Original Article

Mid and long term outcomes after fixation of osteochondritis dissecans

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ABSTRACT

Objective: To assess the longitudinal outcomes of osteochondritis dissecans (OCD) fixation and to detect the influencing factor for the results of OCD.

Methods: 22 OCD fixation using bioabsorbable pins were assessed Lysholm score, Tegner activity scale and KOOS₄ at preoperative, postoperative short (3.0 years) and mid-long (11.9 years) term.

Results: Postoperative Lysholm score was significantly better than the preoperative time. There was no factor influencing KOOS₄ at mid-long term.

Conclusion: OCD fixation contributes good results for a long time regardless of skeletal maturity, the size and the severity of OCD.

1. Introduction

Osteochondritis dissecans (OCD) is an idiopathic disorder primarily affecting subchondral bone that results in destabilization of the affected subchondral bone and its overlying articular cartilage.^{1–3} While lesions can occur in the elbow, ankle, and wrist, the most common site of involvement is the knee.^{4–6}

Multiple hypotheses have been put forward regarding the cause of this condition including inflammation,⁷ ossification abnormalities,⁸ ischemia,⁹ and repetitive microtrauma.^{10,11} The natural history of the disease process has been studied by multiple authors using a variety of methods. These studies generally show the prognosis to be better for smaller lesions and those in the skeletally immature.¹¹

Many authors recommend fixation of loose bodies of OCD when possible.^{7,12–14} Patients did not have symptoms of osteoarthritis pain and had normal function in activities of daily life after surgery.² However, patients reported significantly lower knee-related quality of life.² There were no reports to detect the influencing factor for postoperative knee function at the long term. Furthermore, published operative fixation outcomes are small case series (10 or fewer patients) with short (less than 5 years) follow-up.

The purpose of this retrospective study was to assess the short term (under 5 years), and the mid and long term (over 5 years) outcomes of osteochondritis dissecans (OCD) fixation. Furthermore, the purpose was to detect the influencing factor for the mid-long term results of treatment of osteochondral dissecans.

We hypothesize that the fixation of osteochondral fragment using bioabsorbable pins will heal normal function clinically at the short term, and maintain same function at mid-long-term follow-up. Furthermore, We hypothesize that skeletal maturity, the size and the severity of osteochondral lesion were influencing factors for the mid-long term results of treatment of osteochondritis dissecans.

2. Patients and methods

2.1. Operative technique and postoperative protocol

Between 1998 and 2008, 28 patients underwent operations for OCD. First, all patients were examined arthroscopic evaluation, and the stability of osteochondral lesion was assessed. The size of osteochondral lesion was measured. If the instability of osteochondral lesion existed, an open reduction and internal fixation were performed. Osteochondral fragment was repaired by bioabsorbable pins (poly-L-lactic acid (PLLA): NEOFIX®, Stryker Japan, Tokyo, Japan) (Fig. 1). The diameter of the pin was 1.5 mm, and the length was 30 mm. More than 3 pins were used for the fixation of osteochondral fragment, and the pins were fixed radial due to reinforce stability of the fixation.¹⁴

Postoperatively, patients were allowed full range of motion in all patients. While patients treated medial and lateral condyle lesions were kept non-weight-bearing status on the operative extremity for 12 weeks, patients treated patellofemoral lesion were immediately allowed full-weight-bearing in state of full extension of the ipsilateral knee.

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Fig. 1. Fixation of osteochondral fragment using bioabsorbable pins: Lesion of the photograph was medial femoral condyle of left knee. The fragment was fixed by 6 pins.

2.2. Clinical assessments

After approval by our institutional review board, clinical assessments were examined for all patients. Patients were assessed at preoperative time, postoperative short term (under 5 years), and postoperative mid-long term (over 5 years). Lysholm score and Tegner activity scale were investigated at preoperative time, short term, and mid-long term, respectively. The changes among preoperative time, the short term, and the mid-long term result were investigated. Radiographs of the affected side knee were taken for all patients at the preoperative time, and Bruckl classification was investigated. Knee Osteoarthritis Outcome Score subscales, covering pain, symptoms, activities of daily living (ADL), and quality of life (QOL) (KOOS₄) were investigated at mid-long term. The KOOS₄ was calculated to average of

subscales covering pain, symptoms, ADL, and QOL.¹⁵ The KOOS₄ ranges from 0 (worst) to 100 (best). The influencing factor of the KOOS₄ was detected from skeletal maturity, preoperative Bruckl classification, and the size of osteochondral lesion.

