The aim of the study was to determine the quality of life among groups with different body mass index after anterior cruciate ligament reconstruction. Material and Methods. The study included 510 patients who underwent surgery 95% were athletes, 81% were males, with an average age of 27 years. The body mass index was calculated for all patients, and the quality of life was evaluated using the Knee Osteoarthritis Outcome Score. Results and Discussion. The mean body mass index was 24.65, with the highest percentage of normal weight athletes (59%). The body mass index is inversely proportional to the Knee Osteoarthritis Outcome Score, so obese patients have a poorer quality of life (p = 0.003). Men have a higher mean body mass index (25.21) than women (22.26). The mean body mass index increases with age, whereas recreational athletes and non-athletes have an increased mean body mass index. The correlation between the body mass index and the level of sports activity is significant, so higher body mass index is associated with lower Tegner score. The body mass index is not a significant factor for re-injury and revision reconstruction, since it does not differ significantly among patients with revision and primary anterior cruciate ligament reconstruction. The majority of patients (91.0%) rated their general health as much better than before surgery, and 67.6% of patients with an ideal body mass index thought that surgery did not affect their quality of life at all. Conclusion. The hypothesis that persons with increased body mass index (above 25) have a lower quality of life after anterior cruciate ligament reconstruction compared to persons with ideal body mass index (below 25) was confirmed. Key words: Athletes; Body Mass Index; Anterior Cruciate Ligament Injuries; Anterior Cruciate Ligament Reconstruction; Quality of Life; Risk Factors; Recovery of Function; Treatment Outcome; Surveys and Questionnaires

Original study

THE IMPACT OF BODY MASS INDEX ON THE RESULTS OF ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION

UTICAJ INDEKSA TELESNE MASE NA REZULTAT REKONSTRUKCIJE PREDNJEK UKRŠTENOG LIGAMENTA

Vladimir RISTIĆ1, Vesna ŠUMAR2, Predrag RAŠOVIĆ3,4 and Vukadin MILANKOV4,5

Summary

Introduction. The aim of the study was to determine the quality of life among groups with different body mass index after anterior cruciate ligament reconstruction. Material and Methods. The study included 510 patients who underwent surgery 95% were athletes, 81% were males, with an average age of 27 years. The body mass index was calculated for all patients, and the quality of life was evaluated using the Knee Osteoarthritis Outcome Score. Results and Discussion. The mean body mass index was 24.65, with the highest percentage of normal weight athletes (59%). The body mass index is inversely proportional to the Knee Osteoarthritis Outcome Score, so obese patients have a poorer quality of life (p = 0.003). Men have a higher mean body mass index (25.21) than women (22.26). The mean body mass index increases with age, whereas recreational athletes and non-athletes have an increased mean body mass index. The correlation between the body mass index and the level of sports activity is significant, so higher body mass index is associated with lower Tegner score. The body mass index is not a significant factor for re-injury and revision reconstruction, since it does not differ significantly among patients with revision and primary anterior cruciate ligament reconstruction. The majority of patients (91.0%) rated their general health as much better than before surgery, and 67.6% of patients with an ideal body mass index thought that surgery did not affect their quality of life at all. Conclusion. The hypothesis that persons with increased body mass index (above 25) have a lower quality of life after anterior cruciate ligament reconstruction compared to persons with ideal body mass index (below 25) was confirmed. Key words: Athletes; Body Mass Index; Anterior Cruciate Ligament Injuries; Anterior Cruciate Ligament Reconstruction; Quality of Life; Risk Factors; Recovery of Function; Treatment Outcome; Surveys and Questionnaires

