European Review for Medical and Pharmacological Sciences 2023; 27: 1863-1868

The effect of brace use on clinical outcomes after arthroscopic meniscus repair

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Abstract. – OBJECTIVE: It was aimed to evaluate the necessity of using range of motion (ROM) restrictive braces in the postoperative follow-up and rehabilitation of patients who underwent arthroscopic repair due to meniscal tear.

PATIENTS AND METHODS: Among the patients who applied to our Orthopedics and Traumatology Department with knee pain, stuck and locking sensation, between January 2020 and December 2020, the files of those who were diagnosed with meniscus tear and underwent arthroscopic repair as a result of physical examination and Magnetic Resonance Imaging (MRI) examination, were evaluated retrospectively. Patients who underwent reconstruction in the same session due to concomitant ligament injury and who had repaired with a technique other than the all-inside repair technique were not included in the study. A total of 48 patients were included in the study to form two equal groups. The results of the patients were evaluated using the Lysholm Score, Modified Cincinnati Score and clinical examination results.

RESULTS: The mean age of the patients was 35.3 (18-51). It was determined that the mean Lysholm score was increased by 22.3 points to 89.5, the average Modified Cincinnati score was determined to be 26.95 with an increase of 1.31 points, and the average visual analog scale (VAS) score decreased from 7.2 to 2.1.

CONCLUSIONS: As a result of the current literature and our study, it was concluded that there is no need for ROM restriction in the knee joint in patients who undergo arthroscopic meniscus repair. It was determined that the biomechanical changes demonstrated by cadaver studies and MRI models were not reflected in clinical results.

Key Words:
Meniscus, Arthroscopy, Angle adjustable knee brace, ROM limitation, Postoperative rehabilitation.

Introduction

The menisci are a cartilage structure that reduces the stress on the joint surfaces by increasing the contact surface between the femur and the tibia. They prevent wear by reducing friction during movement. In addition, their functions including lubricating the knee, carrying loads, preventing compression of the capsule and synovium, and contributing to anterior-posterior stability by deepening the joint surface[1-4].

Menisci are the structures most frequently affected in knee injuries[3]. Direct traumas such as traffic accidents and sports injuries can cause meniscal tears, and they may also show loss of elasticity and degeneration due to aging[4].

In cases of meniscus tear, symptoms such as pain, snagging, locking, limitation of movement and fluid collection are observed in the knee joint. The diagnosis of meniscal tear can be evaluated with an accuracy of 95% using physical examination tests and imaging methods[5].

Conservative and surgical methods are available in the treatment of meniscal tears. Surgical treatment options are a meniscectomy and a meniscus repair[1]. Since the increased friction and pressure on the joint surface after meniscectomy accelerates the development of osteoarthrosis, repairing meniscal tears by suturing, in order to preserve the meniscus structure and function, is the primary treatment option[6].

The most important factor in the success of meniscal tear treatment is the amount of blood supply to the tear area. The healing potential of peripheral tears is higher in the presence of a high blood supply to the meniscus tissue, which is divided into red and white zones[7,8]. The type of meniscus tear and the timing of surgery are also important factors affecting the success of

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the repair. Acute, traumatic tears have a higher healing potential than chronic and atraumatic tears[9].

Historically, the gold standard technique in the arthroscopic treatment of meniscal tears has been the suture technique applied from the inside out[10,11]. In order to prevent the risks of neurovascular damage resulting from this technique, the all-inside suture technique has been developed[12]. In addition to the fact that there was no difference between them in terms of fixation power, it should be noted that the all-inside suture technique is less invasive and encounters a lower risk of morbidity[13,14].

In addition to all these factors that affect the success of arthroscopic meniscus repair, some important biomechanical factors should be considered in the postoperative period: ignoring these may increase mechanical stress and cause re-tear development[15,16]. In our study, with the goal of examining the effect of biomechanical stress, we compared the use and non-use of braces that limit joint range of motion in the postoperative period in patients with meniscal tears, who underwent arthroscopic repair with the all-inside suture technique.

Patients and Methods

This study was approved by the Samsun Education and Research Hospital's Scientific Research Ethics Committee and complies with the Helsinki Declaration. The informed consent was waived due to the retrospective nature of the study and the assessment utilized anonymous research findings.

Among the patients who applied to our Orthopedics and Traumatology Department with knee pain, stuck and locking sensation between January 2020 and December 2020, we retrospectively evaluated the files of the patients who were diagnosed with a meniscus tear and underwent arthroscopic repair as a result of physical examination and Magnetic Resonance Imaging (MRI) examination.

