Outcomes Related to the Body Mass Index and Injury Period Following Meniscial Repair

Vücut Kitle İndeksi ve Yaralanma Süresinin Menisküs Tamiri Sonrası Sonuçlara Etkisi

Meniscus Repair

Osman Tugrul Eren[1], Bekir Eray Kilinc[2], Yunus Oc[1], Abdulkadir Sarı[3], Hasan Basri Sezer[1]
[1]Hamidiye Sisli Etfal Training and Researh Hospital, Istanbul, [2]Golhisar State Hospital, Burdur,
[3]Namık Kemal University, Tekirdağ, Turkey

Özet

Amaç: Çalışmamız ön çapraz bağ (ÖÇB) cerrahisi ile birlikte menisküs tamiri uygulanan hastalardaki menisküs iyileşmesinin fonksiyonel aktivite skorları ile değerlendirilmesi amaçlamıştır. Gereç ve Yöntem: Yaralanma sonrası ameliyata kadar geçen sürenin ameliyat sonrası aktivite skorlarına etkisi değerlendirilmiştir. Hastaların vücut kitle indeksleri (VKİ) hesaplanarak aktivite skorlarına etkisi değerlendirilmiştir. Değerlendirmede Tegner Aktivite Skalası, Modifiye Lysholm Diz Skorlaması ve Barret kriterleri kullanılmıştır. Bulgular: Hastaların ortalama VKİ'si 23,99±3,64 kg/m2 (aralık: 19.9-34) idi. VKİ değerleri zayıf (18.5 kg/m2 veya daha az), normal (18.5 kg/m2 to 24.99 kg/m2), kilolu (25 kg/m2 - 29.99 kg/m2) ve obez (30 kg/m2 to 39.99 kg/m2) olarak sınıflara ayrıldı. Hastaların 3'ü zayıf (%8.8), 20 tanesi normal (% 58.8), 9 tanesi kilolu (%26.5) ve 2 tanesi obez (% 5.9) olarak saptandı. VKİ sınıfları iki gruba ayrılarak istatistiksel olarak analiz edildi. Kilolu ve obez hastalar bir gruba, zayıf ve normal kilolu hastalar diğer gruba alınarak değerlendirildi. VKİ'ne göre menisküs iyileşmesi değerlendirildiğinde gruplar arasında Tegner Aktivite Skalası, Modifiye Lysholm Diz Skorlaması ve Barrett kriterlerine göre istatistiksel olarak fark saptanmadı (p> 0.05). VKİ'nin ÖÇB rekonstrüksiyonu ile birlikte menisküs tamiri yapılan hastalarda menisküs iyileşmesine etkisi olmadığı saptandı. Yaralanma ile operasyon zamanına kadar geçen sürenin yine bu grupta operasyon sonrası aktivite skorlarına etkisi olmadığı saptandı (p> 0.05). Tartışma: VKİ ve yaralanmadan operasyona kadar geçen sürenin ÖÇB rekonstruksiyonu ile beraber menisküs tamiri yapılan hastalarda ameliyat sonrası fonksiyonel skorlara etkisinin olmadığı gösterilmiştir. Menisküs tamiri endike olan ÖÇB yaralanmalarda zamandan ve hasta VKİ'nden bağımsız olarak tanı koyulduğu anda tamir edilmelidir.

Anahtar Kelimeler

Menisküs Tamiri; Ön Çapraz Bağ; Vücut Kitle İndeksi; Tegner Aktivite Skoru-Modifiye Lysholm Skorlaması

Abstract

Aim: Our study was to assess the outcome of meniscal repair surgery with anterior cruciate ligament reconstruction, focusing in particular on meniscal healing. Material and Method: We analyzed whether the time elapsed between the injury and the surgery affected the activity scores as measured by the Tegner Activity Scale, Modified Lysholm Knee Scoring, and Barrett criteria. Similarly, we analyzed whether body mass index (BMI) affected the activity scores. Result: The average BMI of the patients was 23.99±3.64 kg/m2 (range: 19.9-34). BMI was graded as underweight (18.5 kg/m2 or less), normal weight (18.5 kg/m2 to 24.99 kg/m2), overweight (25 kg/m2 to 29.99 kg/m2), or obese (30 kg/m2 to 39.99 kg/m2). Patients were divided into two groups. Overweight and obese patients were included in one group, and patients of normal weight or underweight were included in the other group. Out of a total of 34 patients, 3 (8.8%) were underweight, 20 (58.8%) were normal weight, 9 (26.5%) were overweight, and 2 (5.9%) were obese. Based on the BMI there was no significant difference between the two groups for results of the Tegner Activity Scale, Modified Lysholm Knee Score, and Barrett criteria. BMI of the patients was not a risk factor for the post-operative score scale (P>0.05). There was no significant difference between the injury period (the time elapsed between the injury and the surgery) and activity scores (P>0.05). The injury period had no effect on the post-operative scores. Discussion: BMI of the patients and injury time of the meniscus tear had no negative effect on the functional results of the operation. Meniscal lesions with ACL tear should be repaired when diagnosed.

