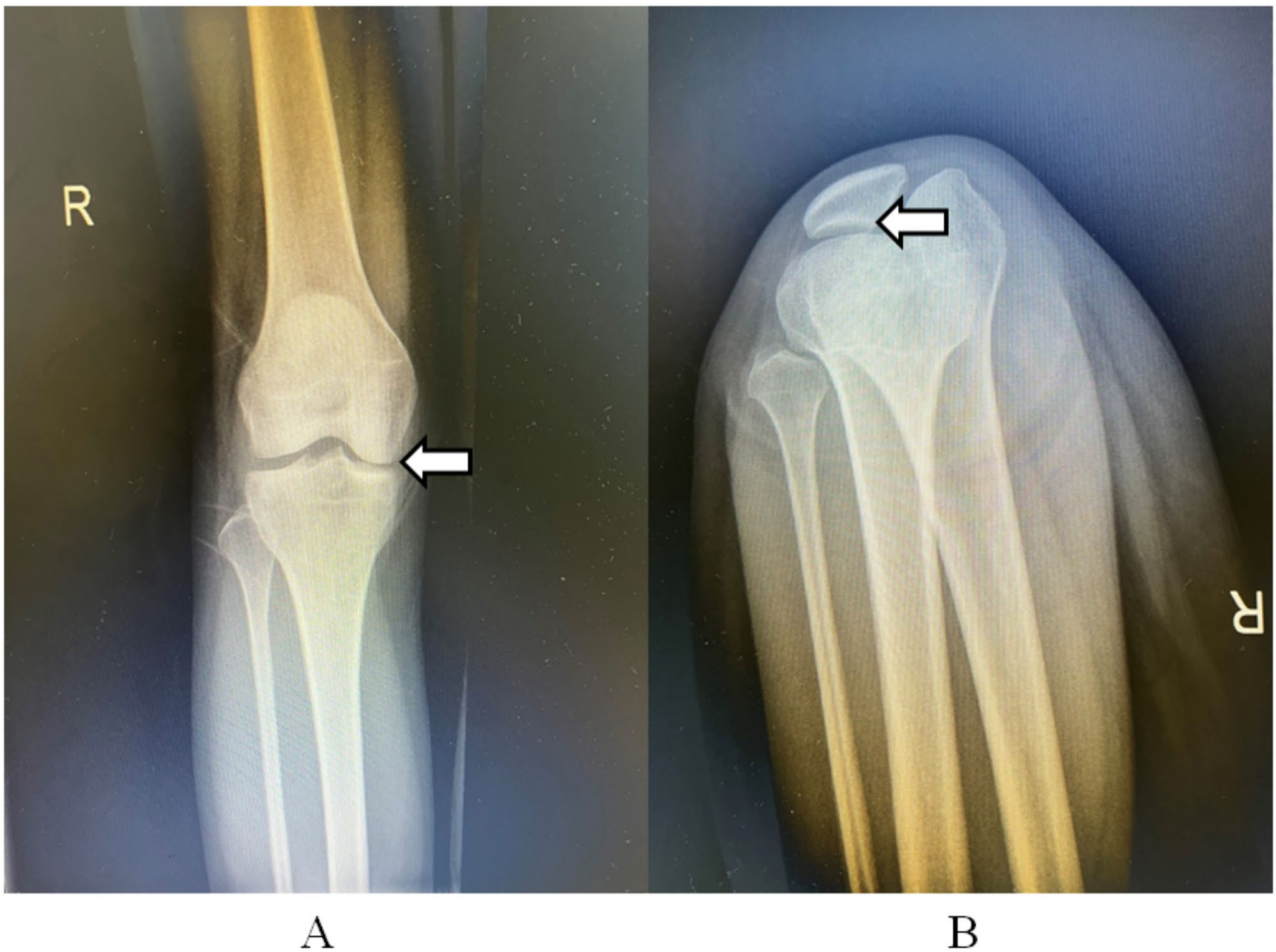


Fig. 4 Anteroposterior radiograph of knee joint and axial radiograph of patella 12 months postoperatively(observation group). **(A)** Slight degeneration of tibiofemoral articular (Arrow); **(B)** No obvious stenosis of lateral patellofemoral articular (Arrow)

Table 2 Clinical outcomes between two groups

	Preoperation	Postoperation (6 months)	Postoperation (12 months)
Lysholm score			
control group	43.34 ± 5.32	69.15 ± 2.03 ^a	77.39 ± 2.38 ^a
observation group	44.42 ± 8.21	71.02 ± 6.29 ^a	85.31 ± 2.54 ^{ab}
kujala score			
control group	60.42 ± 3.23	72.16 ± 2.31 ^a	82.39 ± 2.26 ^a
observation group	59.34 ± 2.81	74.29 ± 6.29 ^a	92.37 ± 2.54 ^{ab}
WOMAC score			
control group	63.29 ± 4.32	52.68 ± 1.23 ^a	44.69 ± 2.26 ^a
observation group	62.93 ± 1.82	50.09 ± 1.69 ^a	38.23 ± 2.54 ^{ab}
VAS			
control group	7.26 ± 1.13	2.46 ± 1.23 ^a	1.96 ± 2.26 ^a
observation group	7.39 ± 1.82	2.19 ± 1.69 ^a	0.93 ± 0.54 ^{ab}