Sažetak

Uvod. Cilj studije predstavlja utvrđivanje kvaliteta života među grupama sa različitim vrednostima indeksa telesne mase, nakon rekonstrukcije prednjeg ukrštenog ligamenta. Materijal i metode. U istraživanju je učestvovalo 510 operisanih pacijenata, 95% sportista, 81% muškog pola, prošćane starosti 27 godina. Svim ima izražen indeks telesne mase, a za analizu kvaliteta života korišćen je Knee Osteoarthritis Outcome Score. Rezultati i diskusija. Prosečna vrednost indeksa telesne mase iznosila je 24,6 a najveći je broj normalno uhranjenih sportista (59%). Indeks telesne mase je indirektno proporcionalan vrednostima bodovne skale korišćenog upitnika, pa gojazni pacijenti imaju lošiji kvalitet života (p = 0,003). Muškarci imaju prosečno viši indeks telesne mase (25,21) od žena (22,26). Godine života povećavaju prosečan indeks telesne mase. Rekreativci i nesportisti imaju povećane prosečne vrednosti indeksa telesne mase. Značajna je korelacija indeksa telesne mase sa nivoom sportske aktivnosti, pa je Tegner skor manji ukoliko ispitanik ima povećane vrednosti indeksa telesne mase. Indeks telesne mase ne predstavlja značajan faktor za ponovnu povredu i revizionu rekonstrukciju jer se značajno ne razlikuje među povređenima sa revizionim i primarnim rekonstrukcijama prednjeg ukrštenog ligamenta. Najveći deo (91%) pacijenata ocenio je svoje opšte zdravstveno stanje mnogo boljim nego pre operacije, a 67,6% sa idealnim indeksom telesne mase smatrao je da operisana povreda kasnije uopšte nije uticala na njihov kvalitet života. Zaključak. Hipoteza je potvrđena da osobe sa povećanim vrednostima indeksa telesne mase (iznad 25) imaju manje kvalitetan život nakon operacije u odnosu na osobe sa idealnim vrednostima (ispod 25). Ključne reči: sportisti; indeks telesne mase; povrede prednjeg ukrštenog ligamenta; kvalitet života; faktori rizika; funkcionalni oporavak; ishod lečenja; ankete i upitnici

Introduction

The incidence of anterior cruciate ligament (ACL) injury in the young population is constantly increasing, especially among active athletes [1, 2]. Although it is well documented that females are at a significantly higher risk of ACL injury [1–4], the dilemmas remain: why males predominate in study samples and why does not ACL reconstruction prevent the development of osteoarthritis, especial-
ly in obese patients, since it provides knee joint stability [1, 3]. Current dilemmas are also related to the prevention of risk factors of ACL rupture [1–7], identification of the best surgical techniques with as few complications as possible [8–14], as well as the best rehabilitation protocols providing safe return to sports activities after surgery [15].

Risk factors associated with ACL injury are divided into environmental factors, hormonal, neuromuscular, biomechanical, and anatomical factors [1–4, 16, 17]. Among the anatomical factors, the most commonly mentioned are ligament laxity, quadriceps angle, knee valgus, width of the femoral intercondylar notch, and posterior tibial slope [3, 16, 17]. Body mass index (BMI) is also considered to be a potential risk factor [18] since obesity may have negative effects on health, quality of life, and postoperative recovery of patients [19].

The purpose of ACL reconstruction is not only to improve the knee function, but also to provide an optimal quality of life. Current questionnaires point to the importance of the patient’s perception of his health status [7, 8, 20]. However, there is little data in the available literature on whether and how body weight, body height, and BMI affect quality of life. Therefore, we hypothesized that obesity decreases the quality of life of patients after ACL reconstruction, compared to normal weight patients; the aim of the study was to determine the quality of life among groups with different BMI after ACL reconstruction.

Material and Methods

The study was performed at the Clinic of Orthopedic Surgery and Traumatology of the Clinical Center of Vojvodina after the approval of the Ethics Committee. The retrospective study included 510 patients with ACL injury who underwent surgical treatment in the period from March 2013 to December 2015.

There were significantly more male patients (413, 81%) than female (97, 19%). The average age of patients was 27 years (15 to 59 years) with a standard deviation (SD) of 7.84. The injury occurred during sports activity in 487 patients (95%), 13 patients had a fall injury (3%), and 10 (2%) were involved in a traffic accident. There were 282 persons in recreational sports (55%), 205 respondents were professional athletes (40%), while 23 respondents were not active in sports (5%). Among the athletes, 58 (11.4%) were competitors at international level, 105 (20.6%) at national, 101 (19.8%) at regional, and 225 (44.1%) at local level.

A total of 272 soccer players underwent surgery, as well as 46 handball players, 39 basketball players, 27 skiers, 21 volleyball players, 20 wrestlers, 18 judokas, 17 karate players, 11 American football players, 10 taekwondo competitors, 4 tennis players, 1 active in athletics and 1 in table tennis. Thus, most of our patients were soccer players (55.9%), since all other sports accounted for less than 10% of the total sample.

