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The three portal (including transpatellar tendon portal) versus two portal technique in the arthroscopic menisectomy procedure for isolated medial bucket-handle type meniscal tears

İzole medial menisküs kovasapı yırtıklarının artroskopik menisektomi ile tedavisinde üçlü portal (transpatellar tendon giriş dahil) ile ikili portal tekniklerinin karşılaştırılması

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Objectives: The aim of this study is to evaluate the efficacy of the central (transpatellar tendon) portal technique for the treatment of isolated medial bucket-handle type meniscal tears with the arthroscopic menisectomy procedure.

Patients and methods: In this study, fifty patients with isolated medial bucket-handle type meniscal tears were evaluated. They were divided into two groups with 25 patients in each group. In the first group, the three portal (including central portal) technique was used and in the second group, the two portal technique was used. The results of the two groups were compared in terms of *(i)* operation times; *(ii)* changes in Insall-Salvati ratios postoperatively; *(iii)* postoperative Cincinatti scores; *(iv)* quadriceps muscle strengths; *(v)* the presence of anterior knee pain and; *(vi)* complication rates, in order to determine the significance of adding a central portal to the standard anterolateral and anteromedial portals in the menisectomy procedure.

Results: There was no significant difference between the two groups in terms of Cincinnati clinical scores, quadriceps muscle strenghts and complication rates. However, the operation time values of the first group were significantly shorter than the second group ($p<0.001$). The postoperative changes in Insall-Salvati ratio values were significantly higher in the first group than the second group ($p<0.002$). This results show us that the first group had a significant decrease in patellar tendon length whereas the second group had no change in size postoperatively.

Conclusion: We suggest that the use of the central portal for viewing and instrumentation is a safe and quick technique in the menisectomy procedure for medial bucket-handle type meniscal tears, due to its unexpected lower complication rates and shorter operation times. While it causes patellar tendon shortening, this does not effect the clinical outcomes.

Key words: Arthroscopy; bucket handle meniscal tear; central portal.

Amaç: Bu çalışmada izole medial menisküs kovasapı yırtıklarının artroskopik menisektomi ile tedavisinde kullanılan iki teknik arasında tek değişken olan santral girişin (transpatellar tendon) etkinliği değerlendirildi.

Hastalar ve yöntemler: Bu çalışmada izole medial menisküs kovasapı yırtığı olan 50 hasta değerlendirmeye alındı. Hastalar her bir grupta 25 hasta olacak şekilde iki gruba ayrıldı. Birinci grupta üçlü portal tekniği (santral giriş dahil), ikinci grupta ise ikili portal tekniği kullanıldı. İki grup; *(i)* ameliyat süreleri, *(ii)* Insall-Salvati oranlarındaki ameliyat sonrası değişiklikler, *(iii)* ameliyat sonrası Cincinatti skorları, *(iv)* kuadriseps kas güçleri, *(v)* diz önü ağrısı varlığı ve *(vi)* komplikasyon oranları yönünden karşılaştırıldı ve menisektomi işleminde santral girişin, anteromedial portal ve standart anterolateral portal tekniğine eklenmesinin farklılık oluşturup oluşturmadığı ortaya konuldu.

Bulgular: Cincinatti skorları, kas güçleri ve komplikasyon oranları açısından iki grup arasında anlamlı fark saptanmadı, ancak birinci gruptaki ameliyat süresi değerlerinin ikinci gruba göre anlamlı derecede daha kısa olduğu tespit edildi ($p<0,001$). Öte yandan birinci gruptaki Insall-Salvati oranlarındaki değişikliklerin ikinci gruba göre anlamlı derecede daha yüksek olduğu gözlendi ($p<0.002$). Bu sonuç ikinci grupta ameliyat sonrasında patellar tendon boyunun değişmediğini, ancak birinci grupta patellar tendon boyunun anlamlı olarak azaldığını gösterdi.

Sonuç: Görüntüleme ve implant kullanma portalı olarak santral girişin kullanımının medial menisküs kovasapı yırtıklarının artroskopik menisektomi ile tedavisinde düşük seviyedeki komplikasyon oranları ve kısa ameliyat sürelerine bağlı olarak güvenilir ve hızlı bir teknik olduğunu düşünüyoruz. Bu yöntem patellar tendon boyunda kısalmaya neden olmakla birlikte klinik sonuçları etkilememektedir.

Anahtar sözcükler: Artroskopi; menisküs kovasapı yırtığı; santral portal.