Among 87 patients who underwent arthroscopic meniscus repair and had at least one year of regular follow-ups, nineteen patients who underwent anterior cruciate ligament reconstruction in the same session were excluded from the study. Among the 68 patients who underwent isolated meniscus repair, only 59 patients treated with the whole inside (FasT-Fix all inside meniscus repair kit, Smith-Nephew) suture technique were selected. Nine patients who were found to have a combination of outside-in and all-inside repair were excluded from the study.

As per the study plan, 24 patients out of 35 who met the exclusion criteria and did not use a postoperative brace were selected randomly in order to set-up a comparison of 24 patients who were followed by using an angle-adjustable knee brace in the first 6-week period and limited range of motion between 0°-90°. As a result, the study was initiated with a total of 48 patients divided into two equal groups.

All patients were operated under an air tourniquet. While the operation of 41 (85%) patients was performed under spinal anesthesia, seven (15%) patients were operated under general anesthesia. A microfracture was applied to the intercondylar notch in all patients and a drain was not used in any of the patients.

While the patients were allowed to be mobilized with crutches in the postoperative period, no weight bearing was allowed on the operated leg for 6 weeks. In the group using an angle adjustable knee brace, the range of motion of the joint was restricted between 0°-90° (Figure 1). The range of motion (ROM) on the Breys unused group was released (Figure 2). Quadriceps exercises and closed chain ROM exercises were shown to both groups. At the end of six weeks, the use of the knee braces was discontinued. The patients in both groups were mobilized with full weight at the end of the 6th week and were referred to the physical therapy and rehabilitation program. The patients were called to outpatient

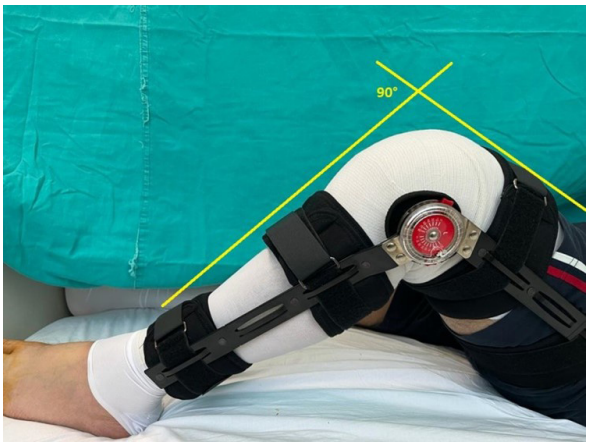

Figure 1. Patient who underwent ROM restriction using a brace in the postoperative period.

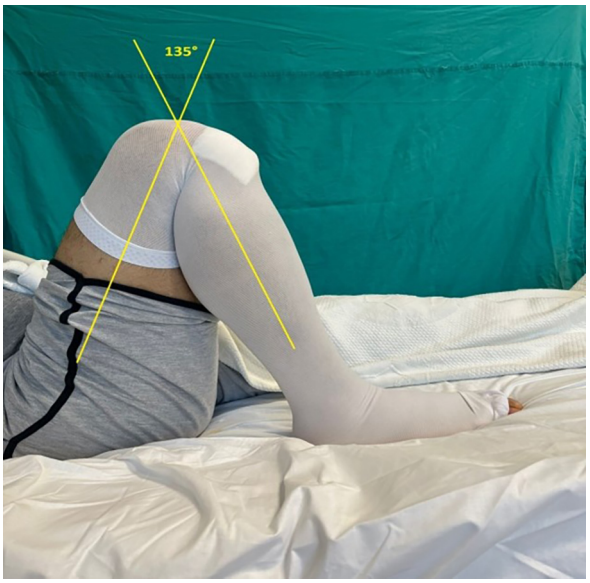

Figure 2. The patient whose ROM was released in the postoperative period.

clinic controls every two weeks for the first six weeks, once a month for the first six months, and every three months thereafter.

Statistical Analysis

The mean follow-up period of the patients included in the study was found to be 17.7 months (12-24). No arthroscopic second look was applied to any patient in the postoperative follow-up. The collected data were evaluated with the Mann-Whitney U test using the IBM SPSS Statistics Software Version 23.0 (IBM Corp., Armonk, NY, USA) program. A p-value < 0.05 was considered statistically significant.

Results

As previously indicated, some 48 patients were included in the study. The mean age of the patients was 35.3 (18-51). 18 (75%) male and 6 (25%) female patients out of 24, for whom braces were used in the postoperative period, were treated with arthroscopic meniscus repair to the right knee in 16 (66%) cases and left knee in 8 (34%) cases. Of 24 patients who did not use braces in the postoperative period, 19 (79%) were males and 5 (21%) were female patients (Figure 3). Arthroscopic meniscus repair was performed on the right knee in 14 (58%) patients and on the left knee in 10 (42%) patients.

