Original Article With Video Illustration

Direct Bursoscopic Ossicle Resection in Young and Active Patients With Unresolved Osgood-Schlatter Disease

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Purpose: The aim of this study was to determine the outcomes of bursoscopic ossicle excision in young and active patients with unresolved Osgood-Schlatter disease. **Methods:** This retrospective study included 18 male military recruits. A direct bursoscopic ossicle excision was performed using low anterolateral and low anteromedial portals. Outcomes were evaluated using the Lysholm knee score, pain score on a visual analog scale (VAS) (from 0 to 10), and Tegner activity scale score. In addition, patients were asked whether they could kneel or squat and whether they were able to return to their duty after surgery. Patient satisfaction was evaluated using the VAS and by asking whether patients thought that the prominence of the tibial tuberosity was reduced and whether they would recommend the same surgical treatment to others. Complications after surgery were also evaluated. **Results:** The mean Lysholm knee score was 71 preoperatively and improved to 99 after surgery. The mean VAS pain score was 6.5 in the preoperative period and decreased to 0.9 after surgery. In addition, the mean Tegner activity scale score improved from 2.7 preoperatively to 6.2 at final follow-up. However, 4 patients were not able to return to their duty, and 4 patients still had difficulties with kneeling after surgery. A superficial infection occurred in 1 patient, and a recurrent ossicle formation was found in 1 patient. Of 18 patients, 17 were satisfied with their surgical outcomes, and the mean VAS score for patient satisfaction was 8.8. Furthermore, all but 1 patient would recommend the same surgical treatment to others. However, 6 patients did not believe that the prominence of the tibial tuberosity was reduced. **Conclusions:** Bursoscopic ossicle excision showed satisfactory outcomes in selective young and active patients with persistent symptoms. However, bursoscopic surgery showed limitation in reducing the prominence of the tibial tuberosity. **Level of Evidence:** Level IV, therapeutic case series.

Surgical treatment can be indicated for unresolved Osgood-Schlatter disease in the subset of young and active patients even if conservative therapy has traditionally been the treatment of choice.[1-10]

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Osgood-Schlatter disease typically affects preadolescent boys and girls and usually presents with anterior knee pain, tenderness, swelling, and/or prominence over the anterior part of the proximal tibia.[11] It was reported that the symptoms can be resolved either spontaneously or with conservative treatment in most patients.[12] However, there are patients who have persistent symptoms, and the long-term outcomes in patients with Osgood-Schlatter disease have not always been favorable.[3,13-15] Furthermore, unresolved symptoms have been more commonly found in persons involved actively in sports activities, such as athletes and military recruits, and can seriously affect their activity levels.[1,4,9,11,16] Therefore, in this subset of patients, surgical treatment can be indicated to resolve their symptoms and allow resumption of their activities.

Various surgical techniques have been suggested ranging from ossicle resection to fusion.[2,4,5,7,9,10] Most studies have used open surgical techniques. However, we anecdotally observed the delayed resolution of pain and swelling at the surgical sites after open surgical procedures. Furthermore, the surgical scar located in

the anterior knee can cause irritation during kneeling and squatting.

Recently, arthroscopic excision techniques have been introduced. Theoretically, arthroscopic surgical techniques may have advantages in terms of functional recovery and cosmetic appearance. On the contrary, a possible disadvantage of arthroscopic surgery is that arthroscopic excision is limited in terms of tubercleplasty for reducing the prominence caused by Osgood-Schlatter disease. In addition, in the classical arthroscopic approach with standard portals, the intra-articular portion of the infrapatellar fat pad can be violated during resection of the ossicle.[1,4] Thus a direct bursoscopic approach may be more suitable for unresolved Osgood-Schlatter disease to minimize infrapatellar fat pad violation. However, most studies regarding arthroscopic or bursoscopic excision are case reports or technical notes and lack sufficient follow-up results.[1,4,17] Therefore more studies including larger numbers of patients with sufficient follow-up period are needed to confirm the effectiveness and feasibility of bursoscopic surgery in young and active patients with unresolved Osgood-Schlatter disease.

The aim of this study was to determine the outcomes of bursoscopic ossicle excision in young and active patients with unresolved Osgood-Schlatter disease. The hypothesis was that bursoscopic ossicle excision could provide satisfactory outcomes with substantial pain relief and functional recovery without any complications.

