Chondral lesions accompanying to acute and persistent tears of anterior cruciate ligament of the knee joint, based on video data made during 144 operations

Uszkodzenia chrząstki stawów kolanowych stwierdzane w czasie artroskopii stawów kolanowych u chorych z ostrymi i zastarzałymi uszkodzeniami więzadła krzyżowego przedniego – na podstawie zapisów video 144 operacji

Grzegorz Adamczyk, Łukasz Antolak, Tomasz Skrok, Robert Śmigielski

Carolina Medical Center, Warszawa

Summary:
An anterior cruciate ligament (ACL) injury leads to instability, irreversible destruction of the articular cartilage and early degenerative changes of the knee joint. The ACL damage is often accompanied by the injury of the different anatomic elements of the joint. At planning treatment, it is important to assess the injuries of all components of the knee, as the serious cartilage injuries accompanying ACL tear, requiring operation, at times make one-stage ACL reconstruction impossible.
In our study we've analysed video data obtained during arthroscopies of two groups of ACL deficient patients operated in Carolina Medical Center – 72 patients with a recent tear (to 6 weeks post-injury), and 72 with a chronic tear (more than 2 years post-injury). Analysing our data we essayed to describe evolution of joint cartilage with time from accident to surgery. [Acta Clinica 2001 2:138-144]

Key words: knee arthroscopy, ACL tear, chondromalacia, early arthritis of the knee.

Streszczenie:
Uszkodzenie więzadła krzyżowego przedniego stawu kolanowego (WKP) prowadzi do niestabilności stawu, uszkodzenia chrząstek stawowych i wczesnych zmian zwyrodnieniowych. Uszkodzeniu WKP towarzyszą urazy pozostałych elementów anatomicznych stawu kolanowego. Przy planowaniu leczenia należy koniecznie uwzględniać inne urazy i zmiany zwyrodnieniowe stawu współistniejące z przerwaniem WKP, gdyż poważne uszkodzenia chrząstki, złamania chrzęstno-stawowe, urazy łękotek wymagające szycia, mogą uniemożliwić jednoetapową rekonstrukcję WKP.
Analizie poddano zapisy video 144 operacji pacjentów z uszkodzeniem WKP – 72 ostrych, do 6 tygodni od urazu i zastarzałych – powyżej 2 lata po urazie kolana. Analizując uszkodzenia chrząstki stawu kolanowego oceniane wg skali Outerbridge'a próbowaliśmy śledzić ewolucję niestabilnego stawu kolanowego w czasie. Wyniki wskazują na postępującą degradację kolana, głównie w zakresie stawu rzepkowo-udowego, a następnie piszczelowo-udowego. W grupie pacjentów z chronicznym urazem WKP 2,5 razy częściej obserwowano uszkodzenia chrząstki IV^{o} wg Outerbridge'a na bocznej powierzchni rzepki, na powierzchni rzepkowej i na kłykciach kości piszczelowej. Znaczny procent pacjentów z chondromalacją chrząstki w I grupie dowodzi choroby chrząstki przed urazem. Łękotki mogą do pewnego stopnia ulegać wygojeniu, czego dowodzi mniejszy procent pacjentów uszkodzeniem łękotki bocznej w grupie I.
[Acta Clinica 2001 2:138-144]

Słowa kluczowe: artroskopia stawu kolanowego, przerwanie więzadła krzyżowego przedniego, chondromalacja, wczesna artroza stawu kolanowego.

Introduction

Being the largest joint of the human organism, the knee joint consists of two separate parts: the femoro-tibial joint and the femoral-patellar joint, covered with the common articular capsule. Because of relatively flat surfaces of bones constituting the knee joint, the basic stabilising elements are: a system of internal and external ligaments, capsule, menisci and muscles. The elements increasing the frequency of injuries are: excessive height, overweight, repetitive microtrauma in sport or at work.