The right knee was operated in 281 cases (55.1%), the left in 212 (41.6%), while injuries of both knees were registered in 17 persons (3.3%).

Patients who signed a written consent to participate in the study were sent a Knee Injury and Osteoarthritis Outcome Score (KOOS) questionnaire by e-mail [21], to which they responded voluntarily at least one year after surgery. In addition to data on the postoperative quality of life, general data were collected about the etiology of injuries in terms of professional and recreational sports, daily activities and possible knee instability. Data on each patient included the following parameters: gender and age, mode of injury, type and level of sports activity, laterality, associated injuries, time elapsed from injury to diagnosis, from injury to surgery, and postoperative values of all segments of KOOS questionnaire including symptoms, pain, daily activities, issues related to sports and quality of life, as well as the Tegner Lysholm Knee Scoring Scale. The KOOS questionnaire is a 42-item self-administered questionnaire with five subscales. Each question has 5 possible answers (Likert boxes). The score is a percentage score from 0 to 100, with 0 representing extreme problems and 100 representing no problems.

Anthropometric data of body weight and body height (Table 1) were collected and based on them the BMI was determined [19]. The BMI is calculated by dividing a person’s weight by the square of their height (kg/m² – BMI/BH²). After the BMI was determined, patients were classified into 5 categories. Malnutrition is a BMI < 18.5, normal or healthy weight range is between 18.5 and 24.9, overweight is 25 – 29.9, mild obesity 30 – 34.9, and severe obesity is above 35 (Table 2).

The descriptive statistics included the following: mean, SD, minimum and maximum. We performed one-way analysis of variance (ANOVA) and F-test. The T-test for independent samples was used in comparative statistics. The results were analyzed and presented in tables. The respondents who did not fill out the KOOS questionnaire voluntarily or completely, as well as those who did not complete the rehabilitation, were excluded from the study.

Results

The average body weight of in our patients was 80.64 kg (SD 8.07). A female patient had the lowest body weight of 52 kg, and a male patient had the highest body weight of 125 kg (Table 1). The average body height was 1.80 m, minimum 1.56 m, maximum 2.05 m (SD = .08) (Table 1).

Most of the patients included in the study had a normal body weight (302, 59%); there were 179 who were overweight (35%), 24 were mildly obese (5%), 5

**Abbreviations**

ACL – anterior cruciate ligament

BMI – body mass index

SD – standard deviation

KOOS – Knee Injury and Osteoarthritis Outcome Score
(1%) were malnourished, while there were no severely and extremely obese persons. The lowest BMI was 16.52, the highest 34.77, and the mean 24.65 (SD 3.01) (Table 3).

A statistically significant difference was found between BMI and gender of the participants, T (508) = 9.35, p = .00 (p < .01), because on average, men had higher BMI (25.21) than women (22.26).

There was a statistically significant correlation between the age of subjects and BMI. The difference was moderately high: r = .442, p .000 (p < .01). Thus, BMI increases with age.

A statistically significant relationship was found between age and BMI groups (malnourished, normally fed, overweight or slightly obese patients): F (3,507) = 27,763, p = .000, p < .001.

The mean BMI among patients who sustained a sports injury was within the normal range (18.5 - 24.9), while persons who suffered an ACL injury in a traffic accident or had a fall injury had an increased mean BMI (> 25). Thus, there is a statistically significant difference: F (2.508) = 29.334, p = .00, p < .001.

A statistically significant difference was observed between the BMI and the level of sports activity among the respondents: F (2.506) = 19.12, p = .000, p < .001. Athletes competing at the international, national and regional levels had ideal BMI, whereas recreational athletes and non-athletes had increased mean BMI (> 25).

We also found a significant correlation between BMI and Tegner score; r = -.282, p = .000 (p < .01). The results indicate that higher BMI is associated with lower Tegner score, which means that obese people are less engaged in professional sports with the highest risk of ACL injury. Therefore, we did not have a single obese soccer player at the national and international level of competition in the sample (with Tegner score of 10).

The BMI showed no statistically significant correlation with the “pain” subscale of the KOOS questionnaire. The correlation of BMI with “activities of daily living” showed the following results: r = .126, p = .000 (p < .01), which indicates that subjects with higher BMI are less active in daily activities. The difference is not high, but it is significant.