Methods

We performed a retrospective review of prospectively collected data. In total, 22 patients who underwent a direct bursoscopic ossicle excision at our hospital from June 2009 to August 2010 were reviewed for eligibility. The inclusion criteria were patients who underwent surgery with more than 2 years' follow-up after surgery. All patients included in this study were military recruits who performed compulsory military service for 2 years. Surgical treatment was considered after 3 months of active conservative treatment with rest, medication, avoidance of active participation in any sports activity, and exemption from training sessions. If a patient's symptoms were not relieved by conservative treatment, we performed surgical treatment with strict indications as follows: (1) visual analog scale (VAS) score greater than 6 during physical activity, (2) focal tenderness over the tibial tuberosity, (3) persistent anterior knee pain since the patient's youth, and (4) presence of an ossicle on radiographs.

Diagnostic Arthroscopy

We performed the diagnostic arthroscopic evaluation using a high anterolateral portal to confirm that there was not any concomitant intra-articular abnormality. In 1 of 18 knees, a small flap tear of the lateral meniscus was found. Therefore we performed partial meniscectomy and then resected the ossicle using a bursoscopic approach.

Fig 1. Diagnostic arthroscopy was performed using a single high anterolateral portal (H-AL). Then, direct bursoscopic approach was performed using low anterolateral (L-AL) and low anteromedial (L-AM) portals, and these portals were created 1 cm lateral and 1 cm medial to the tendon borders, respectively.

Formation of Low Anterolateral and Low Anteromedial Portals

We used low anterolateral (L-AL) and low anteromedial (L-AM) portals separately to perform ossicle excision. First, the soft spot between the lateral border of the patellar tendon and the anterior surface of the tibia, just medial to the Gerdy tubercle, was identified. Then, the L-AL portal was created 1 cm lateral to the lateral border of the patellar tendon (Fig 1). We created a soft-tissue tunnel using a straight mosquito clamp. After the mosquito clamp was inserted into the bursa space, the space was preliminarily expanded by the clamp. An arthroscopic sheath with a blunt trocar was introduced through the L-AL portal, and then the trocar was exchanged for the arthroscope. The L-AM portal could be created using the transillumination technique or outside-in technique using a spinal needle. By using the L-AL and L-AM portals separately, we could minimize injury to the intra-articular portion of the infrapatellar fat pad.

Resection of Ossicle and Tubercleplasty

The arthroscope was introduced through the L-AL portal while a motorized shaver was inserted through the L-AM portal (Video 1, available at www.arthroscopyjournal.org). The working space could be created after resection of some of the bursa and fat tissue. To maximize the working space by relaxing the patellar tendon, the knee should be extended during bursoscopic surgery. Bursoscopic debridement of the

Fig 2. Low anteromedial portal placement was easily determined using a transillumination technique after creation of the low anterolateral portal.

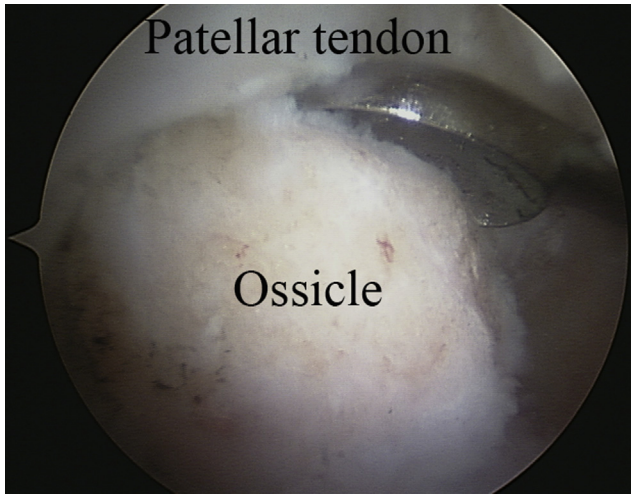

Fig 4. The anterior border of the ossicle was dissected with curettes.

soft tissue around the ossicle was performed, and the ossicle and posterior surface of the patellar tendon were then clearly identified (Fig 2). A 70° arthroscope can be used if available to improve the arthroscopic view. The ossicle was always partly embedded in the tendon and was detached from the tendon by blunt and sharp dissection. The proximal aspect of the ossicle was debrided with a radiofrequency device, and the anterior aspect was dissected with curettes (Fig 3). After dissection of the proximal aspect, anterior aspect, and both sides of the ossicle, the junction of the anterior aspect of the proximal tibia and the ossicle was elevated using a Liberator Knife (ConMed Linvatec, Largo, FL) (Fig 4). After complete dissection of the ossicle, it was extracted through the enlarged L-AM portal using the mosquito clamp. Contouring of the irregular surface of the tibial tubercle was performed with a motorized burr (Figs 5 and 6). A vacuum drainage was placed through the L-AL portal before the portals were closed. The drainage was used to prevent hematoma formation caused by bone bleeding from the trimmed surface of the tibial tubercle.