2.3. Statistical analysis

Analysis of variance (ANOVA) was applied to evaluate the differences of Lysholm score and Tegner activity scale among preoperative time, the short term, and the mid-long term result. Bonferroni test was used as a post hoc test.

The multiple linear regression analysis was performed to detect the influencing factor for KOOS₄ at the mid-long term. R-squared (R^2) over 0.90 was validity, and the P value below 0.05 was defined significant. All data analysis was performed with SPSS software, version 16.0.1 (SPSS, Chicago, IL).

3. Results

3.1. Patient demographics (Table 1)

Twenty-two patients (2 women and 20 men) of all patients completed this study. Six patients dropped out because it could not be evaluated over 5 years. The 22 patients identified above included 20 male patients (90.9%) and ranged in age from 12 to 31 years (mean, 17.9 years) at the time of surgery. Fourteen patients (63.6%) were skeletally mature at the time of the procedure. Duration of symptoms ranged from 1 to 108 months (mean, 27.0 months). Lesions were located on the medial femoral condyle (59.1%), lateral femoral condyle (27.3%), and lateral trochlea (13.6%). Defects ranged in size from 1.2 to 14.6 cm² (mean, 4.9 cm²). Bruckl classification ranged from 1 to 5 (mean, 3.9). Mean follow-up periods were 35.4 months (3.0 years) in short term, and 142.5 months (11.9 years) in mid-long term.

Table 1
Patient Demographics.

Lesion Location	Lesion Size, cm ²	Follow-Up Short Term, mo	Follow-Up Mid-Long Term, mo	Preoperative Bruckl Classification	Preoperative Lysholm score	Postoperative Short Term Lysholm Score	Postoperative Mid-Long Term Lysholm Score	Preoperative Tegner Activity Scale	Postoperative Short Term Tegner Activity Scale	Postoperative Mid-Long Term Tegner Activity Scale
LT	9.5	76	210	1	38	100	92	9	9	5
LT	6.6	70	224	5	49	96	91	8	8	3
MFC	3	80	220	4	43	100	95	4	3	3
MFC	14.6	75	197	5						
MFC	3	64	172	3	43	100	91	7	7	6
MFC	3.8	36	167	5	48	100	100	9	9	9
LFC	1.7	44	152	5	44	100	99	9	9	2
LFC	1.2	28	150	3						
LFC	3	48	140	3	83	100	100	9	9	9
LFC	4.6	34	156	5						
MFC	3.8	38	146	3	60	100	91	8	8	8
LFC	4.5	24	132	5	25	100	84	4	4	4
MFC	5	24	127	2	79	100				
LFC	6	18	126	4	63	100	87	9	9	9
MFC	5.3	17	114	4	67	94	89	5	7	4
MFC	5	19	112	4	53	100	100	9	9	9
MFC	5.6	14	112	4	70	100	95	9	9	7
MFC	8	13	109	4	38	91	89	8	8	8
LT	1.6	12	101	3	63	100	98	9	9	7
MFC	3.3	18	100	4	48	100	89	8	8	5
MFC	5	3	99	4	43	100	100	9	9	9
MFC	3	24	99	5	17	100	95	7	4	4
	4.9	35.4	142.5	3.9	51.3	99.0	93.6	7.8	7.7	6.2

Age^a: at the time of operative fixation of the osteochondral fragment.

Skeletal Maturity^b: Maturity defined as closure of the distal femoral physis.

Lesion Location: MFC; Medial Femoral Condyle, LFC; Lateral Femoral Condyle, LT; Lateral Trochlea.

Fig. 2. Clinical results of Lysholm score and Tegner activity scale.