Keywords

Meniscus Repair; Anterior Cruciate Ligament; Body Mass Index; Tegner Activity Score; Modified Lysholm Score

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Corresponding Author: Bekir Eray Kilinc, Merkez Mahallesi, Gölhisar Devlet Hastanesi, 15300, Burdur, Türkiye.
GSM: +905306061884 E-Mail: dreraykilinc@gmail.com

Introduction

The meniscus protects the joint cartilage and plays an important role in joint stability through axial load distribution, shock absorption, and load bearing. Among these functions, load distribution is crucial for preventing degenerative change, and this function is maintained by the hoop tension of the meniscus [1]. Repair of meniscal tears is commonly performed whenever possible. Short and long-term results are good when compared to a subtotal meniscectomy [2-4]. Therefore, meniscal repair has become the treatment of choice for traumatic meniscal lesions located in the vascularised area [5,6]. Arthroscopic meniscal repair has been performed using inside-out, outside-in, and all-inside repair surgical techniques.

Meniscal injury is currently a well-recognized source of knee dysfunction, and its arthroscopic treatment has become one of the most commonly performed orthopedic procedures around the world. Meniscal resection is performed more commonly than repair, but there has been a shift in focus from meniscal resection to meniscal preservation and repair in recent years [7]. The meniscus withstands different forces, including shear, tension, and compression and plays a crucial role in load bearing, load transmission, and shock absorption. The contact area of a tibiofemoral joint surface may decrease by up to 20% following a partial meniscectomy and by 50–70% following a total meniscectomy. Hence, the resultant increase in contact stresses accelerates the progression of degenerative arthritis following a meniscectomy [8]. The development of arthritis following meniscal resection surgery may take up to 10–15 years in the case of a medial meniscus, but it may happen within 2 years in the case of a lateral meniscus [9].

The objective of our study was to assess the outcome of meniscal repair surgery with anterior cruciate ligament reconstruction, focusing in particular on meniscal healing. We evaluated whether the patients' BMI or the time between injury and surgery influenced the activity score levels.

Material and Method

This retrospective study was conducted at a single center. Ethical approval was obtained from the Institutional Review Board. Informed consent was obtained from all patients prior to participation in the study. Our institution's database was consulted using the search terms "Meniscal repair" and "Anterior Cruciate Ligament surgery" together. A total of 34 patients with ACL reconstruction and meniscal repair procedures with a minimum 2 years follow-up were included into the study.

Taking instability and meniscal injury findings detected on physical examination, direct and indirect ACL insufficiency, and meniscal injury detected in MRI into consideration, reconstruction and meniscal repair were decided in the same surgery.

While deciding when to perform surgery on patients who were referred soon after the injury, edema in the knee and range of motion of the knee were evaluated. Also, the social support structure of the patient, activity level, occupation, presence of inflammation, and adequacy of muscle strength were considered.

Objective parameters included the assessment of joint line tenderness, effusion, McMurray and Apley provocation testing for meniscus injury [10], and Anterior Drawer test, Lachman test and Pivot Shift test for ACL injury. All of the meniscal tears and anterior cruciate ligament injuries were confirmed by diagnostic arthroscopy.

The same rehabilitation protocol was applied to the all patients in the study. Patients were advised to return to sports after having adequate hamstring and quadriceps strength, knee range of motion, stability, and function as compared to the opposite unaffected knee and after successfully undergoing a phase of sports-specific training.