Postoperative Protocol

Patients were allowed to perform tolerable range of motion, full weight bearing, and quadriceps-strengthening exercise immediately after surgery. The vacuum drainage was removed 1 day after surgery without specific criteria regarding removal of the drain. Return to strenuous activity and military duty was recommended at 6 weeks after surgery.

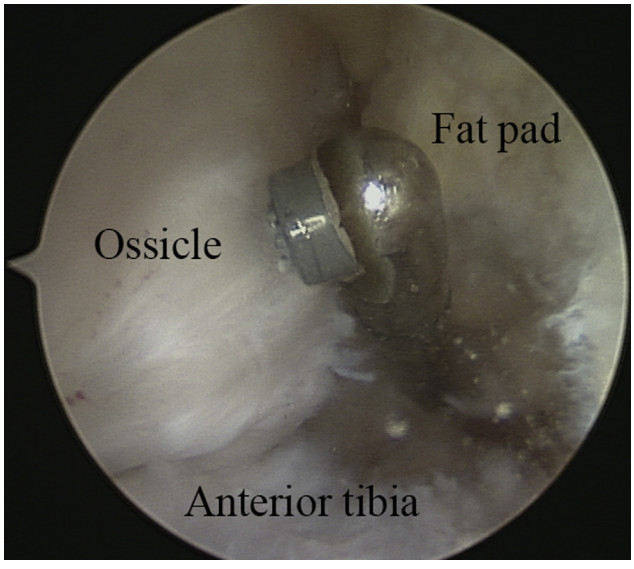

Fig 3. An ossicle embedded in the patellar tendon was clearly identified, and dissection of the ossicle began with debridement of its proximal aspect with a radiofrequency device.

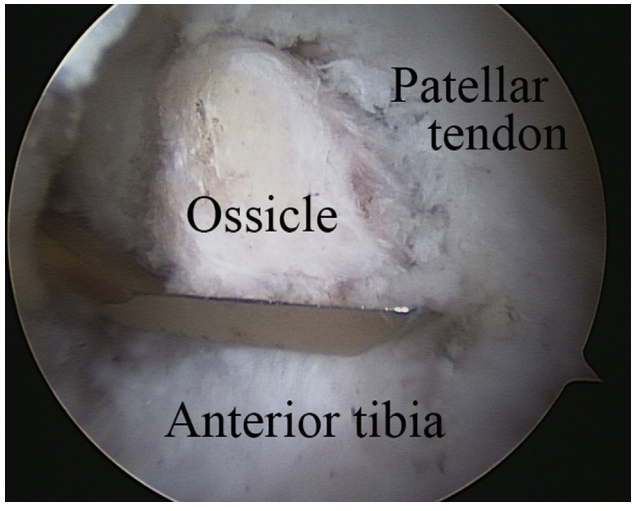

Fig 5. For the final step in dissection of the ossicle, the junction between the ossicle and the anterior aspect of the proximal tibia was detached with a Liberator Knife.

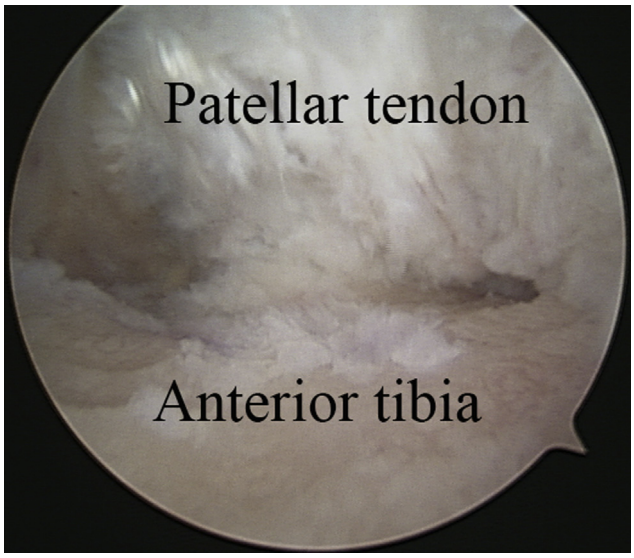

Fig 6. After the ossicle was successfully removed, the prominence of the tibia was trimmed with a motorized burr.

