

# Results of Resection of Medial Patellar Plica through a Supero-lateral Portal as a Main Arthroscopic Procedure

## Výsledky resekce medio-patelární pliky přes suprapaterální port jako hlavní artroskopický výkon

P. JEMELIK<sup>1</sup>, A. E. STROVER<sup>2</sup>, G. EVANS<sup>3</sup>

<sup>1</sup> Research Fellow at London Knee Clinic, London Bridge Hospital  
Trauma and Orthopaedic Dept, Silesian Hospital Opava

<sup>2</sup> Droitwich and London Knee Clinic, England

<sup>3</sup> London Knee Clinic, England

### ABSTRACT

#### PURPOSE OF THE STUDY

The aim of this study was to evaluate the results of resection of Medial Patellar Plica of the knee. The criteria for inclusion was that resection of the Medial Patellar Plica was the main arthroscopic intervention performed.

#### MATERIAL

From 1<sup>st</sup> January 2002 to 31<sup>st</sup> December 2006, 1408 arthroscopies of the knee were carried out at the London Knee Clinic, London Bridge Hospital without the use of a tourniquet. In all cases of Medial Patellar Plica the Plica was observed through a supero-lateral portal as well as the standard portals. 53 knees fulfilled the criteria, of which 35 knees were traced and included in the study with an average follow-up period of 23.7 months. Typically patients were between the ages of 20-30 and engaged in sporting activities.

#### METHODS

Age, sex, symptoms (onset and duration), VAS (Visual Analogue pain Scale from 1 to 10) before and after operation, return to sporting activity and patient's subjective evaluation of the result were recorded in 31 patients (35 knees).

#### RESULTS

The average period of symptom duration prior to the operation was 18.6 months (minimum 2 months). The mean follow-up period was 23.7 months from operation (8-67 months), average VAS score was 6 points before surgery, and 2 points after surgery (0- no pain, 10 excruciating pain). Mean improvement was 4 points. 34 % of patients were totally pain free after arthroscopic resection (0 point on VAS). 65.8% returned to the same level of sporting activity as occurred before the onset of knee problems. When asked whether they would undergo the same procedure on the other knee 72 % replied positively.

#### DISCUSSION

Despite numerous publications about knee Plicae describing their anatomical and patho-physiological characteristics, there are still some arthroscopists who do not believe in their significance as a pathological entity and the diagnosis of Plica Syndrome remains controversial. The success of arthroscopic resection of one or more Plicae in most previous studies is rated on the scale excellent, good, poor, and very poor. The present study focuses on the type of Plica which is most frequently pathological, that is the Medial Patellar Plica and evaluates the outcome of surgery in terms of VAS score, return to sporting activity and the patient's satisfaction with treatment.

#### CONCLUSION

Plicae are common anatomical structures, which sometimes become symptomatic. When pathological, they can give rise to quite disabling patello-femoral symptoms as well as participating in the acceleration of arthritic changes. In order to evaluate the Medial Patellar Plica properly including its involvement in patello-femur disorders, it is essential to examine the knee through a supra-patellar portal and to undertake dynamic examination of the knee in various degrees of flexion and extension. Resection of pathological Medial Patellar Plica is a successful procedure giving good results in a majority of patients with return to sporting activities. In some cases however, symptoms persist at a lower intensity even after their resection so that the sporting activity has to be reduced in the long term.

**Key words:** Plica syndrome, shelf syndrome, synovial membrane, Plica medio-patellaris, medial patellar Plica.

## INTRODUCTION

Plica Supra-patellaris (supra-patellar septum, superior Plica, septum-like folds), Medial Patellar Plica (MPP) (also called Plica synovialis, Plica medio-patellaris, Aoki's ledge, Iino's band, Plica alaris, synovial shelf, patellar meniscus), (see Fig. 1–4), Plica Infra-patellaris (also called ligamentum mucosum, Plica synovialis patellaris) and Plica Lateralis are normal, anatomical structures of the knee joint, which sometimes become symptomatic.