**: $p < .01$, *: $p < .05$

3.2. Clinical outcome

Lysholm score at preoperative time, short term, and mid-long term were mean 51.3, 99.0, and 93.6, respectively (Fig. 2). Lysholm score at preoperative time was significant lower than short term and mid-long term (* $p < .01$). In addition, Lysholm score at short term was significant higher than preoperative and mid-long term (* $p < .01$). Tegner activity scale at preoperative time, short term, and mid-long term were mean 7.8, 7.7, and 6.2, respectively. Tegner activity scale at mid-long term was significant lower than preoperative time or short term score (** $p < .05$). However no significant differences was noted between preoperative time and short term result.

The 18 of 22 all patients completed the questionnaire of KOOS₄ subcategory at mid-long term (11.9 years) (Table 2). The mean KOOS₄ was 94.3 (range, 87.8–98.6). In the multiple linear regression analysis to detect influencing factor for KOOS₄ at the mid-long term, R^2 was 0.141, and P value was over 0.05 (skeletal maturity: 0.33, Bruckl classification: 0.37, the size of oseochochondral lesion: 0.46). Therefore skeletal maturity, Bruckl classification, and the size of oseochochondral lesion were not predicted to the influencing factor of KOOS₄ at the mid-long term.

4. Discussion

There are several studies dealing with OCD of the knee over five years postoperatively. However, there are very few reports of results of OCD over ten years. An observation period from 0 to 15 years is provided by further working groups.^{16–18} A long-term study by Anderson comprises a time span of 2–20 years.¹⁹ The longest postoperative follow-up term took place in a study by Havulinna after 10–34 years.²⁰

Table 2
KOOS₄ subcategory at the mid-long term.

KOOS				
patient	Pain	Symptoms	ADL	QOL
1	97.2	92.9	100	93.8
2	91.7	92.9	100	87.5
3	100	96.4	100	75
4				
5	94.4	85.7	98.5	81.3
6	100	89.3	98.5	68.8
7	97.2	92.9	100	93.8
8				
9	100	100	100	93.8
10				
11	80.6	89.3	100	81.3
12	94.4	100	97.1	68.8
13				
14	91.7	100	97.1	93.8
15	100	92.9	98.5	100
16	94.4	100	100	100
17	100	100	100	93.8
18	94.4	96.4	97.1	93.8
19	100	100	100	93.8
20	97.2	92.9	94.1	81.3
21	94.4	100	100	100
22	91.7	89.3	95.6	81.3
Mean	95.5	95	98.7	87.9

The follow up term of this study was 11.9 years, therefore it was not so long.

Magnnusen reported that at an average 9 years after surgery, patients did not have symptoms of osteoarthritis pain and had normal function in activities of daily life². However, patients reported significantly lower knee-related quality of life. Operative fixation of OCD loose bodies is a better alternative to lesion excision.

Significantly good result was maintained for the mid-long term result of Lysholm score. On the other hand, Tegner activity scale was deteriorated at the mid-long term result. The reason of the deterioration of Tegner activity scale was considered the change of the environment of each patient. Majority of the all patients was a student at the operation because mean age of operation time was 17.9. However, almost patients did not engage sports because they started working at the mid-long term follow-up. Therefore the Tegner activity scale was deteriorated at the mid-long term result.

Skeletal maturity, preoperative Bruckl classification, and the size of oseochochondral lesion were not predicted to the influencing factor of KOOS₄ at the mid-long term. Therefore, the fixation of OCD lesion using bioabsorbable pins was considered good procedure regardless of skeletal maturity, and the size and the severity of OCD lesion.

One of our hypothesis was affirmed for the good results at mid-long-term, but another hypothesis was not affirmed for the influencing factor for the mid-long term results.

There are some limitations in this study. First, the number of cases were few (only 22 cases), and follow-up periods were short (11.9 years). Secondly, preoperative KOOS was not investigated, therefore longitudinal study of KOOS was not assessed in this study.

Finally, there were no imaging findings, which are important to assess osteoarthritis appearance that is a key aspect when studying such techniques at mid-long-term.

The factor of the deterioration of mid-long term result would be detected according to more cases and longer follow-up. Further investigation was needed in the future.

In summary, the present study demonstrated that the results of fixation of oseochochondral fragment maintained high score in Lysholm score and KOOS₄ at the mid-long term results. Fixation of oseochochondral fragment using bioabsorbable pins contributes good results for a long time regardless of skeletal maturity, the size and the severity of OCD

lesion.