Data Analysis

Clinical data were collected by an independent investigator. Patient evaluations were performed preoperatively and postoperatively at 1, 3, 6, and 12 months, as well as every 1 year thereafter. Clinical outcome was evaluated using the Lysholm knee score, and the degree of pain was measured using a numerical VAS (from 0 to 10). The functional status was examined using the Tegner activity scale and by asking whether patients could kneel or squat after surgery and whether they were able to return to their duty. In addition, patient satisfaction was evaluated using a numerical VAS (from 0 to 10, where 0 indicates very dissatisfied and 10 indicates very satisfied) and by asking whether patients thought that the prominence of the tibial tuberosity was reduced and whether they would recommend the same surgical treatment to others who have Osgood-Schlatter disease. We also evaluated complications or adverse events, such as postoperative infection and residual ossicle, after surgery.

Statistical analysis was performed with SPSS software for Windows (version 18.0; SPSS, Chicago, IL). The outcome data including the Lysholm knee score, Tegner activity scale score, VAS pain score, and VAS satisfaction score were summarized using means and standard deviations, and preoperative and postoperative outcomes were compared. The statistical significance of the difference between the preoperative and postoperative scores was determined with the paired *t* test. For patient satisfaction, patients with a VAS score of 8 and greater were considered satisfied with the surgical outcome. The functional evaluations of the ability to kneel and squat after surgery, as well as return to military duty, were conducted using the counts and proportions of patients. The statistical significance of the difference between the results of the preoperative and postoperative evaluations was determined with the McNemar test.

Results

Initially, 22 patients had undergone bursoscopic ossicle excision. Of these patients, 4 were excluded because their follow-up period was less than 2 years after surgery. Finally, 18 patients (18 knees) were included in this study. All patients were men with a mean age of 21 years (range, 19 to 24 years; SD, 1.7 years). The mean follow-up period was 45 months (range, 24 to 54 months; SD, 1.6 months).

All patients showed substantial improvement in terms of pain and function, whereas a subset of patients were not able to return to their duty or had difficulties with kneeling after surgery. The mean VAS pain score was 6.5 in the preoperative period and decreased to 0.9 after surgery ($P < .001$). In addition, the mean Tegner activity scale improved from 2.7 preoperatively to 6.2 at final follow-up ($P < .001$) (Table 1). However, 4 patients (21%) were not able to return to their duty, and 4 patients (21%) still had difficulty with kneeling after surgery. A superficial infection developed in 1 patient and was subsequently managed by intravenous antibiotic treatment. There were no ossicles remaining on postoperative radiographs immediately after surgery. However, focal haziness, which may be regarded as indicating recurrent ossicle formation, was found on follow-up radiographs in 1 patient even though it did not cause recurrence of symptoms.

Seventeen of 18 patients were satisfied with their surgical outcomes; however, 6 patients (33%) did not believe that the prominence of the tibial tuberosity was reduced, and 4 patients were not able to return to kneeling and squatting activities. The mean VAS satisfaction score was 8.8 (range, 4 to 10; SD, 1.4) after surgery. Furthermore, all but 1 patient would recommend the same surgical treatment to others who have Osgood-Schlatter disease.

Table 1. Results of Bursoscopic Ossicle Excision

Parameter	Preoperative	Postoperative	*P* Value
Lysholm knee score, mean ± SD	71 ± 8.2	99 ± 2.2	<.001
Tegner activity scale score, mean ± SD	2.6 ± 0.6	6.2 ± 0.5	<.001
VAS pain score (0-10), mean ± SD	6.5 ± 0.9	0.9 ± 1.2	<.001
No. of patients who could squat	1 (0.6%)	16 (89%)	<.001
No. of patients who could kneel	1 (0.6%)	14 (78%)	.001

VAS, visual analog scale.