The growing social problem is constituted by premature wear of the articular cartilage. Here again factors predisposing for the degenerative disease of the knee joint are: overweight, considerable height, malalignement of the limb axis and injuries. It is assessed that in the adult population over 50 years of age, 80% have features of the knee joint degenerative changes (9, 11).

One of the elements of the knee that undergoes injuries most frequently is the anterior cruciate ligament (ACL). It is estimated that in the United States happens approximately 70,000 ACL ruptures in US per year and 20.000 combined ACL/MCL lesions (11). Thus it can be estimated that every year in Warsaw, there take place approx. 1200 injuries of ACL. In 80% of patients with massive knee haematoma, also the ACL becomes damaged (totally or partially) (2, 4, 6, 12). Acc. to our studies, 4.4% of injuries in children are also knee haematomas.

The ACL injury is always a complex lesion, accompanied by injuries of other elements: collateral ligaments, the meniscus, osteochondral fractures, as well as there later develops inflammation of the synovial membrane and cicatrisation within the knee joint. The ACL is not only a mechanical element, stabilising the knee joint, but is richly innervated, constituting an important tract of deep sensibility, and that is why its damage leads to significant disturbances of proprioception. Thus, arthroscopic reconstruction, after post-injury inflammation calms, seems to be the optimum mode of treatment of this injury.

It can happen sometimes that other injuries, accompanying the ACL lesion, i.e. the meniscus injury requiring suture, serious subchondral fractures, deep degenerative changes of the knee joint or malalignement of the limb axis make the one-step reconstruction impossible. That is why before undertaking the decision; the surgeon should have possibly complete information on the injuries co-existing with the ACL, in order to decide on the appropriate operation and post-operative treatment. Ultrasonographic tests and the magnetic resonance seem to be a very useful tool of pre-operative assessment, but there are also still technical limitations causing the need of verifying the results. Diagnostic arthroscopy seems to be the most efficient way of verification. There are still some controversies about the importance of accompanying lesions on outcome, some authors state, that they have no influence on final result (4).

Surgeons are often surprised by an extent of cartilage destruction and early degeneration, which we observe during initial arthroscopy, few days after accident. Very interesting question might be rise up – whether a certain level of joint degeneration isn't a „normal, healthy knee" and to which extent anterior cruciate ligament reconstruction defends us against premature arthritis.

Aim of the study

Quantitative description of chondral lesion accompanying ACL tear, in a group of patients with a recent, maximum 6 week old injury compared with intra-operative

observations of a group of patients with persistent, more than 2 years lesion.

Material and method

We marked chondral lesion accompanying ACL tear on adapted graphic scheme (6) (Fig. 1). 144 videotapes from anterior cruciate ligament deficient patient, operated in CMC were analysed.

Statistical groups

Group I: 72 patients with a recent tear (within 6 weeks post injury).

Group II: 72 patients with a persistent tear (more than 2 years post injury).

Patients clinically evidently unstable, with a Lachman (++), anterior drawer (++) and pivot (+) test positive, but who arthroscopically present an anterior cruciate ligament partial tear were also included in our study (Fig. 2).

In chronic cases there's always a problem with date of an injury, quite often is difficult to precise, which-one of repetitive traumas is the final one. So, we decided, that the injury with a haematome, or confirmed by utrasounds or magnetic resonance, or the one that patient became symptomatic – it was an anterior cruciate ligament lesion (Fig. 3).