The BMI also showed a statistically significant correlation with “sports and recreational activities”:
The correlation of BMI and the KOOS subscale “subjective symptoms” showed a statistically significant difference only for the question: “How often do you feel knee instability?” The differences were found among those who answered: “rarely” and “mostly”. The one-way ANOVA showed a significant difference: F (4,505) = 2.715, p = .029 (p < .05) (Table 3).

Analyzing the quality of life after ACL reconstruction, we found that most patients (91.0%) felt that their general health was much better than before surgery showing that this surgery significantly improves the quality of life (Table 3).

Comparing the BMI and the patients’ personal perception of the impact of the injury on their quality of life, 345 (67.6%) of those with an ideal BMI responded that the surgery did not negatively affect their quality of life at all (Table 3).

Patients with ideal BMI have a better perception of their own health compared to patients with higher or lower BMI. Respondents are often aware of their knee problem, but no significant association was found between the BMI and their awareness of the knee problem.

The correlation of BMI and overall quality of life with the “KOOS” questionnaire showed a low but significant correlation: p = .003 (p < .01) which indicates that the increase in BMI decreases the quality of life.

All three groups of patients who reported having knee instability of the operated knee: “sometimes”, “often” or “always”, had physiological BMI levels (Table 3). During the 2 – 5 year period after the primary surgery, 18 patients (3.5%) underwent revision ACL surgery. Their mean BMI was 24.80, showing that postoperative ruptures most often occur in normal weight athletes.

**Discussion**

Fifty years ago, complete ACL rupture was the most common reason for the termination of a sports career [10, 16]. Today, with the development of surgical techniques, about two thirds of athletes successfully return to unrestricted sports activities 6 – 9 months after the ACL reconstruction [10, 12, 14, 16, 20]. Of the total number, 67.6% of our patients with ideal BMI also believe that a year after the surgery their quality of life has not changed at all. Therefore, sports medicine and traumatology is focused on finding risk factors for injuries and the development of training processes to avoid them [3, 4, 16].

Depending on the type of sport and due to anatomical and hormonal reasons, women are at 2 – 6 times higher risk of ACL injury [1, 24–26], but there are few studies in Serbia in which the female sex dominates, which is also the case in our study (81% of respondents are men). Although women are at a higher risk of ACL injury due to lesser muscle strength, increased knee valgus, wider pelvis, hormones that affect ligamentous hyperelasticity, narrower intercondylar femoral notch and other factors [1–4, 16], surgeries are more common in the male population [5–14, 23]. The analysis of ACL reconstructions in America shows that 61% of high school students who train basketball are girls, and only 39% are boys [4]. However, after high school, in the same group males were almost 7 times more likely to be injured. The comparison of sex distribution among the athletes of the same first league shows that female basketball players are at a 3.5 times higher risk of ACL injury than male basketball players, and female soccer players are at a 2.67 times higher risk than male soccer players [26]. In our earlier study, we concluded that the overall quality of life after ACL reconstruction did not differ significantly between males and females [7].

In our study, the majority of examinees were athletes, aged between 18 and 25 years, because injuries commonly occur at that age [5–10, 23, 27]. The ACL ruptures are most often caused by non-contact mechanisms, during a sudden change in direction and single-legged landing, at the end of the competition, due to muscle fatigue and lack of concentration [5, 24, 25, 28]. It has been established that neuromuscular body control, especially of the hips and lower extremities, adequate strength and proprioception contribute to the prevention of knee injuries [3, 16]. Muscle fatigue is a significant risk factor for ACL injury, due to weaker neuromuscular stabilization and risky movements of the knee joint [24, 28].

High risk activities for ACL injury include contact sports with rapid changes in direction and landings: soccer [3, 5], basketball [25, 29], handball [22] and American football [30]. Skiing is a non-contact sport with the highest risk of knee injury [31]. The most popular sport in the world is soccer with an estimated 265 million active players [3], so in our study, recreational soccer players were the most often injured. The incidence of ACL injuries also depends on the popularity of a certain sport in different countries, so most studies in Serbia are dominated by soccer players [5–7, 9, 10, 14, 17, 20], in the Nordic countries by handball players and skiers [20, 32], in the USA by rugby and basketball players [4, 30], in Japan by female basketball players, wrestlers and skiers [31, 33]. Due to the absence of shoe-surface friction, ACL injuries are extremely rare among hockey players, skaters and ballet dancers [5–7]. In our previous studies, including about 4,000 operated patients, we did not have a single case of surgical treatment in professional ice hockey players, ballet dancers and dancers [5–10], so we mistakenly thought that injuries do not occur among them. However, in the American Hockey League, there are 6 – 7 hockey players with ACL injury in every season [34], because this sport also requires sudden changes in direction, rotation of the knee joint and pivoting. Although the incidence of ACL injuries among hockey players is significantly lower than in other contact sports, tangling skates and falling to someone’s knee can lead to rupture. Despite successful surgeries, American hockey players show that injuries have consequences, since the operated players...
have lower success in terms of achieving a lower average number of goals per match and season [34].