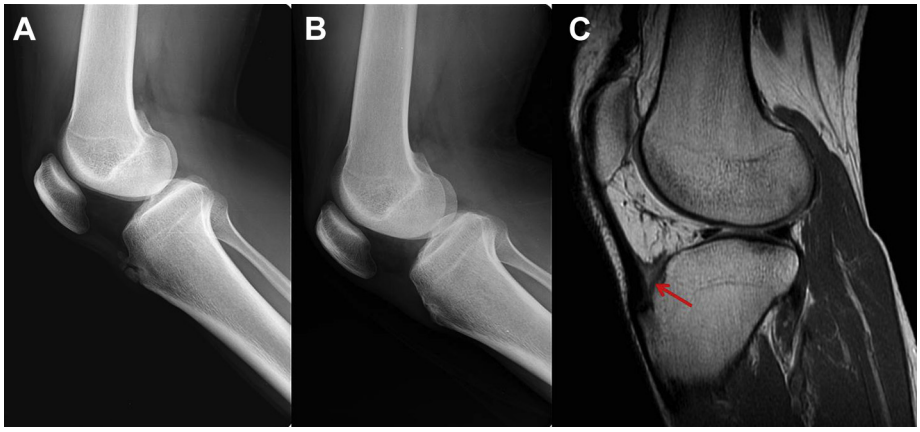

Fig 7. (A, B) We confirmed successful removal of the ossicle on radiographs, and (C) postoperative magnetic resonance imaging showed that there was minimal scar formation around the patellar tendon insertion without violation of the intra-articular portion of the infrapatellar fat pad (arrow).

Discussion

The purpose of this study was to determine the outcomes of bursoscopic ossicle excision in young and active patients with unresolved Osgood-Schlatter disease in terms of pain relief, functional recovery, complications, and patient satisfaction. The principal finding was that patients who underwent bursoscopic ossicle excision showed substantial pain relief and recovery of function even though 4 of 18 patients were not able to return to kneeling and squatting activities.

Our findings support the hypothesis that bursoscopic excision of an ossicle would show satisfactory outcomes in terms of pain relief and functional recovery. Multiple surgical options have been described in the literature, including ossicle excision and tubercleplasty, drilling of the tibial tubercle, bone peg insertion to induce fusion, and removal of the loose fragment, with variable functional outcomes.[2,6,8,10] Recently, arthroscopic excision techniques were reported.[1,4] Arthroscopic surgery may have advantages because diagnostic arthroscopy can be performed. We also found 1 concomitant intra-articular abnormality in our study even though the patient's symptoms and signs were the same as those of other patients. In contrast to previous studies, we used a direct bursoscopic approach. The bursoscopic approach has several advantages over the classical arthroscopic approach because there is no need to perform an anterior interval release. In the classical arthroscopic approach, the anterior horn of the meniscus and/or intermeniscal ligament can be damaged.[4] Most of all, the intra-articular portion of the infrapatellar fat pad will be violated in classical arthroscopic surgery, and this can cause scar formation and discomfort after surgery. In contrast, 1 possible disadvantage of bursoscopic surgery is that the working space can be limited. Thus we created the portals 1 cm from the tendon borders to obtain a sufficient working space and avoid instrument crowding.

Caution should be used in applying bursoscopic surgery in patients without any definite ossicle or with severe prominence of the tibial tuberosity. In this study some patents showed difficulties in kneeling (21%), and 33% of the patients did not think that the prominence of the tibial tuberosity was reduced. Krause et al.[11] emphasized the importance of a prominent tibial tuberosity and its implication leading to difficulty in kneeling. In addition, Flowers and Bhadreshwar[6] reported that 95% of patients showed pain relief and 86% reported relief from the prominence of the tibial tuberosity after excision of the prominent tibial tuberosity with removal of any osteocartilaginous material. We were able to trim the spur-like prominence using a motorized burr around the ossicle (Figs 6 and 7). However, bursoscopic surgery was probably inadequate to reduce the prominence of the tuberosity itself. Therefore the findings suggest that bursoscopic excision may have a limited role in addressing the symptoms generated by the prominence of the tibial tuberosity. On the other hand, among the surgical indications that we used, focal tenderness at the site of the ossicle is most important in our opinion. It was reported that the key factors for successful surgery were clear visualization of the separated ossicle on a lateral radiograph and sliding movement of the ossicle on physical examination.[7] We agree with the indications of the previous study, and we believe that surgical treatment should not be indicated for a patient with diffuse anterior knee pain, which can be 1 of the symptoms of other disease entities such as chondromalacia patellae.