Tab. 1. General information

Group	I – acute tear No – 72	II – persistent tear No – 72
Mean age	34 years (11 - 57)	36 years (17 - 65)
Partial lesions	20,5%	21%
Period from injury	33 days	6,9 years
Sex F/M	34 / 38	31 / 41

Tab. 2. Lesions accompanying to anterior cruciate ligament tear

Group Structure	I – acute tear No – 72	II – persistent tear No – 72
Medial meniscus	83%	86,1%
Lateral meniscus	72%	51,3%
Synovitis	94%	88,9%
Plica mediopatellaris	54,2%	61,1%
Lateralisation of the patella	23,6%	34,7%
Posterior cruciate ligament lesion	6,9%	11,1%
Loose bodies	13,8%	22,2%
Osteophytes	12,5%	37,5%

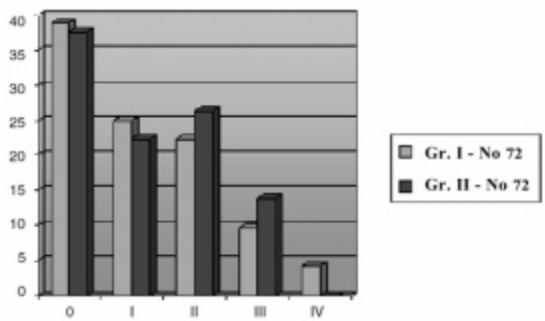
Tab. 3. Operative procedures performed together with initial arthroscopy

Group Procedure	I – Acute lesion No – 72	II – persistent lesion No – 72
ACL reconstruction	37	31
Medial Collateral Ligament reconstruction	2	1
High tibial osteotomy	2	2
Osteochondral grafts	3	7
Microfracture	2	6
Lateral meniscus suture	4	2
Medial meniscus suture	5	0
Arthrocare ACL plasty	3	3

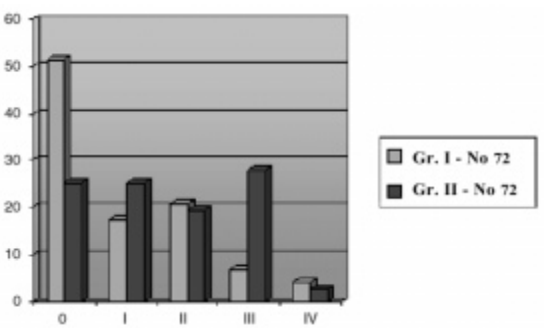
Degree of cartilage destruction was measured according to well-known Outerbridge (13) scale in following sites: 1. Patella – medial aspect, 2. Patella – lateral aspect, 3. Femur – intercondylar sulcus, 4. Femur – medial condyle, 5. Femur – lateral condyle 6. Tibia – medial condyle, 7. Tibia – lateral condyle.

Results:

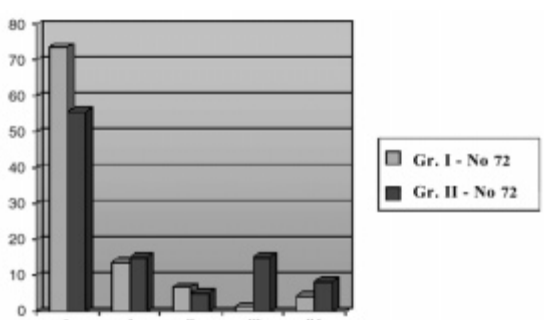
Tab. 4. Cartilage destruction on medial aspect of patella



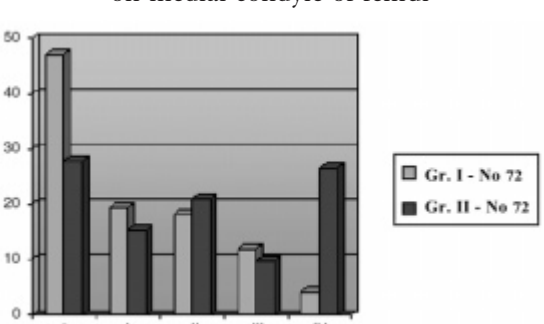
Tab. 5. Cartilage destruction on lateral aspect of patella