Early reports on synovial Plicae date back to the 16th century when Andre Vesalius, a Belgian physician and anatomist was the first to describe the Infra-patellaris Plica. In 1918, Mayeda and in 1934 Iino stated that Plica could account for intra-articular disorders. In 1950, Pipkin wrote a seminal work about Plicae. Further attention was paid to Plica and their effects in the 1970s when the use of arthroscopy became more general (Hardaker, Sakakibara, Patel, Dupont, Aoki).

Plicae are remnants of the incomplete resorption of the mesenchymal tissue that divides the components of the knee in the 8-month embryo.

The existence of Plicae is indisputable but controversy remains concerning their pathology, their effects on other structures and the progression of arthritis (5). Most of our knowledge of Plicae now comes from arthroscopic observations. However most of the studies that have been reported have relatively low numbers and there are differing nomenclatures in current use and different surgical approaches so that there is no uniform method of description of Plicae in the current literature.

The reported incidence of Plica Infra-patellaris is 60–80 % (65 % (1), 85 % (30) and it is rarely pathological. The incidence of Plica Supra-patellaris is 50 % (55 % (6), 58 % (9), medio-patellaris around 25 % (6) (30 % (24), 13.5 % (17), 29 % in our group of patients), Plica Laterallis about 1 % (6, 30).

Dupont et al. found the absence of all types of Plicae in only 10% knees in 200 cadaveric specimens (6). Medial Plica syndrome affects about 1 in 10 patients with a Plicae medio-patellaris and is seen in 3–7 % of arthroscopies (6, 26, 14). The prevalence of supra- and medial Plica syndrome is highest in young people of both sexes in the 2<sup>nd</sup> and 3<sup>rd</sup> decade, but children can also be affected (Plica syndrome as the most frequent reason of persistent anterior knee pain in preadolescents (7, 13).

Pathological Plicae cause a number of symptoms, which gave rise to the term: “Plica syndrome”, most frequently used to describe MPP pathology. Disorders occur spontaneously or after a minor injury with delayed onset of several months.

Non-specific pain is localised around the patella and adjacent area, occasionally with click or clunk in flexion. Symptoms imitate patella-femoral disorders, namely pain on kneeling, squatting, climbing and descending stairs as well as pain on long-term flexion, a sensation of instability and giving-way (due to reflex inhibition of quadriceps muscle), locking, stiffness, swelling, atrophy

of m. quadriceps (1–2 cm in 50 % knees reported by some studies /26/).

Examination methods are as specific as they can be with non-specific symptoms. The “MPP test” (18) may be helpful in pathological medio-patellar Plica: pressure applied to the infero-medial part of the patello-femoral joint causes pain in extension, which disappears in flexion up to 90 degrees.

The main methods used in imaging are ultrasound and MRI. Magnetic resonance allows the detection of and evaluation of the size of Plicae more easily when an effusion is present or alternatively 40 ml of saline can be injected into the knee as a contrast medium (see Fig. 5–8) This is best viewed in T2-weighted transaxial images. A high degree of correlation with subsequent arthroscopic classification of MPP type can be achieved (18).

## MATERIALS AND METHODS

1408 knee arthroscopies were performed during a 5 year period from January 2002 to December 2006. 53 knees fulfilled the study criteria (3.8 %) – resection of MPP as the main arthroscopic intervention. The follow-up was obtained from 35 knees of 31 patients of which the study was comprised. Mean follow-up was 23.7 months after operation.

All patients were examined through at least two arthroscopic portals which in all cases included a supero-lateral portal without the use of a tourniquet. The supero-lateral portal is essential for proper visualisation of MPP and in all cases arthroscopic examination of the knee while undertaking dynamic flexion and extension was performed. Impingement of a MPP occurs during 30–90 degrees of flexion, impingement of Plica Supra-patellaris occurs up to 70 degrees (27). Thirty one patients were traced with 35 affected knees with an average follow-up of 23.7 months. Patients with any other pathology of the knee including cartilage lesions, meniscal pathology, ligament disorders, knee instability, patellar maltracking, previous reconstructive operations or where their main “Plica pathology” was due to a Plica other than Medial Patellar Plica were excluded. We recorded the age and sex of the patients, the VAS before and after operation, their other symptoms of pathological MPP, its duration and character, and their return to previous sporting activity.