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As the number of the arthroscopic procedures performed increases, the selection of appropriate portals becomes more important. If the entry portal is not able to supply adequate vision, maneuverability in all portions of the joint is limited.[1] Aside from the standard portals, there are some auxiliary portals that can provide better vision and instrument insertion. These portals are very helpful during the arthroscopic procedure for the surgeon.[2-5] The central (transpatellar tendon) portal technique is one of those auxiliary portals.

A review of literature shows this portal to be used mainly for the visualization of the posteromedial (PM) compartment of the knee during arthroscopic surgery in selected cases,[1,6,7] but we were not able to find any reports specifically focused on the use of the central portal in the treatment of bucket-handle type meniscal tears. In our institute, we used this portal for both viewing and instrumentation in menisectomy procedures for the treatment of bucket-handle type meniscal tears. By using this portal, we were able to achieve adequate visualization of the characteristics of the tears and were able to use instruments during the intervention, especially in the anterior part of the knee.

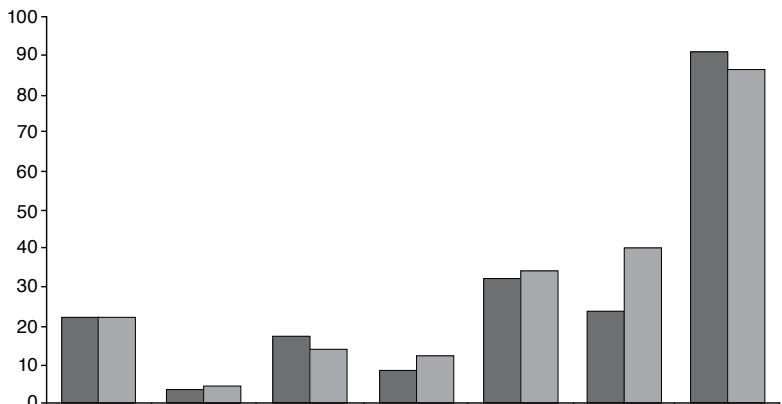
The aim of this study is to evaluate the efficacy of the central portal technique in the treatment of isolated medial bucket-handle type meniscal tears by keeping it the only variable between two techniques for the arthroscopic menisectomy procedure.

PATIENTS AND METHODS

We reviewed two groups of 25 patients, all with isolated medial bucket-handle type meniscal tears. Half were treated by three portal (including central portal) technique and the other half with the two portal technique. There was no intra-articular pathology necessiating surgical intervention other than the medial isolated buckle-handle type meniscal tear in both groups. The average follow-up period was 23.84 months (median: 23 months) in the first group (three portal technique) and 23.72 months (median: 18 months) in the second group (two portal technique). The patient demographics are given in figure 1. Operation times, postoperative Insall-Salvati ratio changes, postoperative Cincinatti clinical sores, postoperative quadriceps muscle strengths, presence of anterior knee pain and complication rates were all noted for each group.

All of the arthroscopic procedures and follow-up controls were performed by the same surgical crew at the same institution. All of the operations were performed under epidural anesthesia. A 30-degree 4.0 mm arthroscope was used in all cases.

Initially, a routine diagnostic arthroscopy procedure was performed in both groups. To open the central portal in the first group, the knee was flexed 90 degrees. A skin incision of 1 cm was made beginning from 1 cm distal to the inferior pole of the patella along the patellar tendon, crossing the joint in the midline, with a number 15 sharp blade. To protect the anterior fibers of the patellar tendon, a sharp obturator was passed beyond the tendon



	Male	Female	Right knee	Left knee	Avrg. age (year)	Avrg. opr. time (min)	Avrg. Cincinatti scores
Three portal group	21	4	17	8	31.40	23.80	90.16
Two portal group	20	5	13	12	32.68	39.92	85.04

Figure 1. Demographics of the patients. Avrg.: Average; opr.: Operation.

and the portal was widened with gentle maneuvers. When the knee was flexed to 45 degrees, the cannula and the obturator were pushed forward over the fat pad to the superomedial compartment to enter the joint. In all cases this portal was used both for viewing and instrumentation (Figure 2).