Conflict of interest

None.

References

- Kon E, Vannini F, Buda R, et al. How to treat osteochondritis dissecans of the knee: surgical techniques and new trends: AAOS exhibit selection. *J Bone Joint Surg Am.* 2012;94:1–8.
- Magnussen RA, Carey JL, Spindler KP. Does operative fixation of an osteochondritis dissecans loose body result in healing and longterm maintenance of knee function? *Am J Sports Med.* 2009;37:754–759.
- Ochs BG, Muller-Horvat C, Albrecht D, et al. Remodeling of articular cartilage and subchondral bone after bone grafting and matrix-associated autologous chondrocyte implantation for osteochondritis dissecans of the knee. *Am J Sports Med.* 2011;39:764–773.
- Kadakia AP, Sarkar J. Osteochondritis dissecans of the talus involving the subtalar joint: a case report. *J Foot Ankle Surg.* 2007;46:488–492.
- Lee YK, Lee M, Lee JM. Osteochondral autograft transplantation for osteochondritis dissecans of the scaphoid: case report. *J Hand Surg.* 2011;36:820–823.
- Schenck Jr RC, Goodnight JM. Osteochondritis dissecans. *J Bone Joint Surg Am.* 1996;78:439–456.
- Smillie IS. Treatment of osteochondritis dissecans. *J Bone Joint Surg Br.* 1957;39:248–260.
- Flynn JM, Kocher MS, Ganley TJ. Osteochondritis dissecans of the knee. *J Pediatr Orthop.* 2004;24:434–443.
- Green WT, Banks HH. Osteochondritis dissecans in children. *J Bone Joint Surg Am.* 1953;35:26–47.
- Aichroth P. Osteochondritis dissecans of the knee. *J Bone Joint Surg Br.* 1971;53:440–447.
- Hughston JC, Hergenroeder PT, Courtenay BG. Osteochondritis dissecans of the femoral condyles. *J Bone Joint Surg Am.* 1984;66:1340–1348.
- Anderson AF, Lipscomb AB, Coulam C. Antegrade curettage, bone grafting and pinning of osteochondritis dissecans in the skeletally mature knee. *Am J Sports Med.* 1990;18:254–261.
- Matsusue Y, Nakamura T, Suzuki S, Iwasaki R. Biodegradable pin fixation of osteochondral fragments of the knee. *Clin Orthop Relat Res.* 1996;322:166–173.
- Nakagawa T, Kurosawa H, Ikeda H, Nozawa M, Kawakami A. Internal fixation for osteochondritis dissecans of the knee. *Knee Surg Sports Traumatol Arthrosc.* 2005;13:317–322.
- Collins NJ, Prinsen CA, Christensen R, Bartels EM, Terwee CB, Roos EM. Knee Injury and Osteoarthritis Outcome Score (KOOS): systematic review and meta-analysis of measurement properties. *Osteoarthritis Cartilage.* 2016;24:1317–1329.
- Dexel M, Jehle U. Osteochondrosis dissecans, 10- und Mehrjahresergebnisse. *Der Orthopäde.* 1979;8:120–126.
- Funke E, Munzinger U, Marty M, Drobny T. Operative Langzeitergebnisse der Osteochondrosis dissecans des Kniegelenkes bei Jugendlichen unter 16 Jahren. *Z Unfallchirurg Vers Med Band.* 1994;87:178–185.
- Rodegerdts U, Gleißner S. Langzeiterfahrungen mit der operativen Therapie der Osteochondrosis dissecans des Kniegelenkes. *Orthop Praxis.* 1979;8:612–622.
- Anderson AF, Pagnani MJ. Osteochondritis dissecans of the femoral condyles: long-term results of excision of the fragment. *Am Orthop Soc Sports Med.* 1997;25:830–834.
- Havulinna J, Jokio P, Lindholm TS, Viljanen V, Savilahti S. Long term results of Smillie pin fixation of osteochondritis dissecans in the femoral condyles. *Ann Chir Et Gyn.* 1995;84:71–80.