## RESULTS

Of 31 patients, there were 12 women (38.7 %) with an average age of 29.8 years and 19 men (61.3 %) with an average age of 32.4 years. The average duration of symptoms prior to operation was 18.6 months (minimum 2 months).

The average score on the VAS before operation was 6 points and following surgery this fell to 2 points (0 = no pain, 10 = excruciating pain). The average improvement in VAS was 4 points. 34 % of patients were totally pain free (0 points on VAS). 65.8 % of patients returned to the same level of sporting activity as they



Fig. 1. Classification of MPP-Sakakibara A – cord-like elevation of the synovium

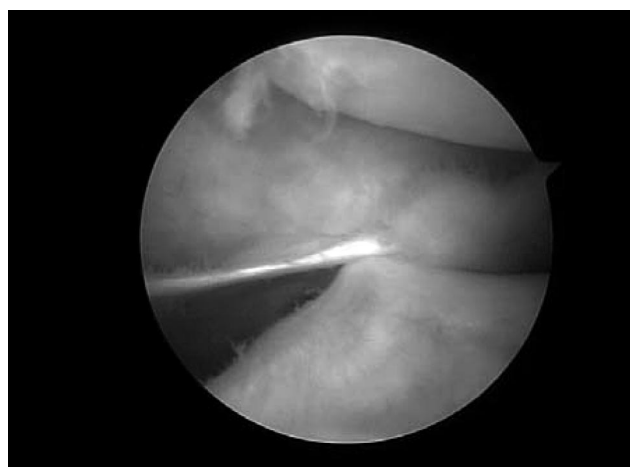


Fig. 2. Classification of MPP-Sakakibara B – shelf of synovium, not wide enough to cover medial femoral condyle

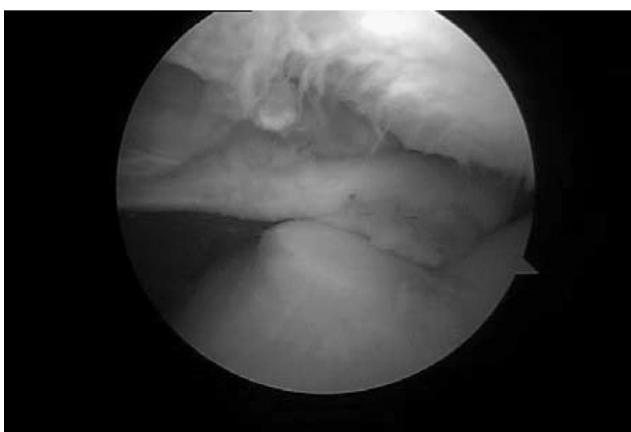


Fig. 3. Classification of MPP-Sakakibara C – a wide shelf covering the med. fem. condyle to a variable extent