During the procedure performed in the first group, the nature, shape, reductivity, length and localization of the tear were determined with the assistance of a probe inserted through the anteromedial (AM) portal. The arthroscope inserted through the central portal was pushed forward to the notch, and the PM compartment and posterior third of the medial meniscus were displayed. The scope was then inserted through the anterolateral (AL) portal. With a grasper inserted through the AM portal, the mobile part of the degenerated white zone tear was held and gently distracted. With a 45 degree right angled punch inserted through the central portal, the PM portion of the torn piece was transected (Figure 3). In some cases, a 15 degree straight punch and a meniscus knife were also used. The meniscal part freed from the PM portion was directed towards the AM portal by gentle traction. The connection between the torn piece and the meniscus was cut with a right angled punch inserted through the central portal and the degenerated torn piece was removed from the joint. Occasionally, a meniscus knife or a 90 degree right angled punch was also used. After the partial menisectomy procedure, the remaining degenerated meniscus margins were trimmed with soft tissue resectors and the meniscus was shaped as the letter "C", and intraartricular residual materials were removed by irrigation and aspiration.

Traditional partial menisectomy was performed in the second group through classical AL and AM portals in the absence of a central portal.

RESULTS

The data (Table I) obtained from the two groups including; the operation times, postoperative Insall-Salvati ratio changes, postoperative Cincinatti clinical sores, postoperative quadriceps muscle strengths, presence of anterior knee pain and complication rates, underwent statistical analysis to define any significant differences among the two techniques. Between the two groups; only the comparison of the operation time values (Mann-Whitney U-test: $p<0.001$) and postoperative Insall-Salvati ratio changes (Paired- T-test: $p<0.002$) were statistically significant. The operation period was significantly shorter in the first group, and there was shortening of the patellar tendon due to the significant positive difference in the postoperative Insall-Salvati ratio changes. However, there was no significance in the comparison of data of the two groups with respect to the postoperative Cincinatti scores, presence of anterior knee pain and complication rates. It was concluded that the use of a central portal decreased the time period of the operation without causing any significant clinical outcome failure, without increasing the incidence of anterior knee pain and without an increased complication rate compared to the standard two portal technique. The considerable

Figure 2. Picture showing the use of central transpatellar portal together with the standard anterolateral and anteromedial portals.

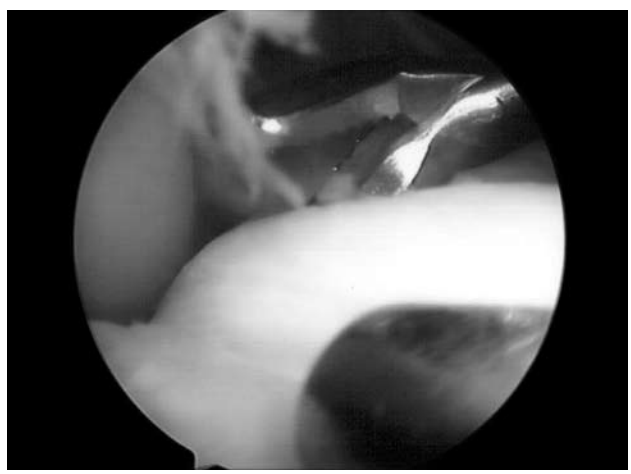


Figure 3. Picture showing the menisectomy procedure performed by using the grasper, left sided punch and the scope through three portals at the same time.

asymptomatic decrease in patellar tendon length that was determined in the study was not clinically significant.

DISCUSSION

In 1976, Gillquist et al.[8] described visualization of the posterior compartments of the knee through the intercondylar notch as a means of overlooking posterior horn medial meniscus tears. They used a central transpatellar tendon portal and examined the posterior compartments in 1.232 patients without complications. On the other hand, Erikkson and Sebik[9] performed a cadaveric study and found no advantage to the transpatellar tendon portal compared with the standard inferior lateral portal for visualization of the posterior compartment.[6] When using the central transpatellar tendon portal in cases where the patella is higher or lower than its normal position and the patellar tendon lies on the lateral side of the joint line, the localization of the portal must be manipulated.[1] This issue is also essential for the other portal localizations. For example; when the pathology is in the lateral compartment, the medial portal should move to a more lateral and higher position; as it is in the patello-femoral auxillary portal which is located at the auxillary point crossed by the lateral edge of the patella and the anterior edge of the lateral femoral condyle.[10] If the pathology is in the back of the lateral compartment, a third portal can be made, if necessary, at the low AL position just above the lateral meniscus.[10]

TABLE I

Data obtained from the two groups including the results of the techniques

	Three portal	Two portal
Number of patients	25	25
Male	21	20
Female	4	5
Right knee	17	13
Left knee	8	12
Age (Year)		
Average	31.4	32.68
Median	27	31
Range	(17-58)	(19-57)
Follow-up period (Month)		
Average	23.84	23.72
Median	23	18
Range	(14-36)	(13-45)
Operation time (Minute)		
Average	23.8	39.92
Median	23	37
Range	(10-50)	(25-75)
Quadriceps strength		
3/5	1	0
4/5	6	10
5/5	18	15
Anterior knee pain		
(Number of patients)	2	1
Complications		
(Number of patients)	2	3
Modified Cincinatti scores		
Average	90.16	85.04
Median	92	86
Range	(68-100)	(54-100)