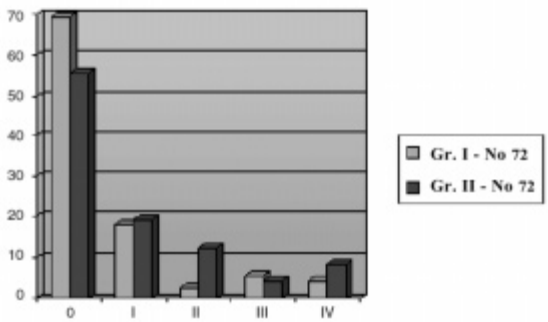
Tab. 6. Cartilage destruction on femoral intercondylar sulcus



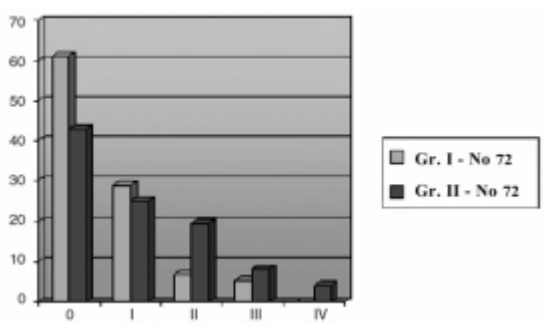
Tab. 7. Cartilage destruction on medial condyle of femur



Tab. 8. Cartilage destruction on lateral condyle of femur



Tab. 9. Cartilage destruction on medial condyle of tibia



Comments

Group of patients were comparable in aspect of sex, age, percentage of partial, symptomatic lesions. Group II is somehow surprising, because many of these patients were observed before arthroscopy, or treated by casts, rehabilitation or periarticular ligamentoplasties or augmentations like MCL suture.

Meniscal lesion may to certain extent heal. It is well known, that instability leads to meniscal destruction, but our observations lead to conclusion, that during initial arthroscopy we probable too often decide, that meniscus was wounded, what may be responsible for low percentage of LM lesion in II gr and lack of evident MM destruction in II group. Other features of osteoarthritis like osteophytes, loose bodies and maltracking of patella are evident in II group.

Lateralisation of the patella and high ratio of III° and IV° lesion on lateral facet

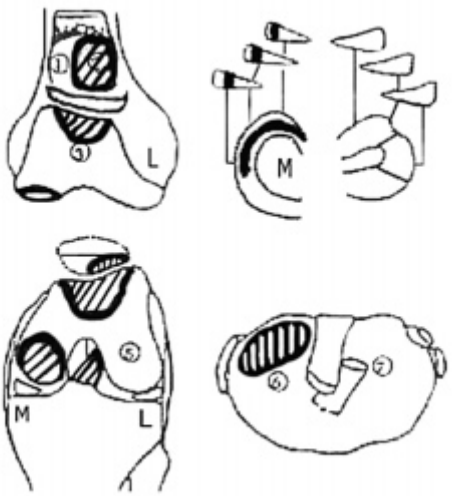


Fig. 1. Schematic drawings of cartilage lesions.

of are results of maltracking of patella due to secondary muscular imbalance and functional incompetence of medial head of quadriceps muscle.

From Tab. 4 – 9 is than visible, that lateral facet of patella and intercondylar sulcus are the most often localisation of IV degree lesions.

Cartilage repairing procedures like OATS or microfractures were 3 x more often performed in a II group. Slightly lower percentage of one-step ACL reconstruction in chronic group were due to the need of performing chondral procedures as a first step operation.

Degenerative changes of menisci reduced the possibility of meniscal sutures in persistent group. Two lateral meniscus sutures were due to secondary lesions due to accident of unstable knee joint.

Medial condyle of femur is the most common locus for IV degree lesion requiring OATS due to chronic antero-medial rotatory instability with a LCL preserved and medial aspect of the knee chronically pivoting during walk.

Conclusions

ACL tear leads to knee degradation observed as a progression of destruction in a patella-femoral joint, and later femoro-tibial joint.

Among patients with persistent tear 2,5 times more often IV° lesions were observed in lateral aspect of patella, intercondylar sulcus and tibia condyles.