Fig. 4. Classification of MPP-Sakakibara D – a shelf with 2-3 pedunculated tags

*Some MRI views of MPP:*

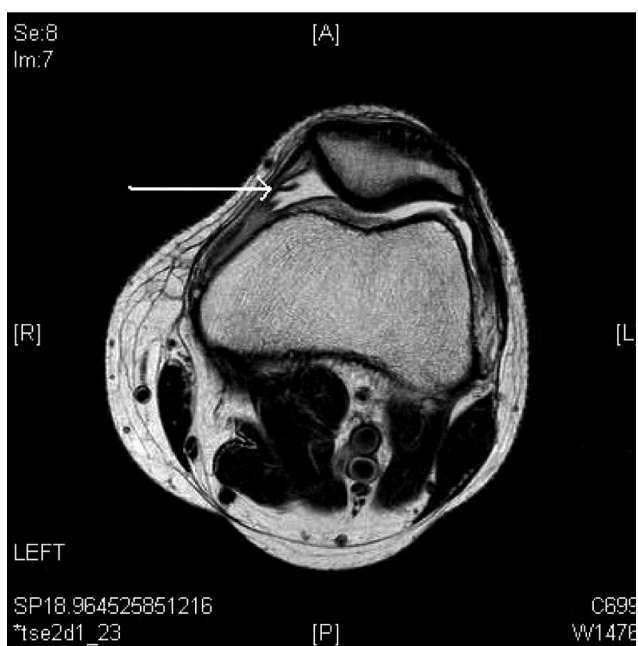


Fig. 5



Fig. 6



Fig. 7



Fig. 8

Fig. 9. The position of the supralateral portal must be at least 1 cm proximal to the upper pole of the patella



had been doing before the knee problems started. When asked whether they would undergo the same procedure on the other knee, 72 % gave a positive answer. 14 % (5 knees) had a previous negative arthroscopy history.

There was a wide range of symptoms reported mostly affecting the patello-femur joint (see Table 1). They often occurred following a minor injury with in some cases a delay of several weeks to several months after injury. A “giving-way” sensation was often reported due to chronic reflex inhibition of the quadriceps muscle.

## DISCUSSION

Plicae, as with all anatomical structures, can become pathological in a variety of ways which includes trauma such as a bucket-handle tear (15), fibrosis and cal-

cification (22) and non-traumatic problems including synovitis, bleeding (31) and hypertrophy of the Plicae. Plicae are often misdiagnosed as they give rise to symptoms that can be mistaken for other problems in the knee. (Broom and Fulkerson (2) made a pre-operative diagnosis of a lesion of medial meniscus in 50 % of pathological Plicae, Hardaker et al (11) made a pre-operative diagnosis of meniscal lesions in 15 % and chondromalacia patellae in 38 % of patients subsequently shown to have Plicae.)

As well as other pathological intra-articular structures Plicae are involved the acceleration of arthritic deterioration (10, 12, 19, 20, 21, 23, 29). The aetiology and patho-physiology articular cartilage changes in relation to Plicae still remains unknown and is the object of further investigation.

Pathological MPP is associated with an increased incidence of cartilage lesions, mainly in the lower patella and the non-weight bearing medial part of medial femoral condyle (3). Larger Plicae have a higher incidence of lesions, but the correlation between the size of Plica and the size of lesions is poor, and the influence of Plica resection on cartilage recovery was not proved. It is also clear that factors other than simple mechanical impingement of the Plica give rise to pathological changes on the cartilage (3, 24).

Non-pathological Plica is a soft synovial structure, which contains synovial cells, abundant blood vessels and collagen fibres, but no elastic fibres. Increasing pathology leads to fibrosis, vascularisation and numerous inflammatory cells (8). The occurrence of calcification, hyalinisation and cartilage metaplasia is also described (26). Pathological Plica also contain a high number of