Compared with preoperation, ^a*P*<0.05; compared with control group, ^b*P*<0.05

sector drilling decompression of patella, and others have observed that patellar osteotomy can also alleviate the pain of patellofemoral joint [13]. Compared with the above surgical methods, arthroscopic lateral patellar

Table 3 Measurement of patellar related angles

	Preoperation	Postoperation (6 months)	Postoperation (12 months)
LPFA(°)			
control group	0.98 ± 1.45	3.84 ± 0.83 ^a	5.43 ± 1.16 ^a
observation group	1.12 ± 0.89	4.72 ± 1.21 ^a	8.31 ± 0.87 ^{ab}
PTA(°)			
control group	2.32 ± 1.03	5.11 ± 1.01 ^a	9.31 ± 0.76 ^a
observation group	2.88 ± 0.84	6.22 ± 0.93 ^a	12.17 ± 1.04 ^{ab}
PSA(°)			
control group	131.09 ± 4.22	132.18 ± 3.12	134.19 ± 3.21
observation group	129.03 ± 5.28	130.51 ± 3.12	131.83 ± 2.94

Compared with preoperation, ^a*P*<0.05; compared with control group, ^b*P*<0.05

retinaculum release is more minimally invasive and safe. It can be operated under the arthroscope to avoid additional injury and eliminate the risk of infection. In order to reduce pain and improve patellar trajectory, the surgeon must consider whether the patient's indications are appropriate before operation. The degree of release is still uncertain clinically, but distal release to the level of

tibiofemoral joint line will significantly increase the patellar range of motion. The release of the lateral patellar retinaculum is difficult to control. Insufficient or excessive loosening of the retinaculum should be avoided during the operation. Insufficient release will lead to no significant relief of postoperative symptoms, and excessive release will lead to iatrogenic medial patellar subluxation [14]. Do not injury the branch of the external superior knee artery during the operation to avoid the formation of postoperative hematoma. Postoperative hematoma should be treated with local compression, ice compress and analgesic drugs immediately. If it affects postoperative rehabilitation exercise, sometimes local puncture and aspiration should be taken. Medial instability can be treated by physical therapy or lateral retinaculum repair, while persistent pain may require drug treatment, intra-articular injection or patellofemoral replacement.

Arthroscopic lateral patellar retinaculum release can significantly reduce the pain of the affected knee joint and improve the stability of the patella by reducing the lateral force vector of the patella or the lateral pressure on the lateral patellofemoral joint surface if the indications are selected correctly and the operation technology is applied appropriately. The potential complications of this procedure are the weakening of the muscle strength of the knee extension device and the instability of the medial patella. The short-term complication is the formation of postoperative hematoma.

There are some limitations in our study. (1) The degree of joint degeneration was not considered and it would affect the long-term efficacy of the surgery. (2) Due to short follow-up time, the long-term effect of the surgery was not obtained. Lack of understanding of the long-term impact of this surgery on knee soft tissue balance and joint cartilage may affect the generalizability of our findings. (3) Further biomechanical experiments are needed for more solid theoretical basis and better understanding of the forces acting on the patellofemoral joint across different patient populations.

Conclusions

Arthroscopic release of the lateral patellar retinaculum is a feasible surgical method for treating patellofemoral arthrosis. Surgeons can observe the trajectory of the patella during surgery, improve the surface of the patellofemoral joint, restore normal force lines, and reduce abnormal pressure on the lateral side of the patellofemoral joint. This procedure is minimally invasive, with satisfactory therapeutic effects and fast recovery. However, whether the surgery can achieve satisfactory postoperative efficacy still depends on comprehensive preoperative evaluation, strict control of indications, correct grasp of surgical points, and active postoperative rehabilitation exercise, all of which are indispensable.

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Not applicable.

Author contributions

Chao Zhuang contributed to the conception of the study; Yun-kun Zhang and Wen-qiang Yang performed the data analyses; Ning Yi and Hang Yuan wrote the manuscript.

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Data availability

Data available on request and should be contacted with corresponding author (zhuangchao@njmu.edu.cn).

Declarations

Ethics approval and consent to participate

This study has been submitted to, and approved by the ethics committee of the affiliated Changzhou second people's hospital of Nanjing Medical University. Informed consent was obtained from all individual participants included in the study. This study has been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

Consent for publication

Patients signed informed consent regarding publishing their data.

Competing interests

The authors declare no competing interests.

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