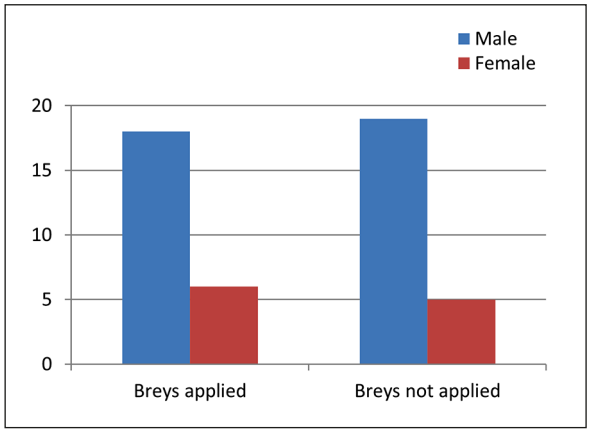

Figure 3. Gender distribution of the patients included in the study.

When the meniscal tear types in the braced group were examined, it was determined that 12 (50%) patients had radial, 5 (21%) patients had horizontal, 3 (12%) patients had longitudinal, and 4 (17%) patients had complex meniscus tears. In the non-bracing group, 11 (46%) patients had radial, 5 (21%) horizontal, 6 (25%) longitudinal and 2 (8%) patients had complex meniscus tears (Figure 4).

A mean of 3.1 (1-6) all-inside sutures [FasT-Fix all inside meniscus repair kit, Smith-Nephew (Watford, England)] were used in arthroscopic repair. Sixteen (66%) of the patients in the Brays group were operated on the right

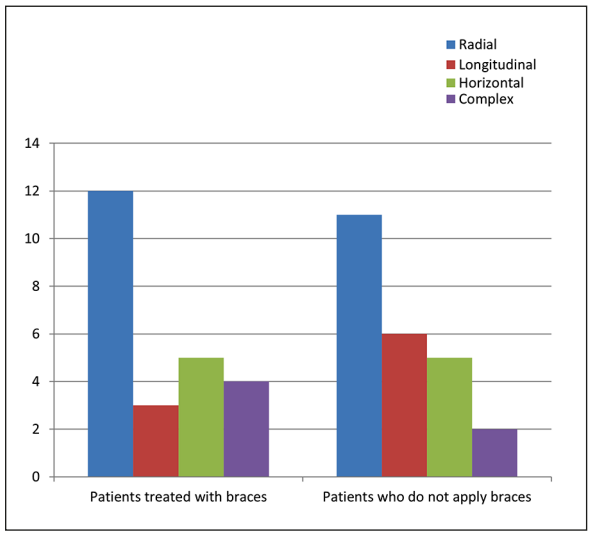

Figure 4. Distribution of patients included in the study by meniscus tear types.

knee, and 8 (34%) on the left knee. In the group without bracing, 14 (58%) patients were operated on the right knee and 10 (4%) patients on the left knee.

In the preoperative clinical evaluations of the patients, the mean Lysholm scores were found to be 67.2 (50-80). In the evaluation made at the last follow-up in the postoperative period, the mean Lysholm scores were determined as 89.5 (69-98). This increase was found to be statistically significant ($p<0.05$), however there was no statistically significant difference between the group using and not using braces ($p>0.05$).

In the preoperative clinical evaluations of the patients, the mean Modified Cincinnati scores were found to be 25.6 (21-28). In the evaluation made at the last follow-up in the postoperative period, the average of the Modified Cincinnati scores of the patients was found to be 26.9 (24-29). This increase was found to be statistically significant ($p<0.05$), however there was no statistically significant difference between the group using and not using braces ($p>0.05$).

In the preoperative clinical evaluations of the patients, the mean VAS scores were found to be 7.2 (6-9). In the evaluation performed at the last follow-up in the postoperative period, the mean VAS scores of the patients were found to be 2.1 (1-5). This progress was found to be statistically significant ($p<0.05$), however there was no statistically significant difference between the group using and not using braces ($p>0.05$).

Discussion

Although arthroscopic meniscus repair is a widely used treatment method, there is no standard protocol for weight bearing and rehabilitation in postoperative follow-up. Postoperative rehabilitation is of great importance in helping meniscus heal and returning the patient to pre-injury activity level.