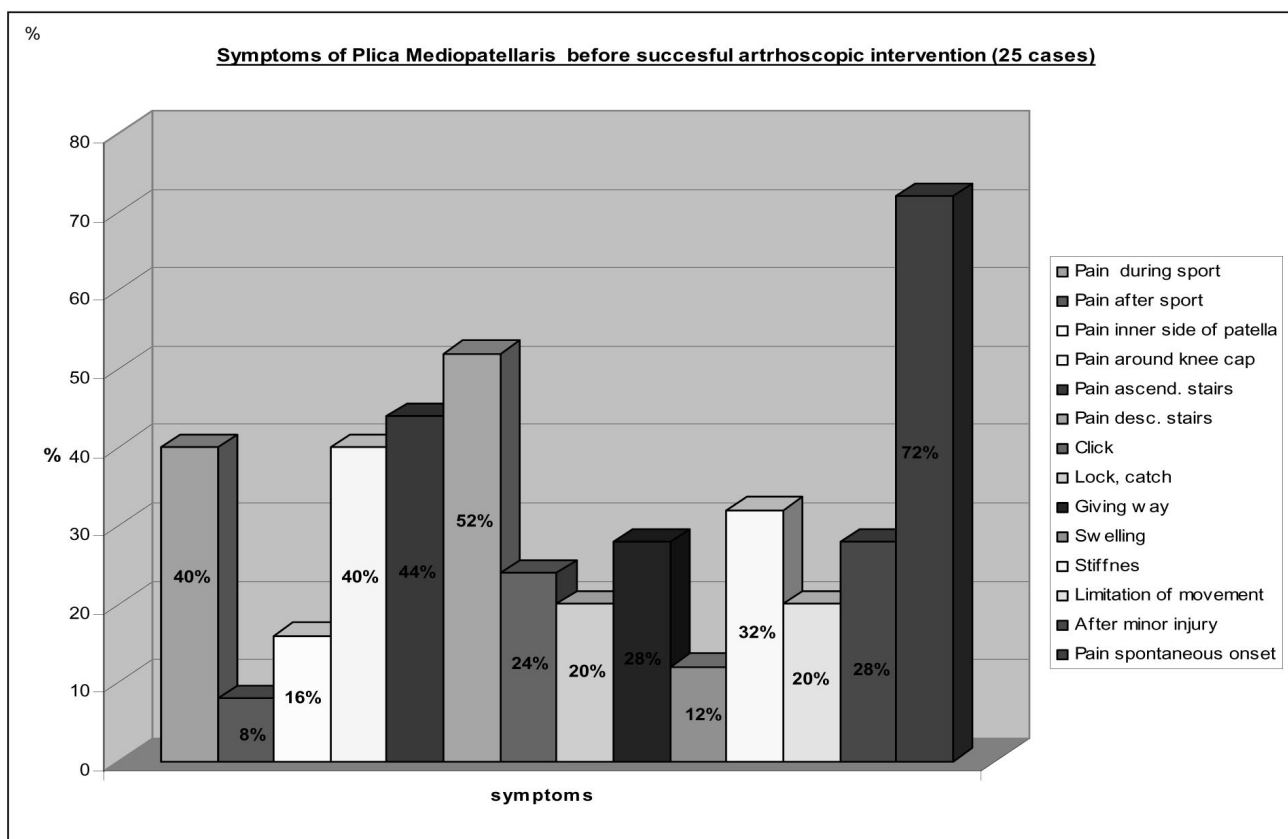


Table 1

sensory nerves, which decrease pain threshold and increase sensitivity (6)- and may induce an ongoing higher level of sensitivity after excision. With increasing age Plicae become more rigid (increased fibre content ratio) (24) and reduce in size (abrasion phenomenon?) (25).

The rate of successful conservative treatment of Plica syndrome is below 20 % (11). The success of arthroscopic excision of pathological MPP is not uniform in the literature and is variously quoted as 65 % (32), 75 % (4, 11), and 90 % (9). The success rate falls quite dramatically when other pathology is present in the knee joint (40 %) (6). Excision of retinacular bands underneath the Plica may improve the outcome in the treatment of Plica syndrome (32). In this present study it was clear that minor symptoms persist in some patients even after removal of the MPP. While 72 % were satisfied with the results of treatment only 34 % were totally pain free.

With correct diagnosis and adequate excision, relief of symptoms occurs within 2–4 weeks after arthroscopy in the majority of cases of MPP, if not the diagnosis should be reconsidered. We agree with the statement that un-diagnosed patellar maltracking is the most frequent reason of poor outcomes of Plica resection (30).

## CONCLUSION

Although Plicae have often been dismissed as a cause of symptoms in the past we are now beginning to understand their true significance. Their existence was at one time denied by many senior arthroscopists, who were unable to see Plicae from 2 standard portals especially when using a tourniquet, which makes the access to supero-lateral portal difficult. However they are now well documented in the literature as a cause of knee pain. On the other hand their significance has been overestimated by others as there is a considerable subjectivity of in the evaluation of pathological findings. The term Plica Syndrome has also been misused in diagnostic dilemmas. In our opinion, only a view from a supero-lateral portal (Fig. 9) provides a sufficient spatial visualisation of the patella and trochlea and their relation to other surrounding structures including a dynamic examination during flexion, to reach a firm conclusion on the significance or otherwise of a Plica. Thus more information is required to confirm or exclude the diagnosis of a pathological Plica than is available through conventional arthroscopic portals. It is clear from our experience that in a majority of cases excellent symptomatic

relief is obtained by removal of pathological Plicae. In some cases however, symptoms persist at a lower intensity even after their resection so that the sporting activity has to be reduced in the long term.