The Tegner Activity Scale is a subjective rating scale used to assess the patient's activity level before and after surgery. It comprises eight knee symptoms; each has a range of function that the patient matches to their level of activity if the symptom occurred. The total score is graded as poor (<66), fair (66-83), good (84-90), and excellent (>90) [11].

The Modified Lysholm Knee Scoring is a questionnaire to evaluate outcomes of knee ligament surgery, particularly symptoms of instability. The total score is categorized as no symptoms or disability (100), excellent (95–100), good (84–94), fair (65–83), and poor (≤64) [12].

Tegner Activity Scale and Modified Lysholm Knee Scoring were recorded prior to surgery and at the last follow-up. Similarly, results for the Barrett test [10] were recorded prior to surgery and at the last follow-up. Outcomes were compared between the two groups.

The period from injury to surgery was noted, and we analyzed whether it affected the activity score.

Each patient's body mass index (BMI) was calculated. BMI was graded as underweight (18.5 kg/m2 or less), normal weight (18.5 kg/m2 to 24.99 kg/m2), overweight (25 kg/m2 to 29.99 kg/m2), or obese (30 kg/m2 to 39.99 kg/m2). Patients were divided into two groups. Overweight and obese patients were included into one group, and the patients of normal weight or underweight were included into the other group. The Tegner Activity Scale, Modified Lysholm Knee Scoring, and Barrett criteria results were compared between the two groups.

NCSS (Number Cruncher Statistical System) 2007 and PASS (Power Analysis and Sample Size) 2008 Statistical Software (Utah, USA) were used for statistical analysis. Data was analyzed using descriptive statistical methods (mean, standard deviation, median, frequency, ratio, minimum, maximum) and for comparing quantitative data. Student's t-test was used for two-group comparison of parameters with normal distribution, while Mann-Whitney U test was used for two-group comparison of parameters without normal distribution. In the comparison of qualitative data Pearson Chi-square test, Fisher-Freeman-Halton test, Fisher's exact test, and Yates Continuity Correction test (Yates adjusted Chi-square) were used. Spearman's correlation analysis was used for the evaluation of the relation between parameters. Wilcoxon Signed Ranks test was used for within-group comparison of parameters without normal distribution. Significance was evaluated in $P < 0.01$ and $P < 0.05$.

Results

A total of 34 patients with meniscus repair and ACL reconstruction were included into our study. 30 patients were male (88.2%) and 4 (11.8%) were female. The average age was 28.09 ± 7.38 years (range: 11-44). The average time between injury and op-

eration was 11.45 ± 17.48 months (range: 1-84). Seventeen of the patients (50%) had a right side injury and 17 (50%) had a left side injury.

The average BMI of the patients was 23.99±3.64 kg/m2 (range: 19.9-34). Out of 34 patients (8.8%) were underweight, 20 (58.8%) were normal weight, 9 (26.5%) were overweight, and 2 (5.9%) were obese.

In terms of Barrett criteria, before the surgery all patients were positive. After surgery, 27 patients (79.4 %) were normal in terms of Barrett criteria and 17 patients (20.6 %) were positive (Figure 1). There was a significant difference between pre-operative and post-operative Barrett criteria evaluation of the patients (P<0.01) (Table 1).

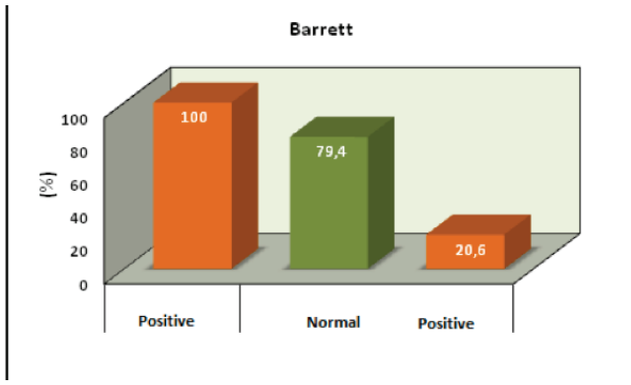

Figure 1. Pre-operative and post-operative Barrett diagram

Table 1. Pre-operative and post-operative Barrett evaluation

Barrett		n	%
Pre-op	Positive	34	100
Post-op	Normal	27	79.4
	Positive	7	20.6
	[a]p	0.001**	

[a]Marginal Homogeneity Test; **p<0,01

There was a significant difference between pre-operative and post-operative Lysholm Score (P<0.01) (Figure 2, Table 2).