In cadaver studies, it has been shown that the contact pressure between the femur and the tibia increases with the increase in knee flexion[15]. Therefore, it was thought that restriction of ROM in the postoperative period would reduce the mechanical stress on the applied repair and protect the repair[16]. In a study using 3D formats of MRI images, it was shown that there is a posterior displacement of 5.1 mm of the medial meniscus and 11.2 mm of the lateral meniscus during knee flexion[17].

In cadaver studies, it has been shown that the medial femoral condyle remains stable during flexion in the non-load-bearing knee and participates in the movement. On the other hand, in the load-bearing knee, 4 mm forward displacement developed during 0-10 degrees of flexion, however the lateral femoral condyle is displaced 1 mm in 0-60 degrees of flexion and 13 mm in 60-110 degrees of flexion[18]. Considering this movement pattern in isolation, flexion up to 110 degrees seems safe after medial meniscus repair, while for its part flexion up to 60 degrees after lateral meniscus repair seems safe. This data suggests that ROM restriction after meniscus repair will help maintain the stability of the repaired area, however these findings have not been supported by clinical studies.

In a cadaveric study, full weight bearing and maximum flexion degrees were modelled in the meniscus repaired knee. It was observed that the applied stress did not cause gap formation in the ruptured area nor in the repaired area[19]. As a result of the study, it was suggested that rehabilitation programs without ROM restriction and without resistance exercises should be implemented.

There are limited, free, and accelerated rehabilitation procedures after arthroscopic meniscal repair in the literature. In a study[20] conducted on 100 patients, ROM restriction was applied in full extension for three weeks and then the ROM was released. Patients were evaluated with the WOMET score and it was found that a statistically significant improvement was achieved[20]. In the study performed by Logan et al[21], 42 patients were examined, and knee ROM was limited to 0-90 degrees for 6 weeks after the arthroscopic meniscus repair. During this period, controlled weight-bearing was applied. In this study, patients were evaluated using the Lysholm score, and it was reported that 89% of patients had good and excellent clinical results. Lind et al[22] followed 32 (53%) of 60 patients who underwent arthroscopic meniscus repair without applying ROM restriction in the postoperative period, and 28 (47%) by restricting ROM in full extension for 6 weeks; patients in both groups began to give touch-down weight bearing from the first postoperative day they gave permission. The patients were evaluated with KOOS and Tegner scores, and as a result, it was determined that there was a statistically significant improvement in all the patients included in the study[22]. Twenty-four (50%) of 48 patients included in our study were applied 0-90 degrees ROM restriction with an angle-adjustable knee brace for 6 weeks, and knee ROM was released in the remaining 24

(50%) patients. All patients were asked not to put any weight on the operated leg. Lysholm score, Modified Cincinnati score and VAS scores were evaluated preoperatively and postoperatively for the follow-up of the patients we examined. It was determined that the clinical scores of all patients improved statistically significantly. There was no significant difference in clinical outcomes between the two groups.

In our study, the failure rate was found to be 8.3% (4 patients). Considering the literature, it was thought that this rate, which was found to be low, was related to the relatively short mean follow-up period (17.7 months), and this rate might increase in long-term follow-up[23]. Since all-inside sutures were used in all of the patients included in the study, the effect of other suture techniques on clinical results could not be examined. In addition, our study does not give an idea about the effects of weight bearing, since the mobilization of all patients in the two groups was restricted by weight bearing.

Conclusions

As a result of the current literature and our study, it was concluded that there is no need for ROM restriction in the knee joint in patients who undergo arthroscopic meniscus repair. It was also determined that the biomechanical changes demonstrated by cadaver studies and MRI models were not reflected in clinical results. It was thought that ROM restriction could be considered as overtreatment in order to preserve the applied arthroscopic meniscus repair.

To develop a gold standard protocol for the rehabilitation of patients undergoing arthroscopic meniscus repair, there is a need for prospective studies with a higher number of patients and the ability to examine all the variables jointly.

Conflict of Interest

The Authors declare that they have no conflict of interests.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Ethics Approval

The study was approved by the Samsun Education and Research Hospital's Scientific Research Ethics Committee (Approval number: 2022/2/10). All procedures performed in studies involving human participants were executed in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Informed Consent

The informed consent was waived due to the retrospective nature of the study and the assessment utilizing anonymous research findings.

Authors' Contribution

ÖB: Project development, Data Collection, Data analysis, Manuscript writing/editing. EG: Project development, Data Collection, Data analysis, Manuscript writing/editing. ÖÇÇ: Project development, Data Collection, Data analysis, Manuscript editing.

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