## References

1. BOLES, C. A., BUTLER, J., LEE, J. A., REEDY, M. L., MARTIN, D. F.: Magnetic Resonance Characteristics of Medial Plica of the Knee, Correlation with Arthroscopic Resection. *J. Comput. Assist. Tomogr.*, 28: 397–401, 2004.
2. BROOM, M. J., FULKERSON, J. P.: The Plica Syndrome: A new perspective. *Orthop. Clin. N. Amer.*, 17: 279–281, 1986.
3. CHRISTOFORADIKIS, J. J., BALLESTER, J., HUNT, N., THOMAS, R., STRACHAN, R. K.: Synovial shelves of the knee: association with chondral lesions. *Knee Surg. Sports Traumatol. Arthrosc.*, 14: 1292–1298, 2006.
4. DORCHAK, J. D., BARRACK, R. L., KNEISL, J. S., ALEXANDER, A. H.: Arthroscopic treatment of symptomatic plica of the knee. Long-term follow-up. *Amer. J. Sports Med.*, 19:503–7, 1991.
5. DUFEK, P., PINK, M.: Diagnosis and treatment of the so-called plica syndrome of the knee joint. *Acta Chir. orthop. Traum. čech.*, 48:17–521, 1981.
6. DUPONT J. Y.: Synovial plicae of the knee. Controversies and review. *Clin. Sports Med.*, 16:87–121, 1997.
7. FARAJ, A. A., SHILDERS, E., MARTENS, M.: Arthroscopic Findings in the Knees of Preadolescent Children: Report of 23 Cases. *Arthroscopy*, 16: 793–795, 2000.
8. FARKAS, C., HARGITA I., Z., GASPARI, L., KUKI, A., CSERNATONY, Z., SZEPESI, K.: Histological changes in the symptomatic mediopatellar plica. *The Knee*, 11:103–108, 2004.
9. GURBUZ, H., CALPUR, O. U., KUTOGLU, T., MESUT, R.: The Synovial Plicae in the Knee. *Jt. Saudi Med. J.*, 27:1839–1842, 2006.
10. HANDL, M., TRČ, T., HANUS, M., ŠTASTNÝ, E., FRIČOVÁ-POULOVÁ, M., NEUWIRTH, J., ADLER, J., HAVRÁNOVÁ, D., VARGA, F.: Therapy of severe chondral defects of the patella by autologous chondrocyte implantation. *Acta Chir. orthop. Traum. čech.*, 73:373–9, 2006.
11. HARDAKER, W. T., WHIPPLE, T. L., BASSET, F. H.: Diagnosis and treatment of the plica syndrome of the knee. *J. Bone Jt Surg.*, 63:221–5, 1980.
12. HART, R., KREJZLA, J., ŠVÁB, P.: Accurate placement of bone tunnels in reconstruction of the anterior cruciate ligament – a contribution of computer-assisted navigation. *Acta Chir. orthop. Traum. čech.*, 74: 118–25, 2007.
13. HAVLAS, V., TRČ, T., RYBKA, J.: Arthroscopy of the knee joint in childhood. *Acta Chir. orthop. Traum. čech.*, 71:152–156, 2004.
14. HEHL, G., LUNIG, H., STRECKER, W., BECKER, U., KINZL, L.: Plica syndrome as a cause of recurrent knee complaints. *Unfallchirurg*, 101:440–5, 1998.
15. KERIMOGLU, S., CITLAK, A., CAVUSOGLU, S., TUTHAN, A. U.: Bucket-handle tear of medial plica. *The Knee*, 12:239–241, 2005.
16. KIM, S.-J., JEONG, J.-H., CHEON, Y.-M., RYU, S.-W.: MPP Test in the Diagnosis of Medial Patellar Plica Syndrome. *Arthroscopy*, 20: 1101–1103, 2004.
17. KLEIN, W.: The medial shelf of the knee: A follow-up study. *Arch. Orthop. Trauma Surg.*, 102:67–72, 1983.