Great percentage of chondromalacia among patients with acute tear might mean the chondral disease before an accident.

Meniscus tear might to certain level heal spontaneously (lower percentage of ML tear in II group).

In 50% of cases we reconstructed ACL and other lesions as a one step procedure.

Discussion

Osteoarthritis of the knee joint is a growing both medical and social problem. Acc. to the American data, in the so-called „upper middle class", there is one ACL injury per 3 000 of adults a year, what results in the necessity to perform approximately 100 000 ACL reconstructions in the United States every year (2, 4, 7). Active people, working professionals, young, of high expectations towards their own organism, constitute the basic group of patients. Thus, such modes of treatment should be looked for which could be implemented without taking them away from work or school.

Not all patients with the anterior cruciate ligament undergo surgical treatment. The advanced age, advanced degenerative changes in the knee joint, osteoporosis of a considerable degree or inability to have good contact with the patient constitute predominating contraindication to reconstruction of the anterior cruciate ligament (3, 4, 7, 11). Approximately 30% of patients, in particular persons of small physical requirements, do not develop clinical

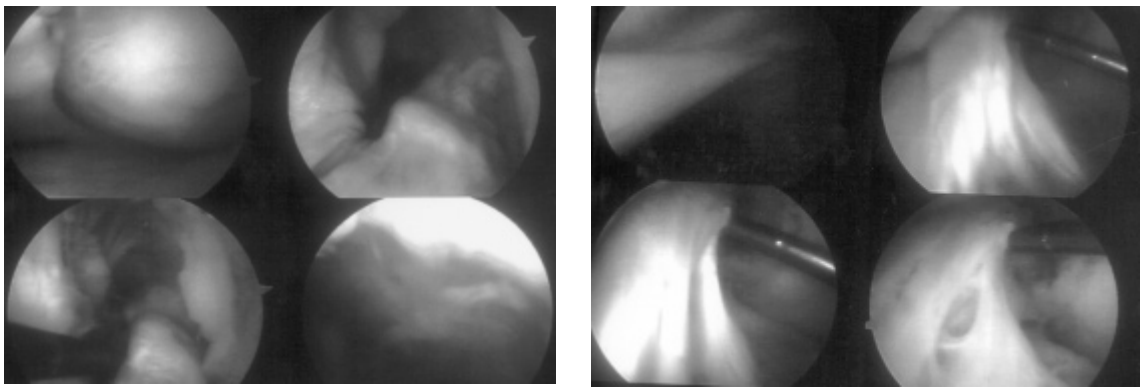


Fig. 2 – Partial lesions of ACL

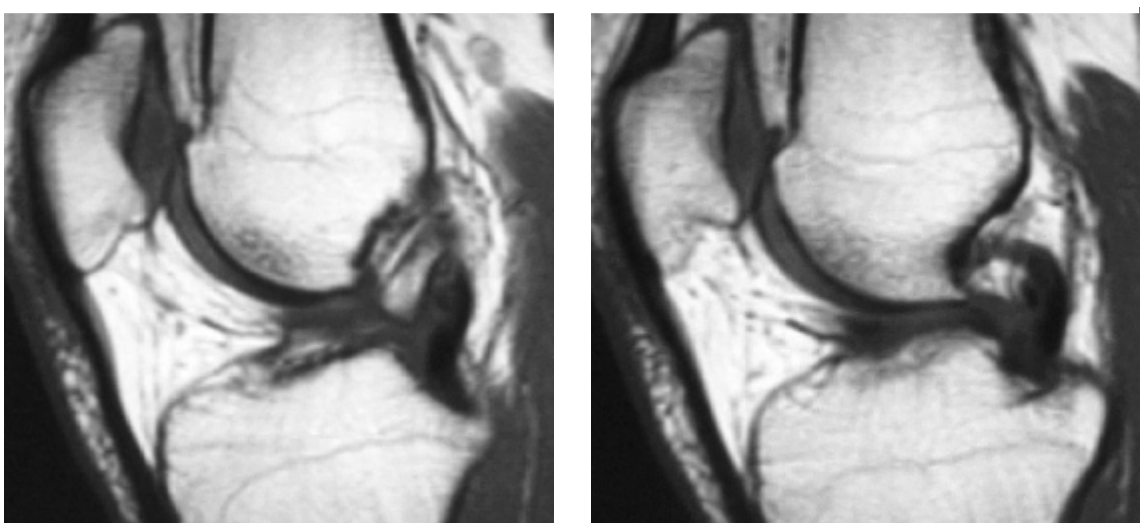


Fig. 3 Magnetic resonance of ACL lesion, PCL laxity and MM lesion „bucket handle type"