The largest published series of ACL ruptures among ballet dancers included 12 injuries during a five-year follow-up in New York [24]. Each ballet dancer performs over 200 jumps during a 1.5-hour workout per day, more than half of which involve landing on one leg [24], which is particularly risky for ACL injury. However, only 0.2% of ballet dancers and 0.4% of contemporary dance competitors experience ACL injury [24], while among team ball sports 1 – 8% of competitors suffer ACL injury [25, 29, 35]. The reason for a low incidence of ACL injuries among dancers lies in the fact that their professional activity requires special skills in balance movement and landing control. Unlike most sports, ballet is more focused on the technique of performing risky knee movements, whereas athletes are focused on scoring goals and points, as well as contact with opposing players [24]. Also, professional ballet dancers and contemporary dancers usually have ideal body weight, because those with ACL injury have a mean BMI of 26.5 and those without injury 25.5 [24]. The reason for rare ACL injuries in ballet dancers lies in the fact that their movements are routine, practiced daily, with elegant arm movements that contribute to balance, without improvisation and influence of the environment, field and opposing players [24]. So, although ballet dancers do not belong to obese people, they also experience ACL ruptures. Obesity is a major epidemiological problem, both in the world and in our country. Over the last 40 years, the mean BMI in the female population of Serbia has increased from 24.1 to 25.3 [36]. In males, obesity has increased even more, from 23.8, to a mean BMI of 26.3 [36]. Today, more than half (54%) of the adult population of Serbia is overweight and 37% are obese [36]. The mean BMI in the general population of Serbia is about 26 [36], and in our sample 24.6, because it is dominated by athletes. The mean BMI in other studies that followed athletes ranged between 23.3 and 27.6 [24, 27, 37, 38]. Our study shows that there is a statistically significant difference between BMI and gender of respondents, since males have a higher BMI (average 25.21) than females (22.26), which is consistent with other studies [26, 27, 37].

According to the literature, BMI is a risk factor for ACL injury, especially in young athletes [39 - 41]. Women with increased body weight are at more than three times the risk of ACL injury than women with a normal BMI [40, 41]. Body height, especially during growth of the tibia and femur at puberty, leads to a shift in the center of gravity, which complicates neuromuscular control [16]. The increase in body weight directly affects the increase of forces acting on the knee joint during sports movements of strong intensity [16]. The most hazardous positions for ACL injury are flexion, abduction, valgus, anterior translation, and external tibial rotation [4, 42, 43]. Athletes, like in our study, have statistically significantly lower BMI compared to non-athletes [44]. The analysis of 140 athletes of both sexes from Novi Sad training volleyball, basketball, soccer, handball, athletics and rowing, showed that BMI in all groups ranged in physiological limits, except in the group of male handball players, whose mean BMI was moderately higher (25.70) [45]. The average values of body fat percentage were significantly lower among female athletes, with the lowest values in women's athletics, while, among men, basketball players had the highest percentage of fat [45].

Modern questionnaires prove the importance of the patient’s perception in assessing their own health [5, 7, 8], so we found that an increase in BMI reduces the quality of life in patients undergoing ACL reconstruction. Obese patients (BMI > 25) show a lower postoperative quality of life compared to normal weight patients. The difference is not high, but it is statistically significant. Kowalchuk et al. [46], like us, found that patients with BMI > 30 had less successful ACL reconstruction results than patients with physiological BMI. Other studies confirm that BMI can change the quality of life of patients after ACL reconstruction [47, 48]. It has also been shown that patients with BMI over 35 have poorer postoperative results after arthroscopic meniscectomy than patients with BMI < 30, because postoperative “KOOS” results are better in normal weight patients than in obese individuals [49, 50]. In an earlier study, we found that increased BMI was also associated with higher incidence of ACL injury associated with meniscus injuries [51].