There was no significant difference in Tegner Activity Score between pre-operative and post-operative period (P>0.05) (Table 3).

Based on the BMI there was no significant difference between the two groups in the Tegner Activity Scale, Modified Lysholm Knee Score, and Barrett criteria results. BMI was not a risk factor for the post-operative score scale (P>0.05) (Table 4).

There was no significant difference between injury period and activity scores (P>0.05). Injury period had no effect on the post-operative scores (Tables 5, 6 and Figures 3, 4).

Discussion

Both meniscal repair (open or arthroscopic) and meniscectomy procedures are standard therapies for meniscal tear treatment. Our outcomes, measured by post-surgery increases in the Modified Lysholm Score and the Tegner Score, indicate that meniscal repair with ACL reconstruction is an effective surgical approach. Modified Lysholm Score is a condition-specific, subjective outcome score used by physicians to determine improvement in the injured or postsurgical knee. The Tegner Activity Scale was designed as a score for patients with ligamentous injuries. However, the two scoring systems are subjective, showing large variability across patients, which should be taken into consideration.

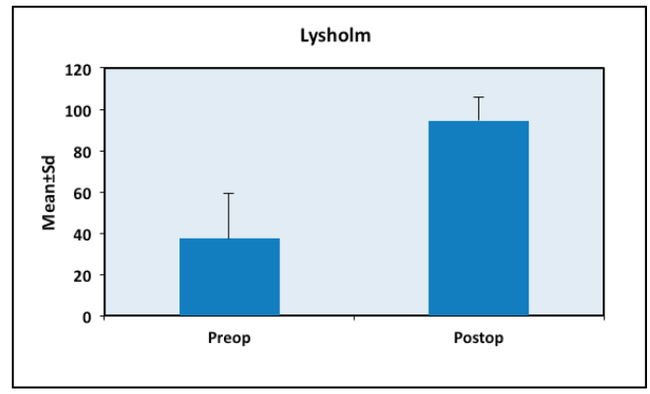

Figure 2. Pre-operative and post-operative Lysholm Score diagram

Table 2. Pre-operative and post-operative Lysholm Score evaluation

	Lysholm Score	
	Min-Max (Med)	Ave±Sd
Pre-op	5-79 (37)	37.47±21.61
Post-op	53-100 (100)	94.47±11.24
	[b]p	0.001**
Preop-Postop Difference	21-88 (51.5)	57.00±20.99

[b]Wilcoxon Test **p<0,01

Table 3. Pre-operative and post-operative Tegner Score evaluation

	Tegner	
	Min-Max (Med)	Ave±Sd
Preop	4-9 (5.5)	5.91±1.11
Postop	4-9 (5.5)	5.91±1.11
	[a]p	1.000

[b]Wilcoxon Test

Table 4. BMI evaluation

		BMI		P
		Normal	Overweight&obese	
Barrett	Negative	19 (82.6)	8 (72.7)	c0.656
	Positive	4 (17.4)	3 (27.3)	
Lysholm	Min-max (med)	21-87 (50)	21-88 (52)	d0.531
	Ave±SD	55.56±20.06	60±23.54	
Tegner	Min-max(med)	4-9 (6)	5-7 (5)	d0.523
	Ave±SD	6±1.16	5.73±1	

[c]Fisher's Exact test [d]Mann Whitney U test

Central, unstable lesions in the white zone of meniscus are indicators for meniscectomy. After this procedure, there is a better short-term outcome for patients and a lower re-operation rate [13]. However, some studies have reported that meniscectomy significantly increases contact pressures of the tibiofemoral joint, especially in patients who have chondral damage [14-16]. Meniscectomy has been associated with poorer postoperative outcomes when considering knee function, Lysholm Scores, Tegner activity level and instability. The medial compartment is more conforming than the lateral compartment. Thus, loss of the meniscus on the lateral side may lead to an increased

Table 5. Effect of injury period on Tegner and Lysholm Score

	Injury Period	
	R	P
Preop Tegner	0.206	0.257
Postop Tegner	0.206	0.257
Preop-postop Tegner	-	-
Preop Lysholm	0.138	0.452
Postop Lysholm	0.18	0.323
Preop-postop Lysholm	-0.2	0.273

r: Spearman's Correlation

Table 6. Effect of injury period on Barrett criteria

		Injury Period			P
		n	Min-max (med)	Mean±Sd	
Postop Barrett	Negative	26	1-84 (5.5)	12.98±19.05	0.410
	Positive	6	1.5-12 (3)	4.83±3.98	