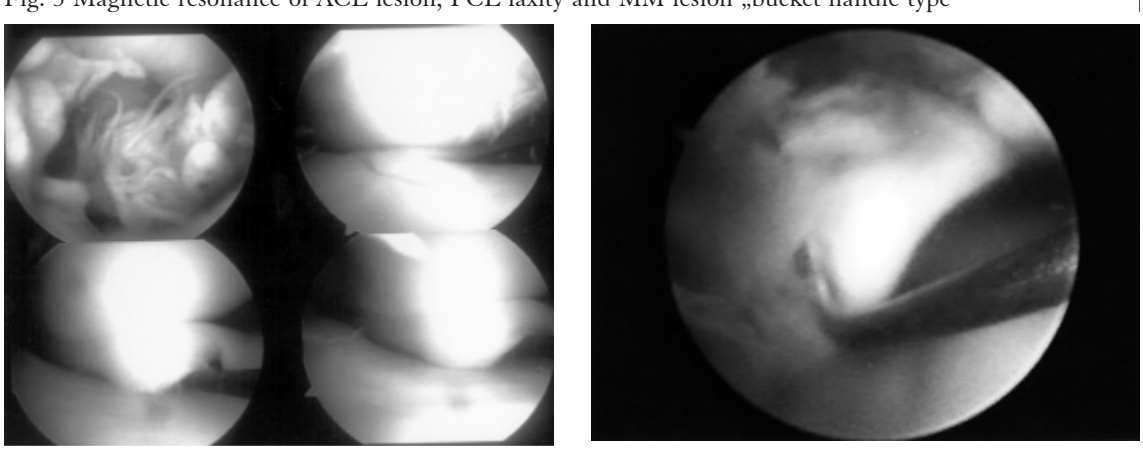


Fig. 4. Intraoperative photograph of ACL lesion, MM „bucket handle", chondral fractures

features of knee joint instability (11). Three years after an ACL tear, the cartilage injuries become so deep (Outerbridge degree 3 and 4), that they are practically irreversible (4, 11). From our studies, however, it results that almost 50% of patients we arthroscopied because of the anterior cruciate ligament injury up to 6 weeks after the accident, already has degenerative changes of degree 3 and 4, which probably developed before the injury (1).

Thus, a very difficult question arises: What does a „healthy" normal knee of an adult mean? Isn't a certain degree of dege-

nerative and overload changes of the knee joint, and in particular of the patella-femoral a standard of a certain kind, which we have to accept and get use to?

In our material, no „isolated injuries of the ACL" were observed. That is why the surgeon undertaking reconstructive procedure should have full information on the state of the remaining anatomical components of the knee joint, in order to select properly operative technique, and to decide on the tactics of surgical and rehabilitative treatment.

In our assessment, in 84% of cases of the ACL injury, it takes place in this region. Moreover, it is just there that the diagnostically difficult lesion occurs: the partial lesions, incomplete lesions healed in Wittek's mechanism. In our material, they constituted approximately 21% of cases.