In adults, increased BMI is often associated with knee osteoarthritis [27], which explains why obese people with elevated BMI have a lower level of postoperative activity after ACL revision. Ankle injuries are about 19 times more common among athletes with increased BMI and a previous ankle sprain, compared to athletes with a previous ankle sprain and with normal BMI [52]. Considering that after surgery most patients spend most of their time inactive, there may be an imbalance between energy intake and expenditure. Therefore, after some time, they gain weight and even though they are athletes, they have an increased BMI [27]. The postoperative quality of life is also affected by subsequent ACL injuries, because within 2 – 3 years after unilateral injury, about 3% of patients experience contralateral rupture [53, 54]. Also, ACL injuries may cause chronic knee instability, muscle weakness, and early onset of osteoarthritis [54, 55]. Professional sports and biomechanical joint stress are the main reasons for the pathogenesis and progression of knee osteoarthritis [56]. Losing 1 kg of body weight results with a 4-fold reduction in the load exerted on the knee per step during daily activities [56]. A loss of 5% of the total body weight in obese adults with knee osteoarthritis over 18 months results in an 18% improvement in the knee function and if combined with exercise, the mobility improves by 24% [56].

Some studies have concluded that increased BMI may also be a potential risk factor for revision surgery after primary ACL reconstruction [18, 30]. American rugby players also have a significantly increased risk for new injuries if they are overweight and had a former ACL injury [30]. In contrast, other authors believe that
there is still insufficient evidence that BMI is a significant risk factor for ACL rerupture [38, 47, 57], since the mean BMI of patients with primary rupture is 27.6, and it is slightly higher among revision surgeries [27.8] [38]. Our study showed similar findings (24.65 in primary vs. 24.80 in revision). The above studies, like ours, found that factors such as gender, body weight, height, and BMI were not significant factors for re-injury and revision ACL reconstruction [38, 47, 57], and the causes should be sought in incorrect position of bone tunnels, new traumas, and premature return to sports activities [7, 9, 10, 58, 59].

The disadvantage of this study is the subjectivity of the respondents. The study raises dilemmas related to surgical treatment of obese patients (whether they should undergo surgery or lose weight first). There is no consensus on whether to define a marginal BMI for safe ACL reconstruction, which may be the basis for future research. Since we did not have extremely obese respondents in the sample, our study imposes a potential hypothesis of future studies: are excellent results of ACL reconstructions partly due to the fact that obese people get injuries less often because they do not play sports, or obese persons with injuries do not want surgery. Perhaps orthopedic surgeons adhere to strict selection of patients for reconstruction, so that being overweight would not lead to bad results.

A recent large-scale study [57] showed that fear of surgical procedures in obese patients is irrational; it compared the outcomes of primary ACL reconstructions between the normal weight and overweight patients (BMI > 25) and found that in obese patients the risk for arthritis was significantly higher, but the risk for revision surgery or contralateral ACL tear was lower [57]. There was no significant difference in complication rates and in the majority of functional scores [57]. In addition, if we knew all the causes of injuries, we would know how to prevent them and treat them more successfully.

**Conclusion**

By determining the body mass index, it was established that the highest prevalence of patients undergoing anterior cruciate ligament reconstruction were normal weight patients (athletes). Men have a higher mean body mass index than women and older athletes have an increased mean body mass index. Individuals injured in traffic accidents and in daily activities have a higher mean body mass index than those injured in sports. Professional athletes have a body mass index within ideal limits, while recreational and non-athletes have elevated mean values. The association between the body mass index and the level of sports activity is significant. The body mass index is not a significant factor for re-injury and revision reconstruction. The anterior cruciate ligament reconstruction contributes to better quality of life since the majority of patients (91.0%) rated their general health as much better than before surgery, and 67.6% of patients with ideal body mass index thought that surgery did not affect their quality of life at all. Increased body mass index (> 25) is associated with lower quality of life after surgery.

**References**


7. Ristić V, Ilić M, Bjelobrk M, Harhaji V, Milankov M. Reconstruction of anterior cruciate ligament by using new techniques and in the majority of functional scores [57]. In addition, if we knew all the causes of injuries, we would know how to prevent them and treat them more successfully.