The best way to determine the definite location of the entry portals is to highlight the joint line, soft tissue and bone anatomic landmarks carefully with a skin pen just before widening the joint.[1] A central transpatellar tendon portal is located approximatelly 1 cm distal to the inferior pole of the patella on the line lying along the patellar tendon on the joint midline. When opening this portal, a cannula is not used for penetration as the part of the cannula that is on the trocar may cause detachment in tendon fibers.[1] Moreover, repeated insertion through the fat pad may cause inflation of the fat pad causing poor visualization. Repeated irritations may also cause hemorrhage, hypertrophy and fibrosis in the fat pad.[1] Because of these reasons, some authors claim that they avoid using the central portal as much as they can.[7] In our study, we noticed patellar tendon shortening due to the central portal, but with no failure of quadriceps mechanism, no range of motion restriction nor increased complication rate compared to the two portal group.

Another portal option for bucket-handle type meniscal tears is Patel's midpatellar portal.[2,3] Patel claims that his own portal provides better vision for posterior horns of the menisci and there is less jam or intersection with accessory operative instruments.[2,3] Additionally, this portal was modified by Calvisi et al.[4] and has been used for ACL primary and revision arthroscopic procedures since 1981. The modified Patel's portal location is more proximal than the original one. Therefore, it takes the advantage of the subdivision of the medial patellar facet by a distally and medially oriented ridge.[4]

Another central portal is the 'central AM' portal which is used as a working and viewing portal.[5] It is placed nearly 1 cm lateral to the medial border of the patellar tendon (intratendinous) just inferior to the inferior pole of the patella when the knee is flexed 60 degrees.[5] This portal is specifically used for viewing the wall of the lateral intercondylar notch and marking the insertion of the AM and posterolateral bundles of the ACL.[5]

A previous study compared the results of a two-portal versus three portal technique for knee arthroscopy and determined the differences in patient-muscle recovery time and postoperative pain.[11] In the three-portal group they used a superomedial portal in which the inflow cannula was inserted. They concluded that in the three-portal technique, the vastus medialis muscle was violated by the cannula while the standard knee arthroscopy using the two-portal technique did not violate the vastus medialis muscle, allowing for an earlier return of quadriceps function and a faster return to normal activity. In our study, we used the central portal as the third enterance to the knee joint and noted patellar tendon related shortening due to the technique.

There are several two-incision techniques for the treatment of bucket-handle meniscal tears, such as Spraque's seven step technique[12] and suture punch techniques,[13,14] where the visualization of the torn meniscal fragment still remains contraversial. Among the various methods for resecting bucket-handle tears of the meniscus that have been introduced before, Ahn and Oh[15] suggested using the PM portal for accurate visualization and resection of the posterior base of the bucket-handle tear in the medial meniscus posterior horn. Hershman et al.[16] used an inframeniscal approach for artrhroscopic resection of tears of the posterior one-third of the medial meniscus and advocated that partial menisectomy could be accomplished with relative ease without requiring excessive valgus stress. They stated that a PM portal might be associated with some difficulties because of its location in an antomically constrained area, only giving the view of the peripheral attachment of the medial meniscus when the arthroscope was passed through this portal. In our study, we noted the central portal has the advantage of both visualization and instrumentation of the posterior compartments of the knee, which allows the procedure not to require an excessive number of steps shortening the surgical time.

The lack of more preoperative clinical data, less number of patients and the lack of more objective functional assesment tools are the weaknesses of our study.

The central portal is an advantageous portal because it allows instrumentation through the AL and AM portals at the same time, especially in the anterior portion of the joint. It is also helpful in displaying posterior joint structures directly and it allows examining the posterior structures with a probe. The easy removal of the mobile portion of the tear by means of the central portal eliminates the time-consuming efforts which add to the surgical time, therefore shortening the operation time and helping decrease the complication rate. In cases which are extended posteriorly, especially in which the meniscus is stuck behind the eminentia, this portal provides an easy access and favours the procedure. As the complication rate is quite low, and the decrease in the size of the patellar tendon is asymptomatic, we suggest that the use of the central transpatellar tendon portal as a viewing and instrumentation portal is a safe and quick technique especially in the arthroscopic menisectomy procedure performed in the treatment of medial bucket-handle type meniscal tears.

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