Mann-Whitney U test

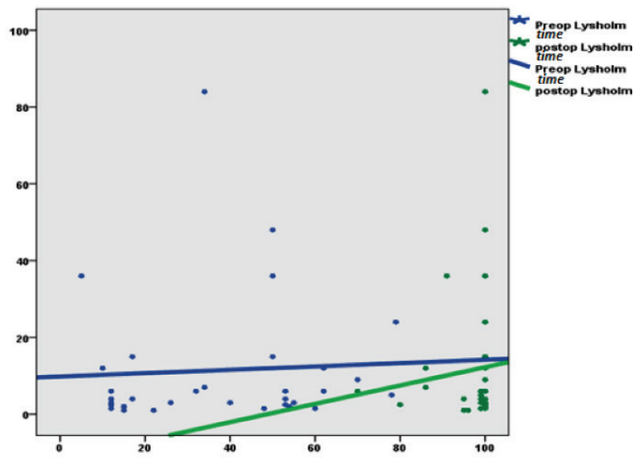

Figure 3. Effect of injury period on Tegner and Lysholm Score

amount of instability and resultant force transmission to the articular cartilage, leading to increased degeneration and potentially the poor outcomes observed [17].

Open meniscal suture and arthroscopic inside-out procedure, as a meniscus-preserving procedure, each has biomechanical advantages [14]. Meniscus repair with open-suture technique was a regular therapy for repair in the 1980s and early 1990s. However, with the popularity of arthroscopic techniques, arthroscopic meniscal repair has become a standard procedure with different suture techniques, such as outside-in and inside-out. The indications for meniscal repair remain controversial. Peripheral or nearly peripheral meniscus tears within 2 mm of the meniscosynovial junction are good suture repair indications [18]. According to another study, suitable tears for arthroscopic repair are 4 mm from the periphery. A 2.5-mm tear from the periphery should be repaired by performing an arthrotomy. Tears less than 2 mm from the periphery heal better than those 4 mm from the periphery [19]. Another study also stated that meniscal repair must be in the red zone [20]. Several studies reported that the meniscus, especially its roots, plays an important role in knee stability and preventing the knee from early degeneration [18,19,21]. In addition, arthroscopic meniscus repair has a relatively better prognosis than an open-suture procedure due to its minimal incision and early recovery and rehabilitation [18]. Hence, the meniscal repair had a lower failure rate and more satisfaction than meniscectomy.

In our study, regardless of BMI, the patients showed increased activity level and scores after surgery. We also found that the injury period (the time period between the meniscal tear and the operation) had no effect on the functional scores. Therefore, meniscal injury should be repaired with ACL injury when diagnosed regardless of the injury period.

It would be ideal to repair all meniscus injuries; however, the failure rate has been found to be significantly high and the implant costs considerable, requiring careful consideration and selection of the patients. Some studies have reported success rates for meniscal repair to be up to 60–90% depending on the region of meniscal repair [22,23]. Meniscal repairs performed in conjunction with ACL reconstruction are generally thought to have a better healing rate than meniscal repair in knees with intact ACLs [22].

It is interesting that past studies of meniscal repair have shown higher re-operation rates compared with meniscectomy, depending on surgical skills, the meniscal tear pattern, patient age and activity level, and proper post-operative rehabilitation. According to a systematic review, a higher re-operation rate was shown in medial meniscus repairs [3,24]. Possible reasons for this include the fact that the medial side of the meniscus is anchored more tightly to the tibial plateau and that the medial side experiences higher biomechanical loads [25].

Our study showed that meniscal tear repair with ACL reconstruction increased the functional scores and patients' satisfaction. Whereas meniscal repairs have a higher re-operation rate than meniscectomy, they likely result in better long-term patient reported outcomes and better activity levels. Neither patient BMI nor injury time of the meniscus tear had a negative effect on the functional results of the operation. Meniscal lesions with ACL tear should be repaired when diagnosed.

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Compliance with Ethical Standards:

Approval by the Institutional Review Board was obtained.

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Competing interests

The authors declare that they have no competing interests.

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