Limitations

This study has several limitations to be considered. First, a relatively small number of patients was included in this study. However, in considering that most previous studies on arthroscopic treatment of Osgood-Schlatter disease were case reports or technical notes, the volume of 18 patients is relatively large. Second, there was no control group consisting of patients who underwent conservative treatment or open surgery. Thus we were not able to compare the results between

bursoscopic surgery and other treatment options. However, we performed the study in a relatively large number of patients with a mean follow-up period of 45 months. Thus we believe that this study can provide valuable information to the reader regarding the results of bursoscopic surgical treatment of unresolved Osgood-Schlatter disease. Third, all patients included in this study were military recruits who were performing compulsory military service. Their activity levels were not the same as those of the general population; thus caution should be used when applying our results to other populations with different activity levels.

Conclusions

Bursoscopic ossicle excision showed satisfactory outcomes in selective young and active patients with persistent symptoms. However, bursoscopic surgery showed limitation in reducing the prominence of the tibial tuberosity.

References

1. Beyzadeoglu T, Inan M, Bekler H, Altintas F. Arthroscopic excision of an ununited ossicle due to Osgood-Schlatter disease. *Arthroscopy* 2008;24:1081-1083.
2. Binazzi R, Felli L, Vaccari V, Borelli P. Surgical treatment of unresolved Osgood-Schlatter lesion. *Clin Orthop Relat Res* 1993:202-204.
3. Cakmak S, Tekin L, Akarsu S. Long-term outcome of Osgood-Schlatter disease: Not always favorable. *Rheumatol Int* 2014;34:135-136.
4. DeBerardino TM, Branstetter JG, Owens BD. Arthroscopic treatment of unresolved Osgood-Schlatter lesions. *Arthroscopy* 2007;23:1127.e1-1127.e3. Available at www.arthroscopyjournal.org.
5. El-Husseini TF, Abdelgawad AA. Results of surgical treatment of unresolved Osgood-Schlatter disease in adults. *J Knee Surg* 2010;23:103-107.
6. Flowers MJ, Bhadreshwar DR. Tibial tuberosity excision for symptomatic Osgood-Schlatter disease. *J Pediatr Orthop* 1995;15:292-297.
7. Nierenberg G, Falah M, Keren Y, Eidelman M. Surgical treatment of residual Osgood-Schlatter disease in young adults: Role of the mobile osseous fragment. *Orthopedics* 2011;34:176.
8. Orava S, Malinen L, Karpakka J, et al. Results of surgical treatment of unresolved Osgood-Schlatter lesion. *Ann Chir Gynaecol* 2000;89:298-302.
9. Pihlajamaki HK, Mattila VM, Parviainen M, Kiuru MJ, Visuri TI. Long-term outcome after surgical treatment of unresolved Osgood-Schlatter disease in young men. *J Bone Joint Surg Am* 2009;91:2350-2358.
10. Weiss JM, Jordan SS, Andersen JS, Lee BM, Kocher M. Surgical treatment of unresolved Osgood-Schlatter disease: Ossicle resection with tibial tubercleplasty. *J Pediatr Orthop* 2007;27:844-847.
11. Krause BL, Williams JP, Catterall A. Natural history of Osgood-Schlatter disease. *J Pediatr Orthop* 1990;10:65-68.
12. Weiler R, Ingram M, Wolman R. 10-Minute consultation. Osgood-Schlatter disease. *BMJ* 2011;343:d4534.
13. Baltaci G, Ozer H, Tunay VB. Rehabilitation of avulsion fracture of the tibial tuberosity following Osgood-Schlatter disease. *Knee Surg Sports Traumatol Arthrosc* 2004;12:115-118.
14. Ishida K, Kuroda R, Sato K, et al. Infrapatellar bursal osteochondromatosis associated with unresolved Osgood-Schlatter disease. A case report. *J Bone Joint Surg Am* 2005;87:2780-2783.
15. Kaya DO, Toprak U, Baltaci G, Yosmaoglu B, Ozer H. Long-term functional and sonographic outcomes in Osgood-Schlatter disease. *Knee Surg Sports Traumatol Arthrosc* 2013;21:1131-1139.
16. Ross MD, Villard D. Disability levels of college-aged men with a history of Osgood-Schlatter disease. *J Strength Cond Res* 2003;17:659-663.
17. Wysokinska A. Rehabilitation after bursoscopic treatment of Osgood-Schlatter disease—Preliminary report. *Ortop Traumatol Rehabil* 2007;9:423-428.