18. KOBAYASHI, Y., MURAKAMI, R., TAJIMA, H., YAMAMOTO, K., ICHIKAWA, T., MASE, I., KUMAZAKI, T.: Direct MR arthrography of plica synovialis mediopatellaris. *Acta Radiol.*, 42:286–290, 2001.
19. KRÍŽ, J., JEHLIČKA, D., NOVÁK, P.: Infectious complications after arthroscopic replacement of the cruciate. *Acta Chir. orthop. Traum. čech.*, 72:28–31, 2005.
20. LUBOJACKÝ, J.: Tibial tubercle avulsion fracture – an original method of fragment fixation by K-wires. *Acta Chir. orthop. Traum. čech.*, 73:403–404, 2006.
21. MUSIL, D., FILIP, L., VODIČKA, Z.: Reconstruction of the anterior cruciate ligament: comparison of patellar Bone-Tendon-Bone and hamstring tendon graft methods. Part 1. Evaluation of patients treated by the patellar Bone-Tendon-Bone graft technique. *Acta Chir. orthop. Traum. čech.*, 72:235–238, 2005.
22. PIPKIN, G.: Lesions of the suprapatellar plica. *J. Bone Jt Surg.*, 32-A:363–369, 1950.
23. PODŠKUPKA, A., POVÝŠIL, C., KUBEŠ, R., SPRINDRICH, J., SEDLÁČEK, R.: Treatment of deep cartilage defects of the knee with autologous chondrocyte transplantation on a hyaluronic Acid ester scaffolds (Hyalograft C). *Acta Chir. orthop. Trauma. čech.*, 73:251–63, 2006.
24. SHAW-RUEY, L., JEH-EN, T., CHIA-YUAN, K., AI-RU, J., DE-SHIN, L.: Mechanical strength of mediopatellar plica – The influence of its fiber content. *Clinical Biomechanics*, 21:860–863, 2006.
25. SHAW-RUEY, L., CHIA-CHEN, H.: Medial Plicae and Degeneration of the Medial Femoral Condyle. *Arthroscopy*, 22:17–26, 2006.
26. SCHINDLER, O. S.: Synovial plicae of the knee. *Current Orthopaedics*, 18:210–219, 2004.
27. STROVER, A. E., ROUHALMIN, E., GUIRGUIS, N., BEHDAD, H.: An Arthroscopic Technique of Demonstrating the Pathomechanics of the Suprapatellar Plica. *Arthroscopy*, 7: 308–310, 1991.
28. THOMEE, R., AUGUSTSSON, J., KARLSSON, J.: Patellofemoral Pain Syndrome, a review of current issues. *Sports Med.*, 28:245–262, 1999.
29. VIŠNA, P., KOČIŠ, J., MUŽÍK, V.: Arthroscopic stabilization of the fractured intercondylar eminence. *Acta Chir. orthop. Traum. čech.*, 72:160–163, 2005.
30. WACHTLER, F.: Die plica synovialis infrapatellaris beim Menschen. *Acta Anat.*, 104:451–9, 1979.
31. YAMAMOTO, Z., FUJITA, A., MIMAMI, G., ISHIDA, R., ABE, M.: Atraumatic Hemarthrosis Caused by a Large Mediopatellar Plica. *Arthroscopy*, 17: 415–417, 2001.
32. YILMAZ, C., GOLPINAR, A., VURUCU, A., OZTURK, H., ESKANDARI, M. M.: Retinacular band excision improves outcome in treatment of plica syndrome. *International Orthopaedics (SICOT)*, 29:291–295, 2005.

MUDr. Petr Jemelík,  
Ortopedicko-traumatologické odd.  
Slezské nemocnice Opava,  
Olomoucká 86,  
783 06 Opava

Práce byla přijata 23. 6. 2008.