There are certainly other ways of verification of the surgical diagnosis of the knee joint instability, i.e. magnetic resonance and ultrasounds (8, 15, 14). It seems, however, that at the present stage of the development, their agreement with the clinical state constitutes approximately 80 per cent. Arthroscopy remains the most perfect way of diagnostics of knee joint injuries (10).

Bibliography

1. Adamczyk G., Antolak Ł., Skrok T., Stolarczyk A., Śmigielski R., Ziółkowski M.: Uszkodzenia towarzyszące ostrym i zastarzałym urazom więzadła krzyżowego przedniego stawu kolanowego – na podstawie analizy zapisów video 140 operacji artroskopowych. Medycyna Sportowa 1999; 98, 11
2. Bomberg B.C. and McGinty J.B.: Acute haemarthrosis of the knee: indications for diagnostic arthroscopy. Arthroscopy, 1990; 6 (3), 221 – 225
3. Buss D.D., Warren R.F., Wickiewicz T.L., et al. Arthroscopically assisted reconstruction of the anterior cruciate ligament with use autogenous patellar-ligament grafts. Results after twenty-four to forty-two months. J Bone Joint Surg 1993; 75A: 1346 – 1355
4. Daniel D.M. et al. A ten-year prospective outcome study of the ACL-injured patient. In Orthopaedic Research Society, Atlanta, GA: J Bone Joint Surg. (Am) 1996, 98 (2)
5. Gillquist J. and Hagberg, G. A.: New modification of the technique of arthroscopy of the knee joint. Acta Chir. Scand. 1976; 142, 123 – 130
6. Jackson D. W and Shrock K.B.: Arthroscopic Management of the Anterior Cruciate Ligament-Deficient Knee - Operative Arthroscopy, Second Edition, ed: McGinty J.B., Caspari R.B., Jackson R.W., Poehling G.G. Lippincott-Raven Publishers, Philadelphia 1996
7. Jackson R.W.: Arthroscopic Treatment of Degenerative Arthritis - Operative Arthroscopy, Second Edition ed: McGinty J.B., Caspari R.B., Jackson R.W., Poehling G. G, 405 – 409 Lippincott-Raven Publishers, Philadelphia 1996;
8. Johnson DL, Warner JJP: Diagnosis for anterior cruciate ligament surgery. Clin. Sports Med 1993; 12:671 – 684
9. Johnson L.L.: Arthroscopic abrasion arthroplasty In: McGinty J.B. (ed), Operative Arthroscopy, New York, NY: Raven Press 1991, pp 341 – 360,
10. Kapandji L.A.: The physiology of the joints. 1987; Vol. II
11. Meunier A.: Osteoarthritis after surgical or conservative treatment of the acutely torn anterior cruciate ligament – a randomised study with 15 years follow-up. Swedish Orthopaedic Society. 1999: Acta Orthopaedica Scand. (Suppl. 287)
12. Noyes F.R.: Arthroscopy in acute traumatic haemarthrosis of the knee. Incidence of anterior cruciate tears and other injuries. J. Bone Joint Surg. (Am) 1980, 85(2), 687 – 95
13. Outerbridge RE. The aetiology of chondromalacia patellae. J. Bone Joint Surg. 1961; 43B; 752 – 757
14. Stoller D.W.: Magnetic Resonance Imaging in Orthopaedics & Sports Medicine, Lippincott Williams & Wilkins, Philadelphia, Second Edition 1997,
15. Van Holsbeeck M., Introcaso J.H. Musculoskeletal Ultrasound, Mosby Year Book, New York, 1991
16. Woo S. L-Y: Interdisciplinary Research on Ligament Healing. The Panther Sports Medicine Symposium, Pittsburgh, Pennsylvania 2000 May 4 – 6

Address for correspondence: Grzegorz Adamczyk, Carolina Medical Center, ul. Broniewskiego 89, 01– 876 Warszawa. Phone /Fax. (48 22) 633 36 65; Mob. Phone: (48) 602 353 227; E-mail: grzegorz.adamczyk@carolina. pl