RESEARCH ARTICLE

Clinical Results of Meniscal Repair Using Submeniscal Horizontal Sutures

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Abstract

Background: Parts of the implants placed over the meniscus during meniscal repair can wear down the cartilage in the contact zones and cause chronic synovitis. Placing horizontal sutures under the meniscus may overcome this potential hazard. The purpose of this prospective study was to evaluate the midterm results of arthroscopic meniscal repair using submeniscally placed out-in horizontal sutures.

Methods: One hundred and three meniscal repairs with submeniscal horizontal out-in technique in 103 patients were performed between 2009 and 2012. Our indications for meniscal repair were all longitudinal tear in red-red and red-white zone with acceptable tissue quality. Clinical evaluation included the Tegner and Lysholm knee scores and clinical success was defined as absence of joint-line tenderness, locking, swelling, and a negative McMurray test.

Results: The average follow-up was 19 months (range, 14 to 40 months). The time interval from injury to meniscal repair ranged from 2 days to 390 days (median, 96 days). At the end of follow-up, the clinical success rate was 86.5%. Fourteen of 103 repaired menisci (13.5%) were considered failures according to Barrett's criteria. The mean Lysholm score significantly improved from 39.6 preoperatively to 84.5 postoperatively (P<0.001). Eighty five patients (82.5%) had an excellent or good result according to Lysholm knee score. Tegner activity score improved significantly (P<0.01) from an average of 3.4 (range, 2-6) preoperatively to 5.9 (range, 5-8) postoperatively. Statistical analysis showed that age, simultaneous anterior cruciate ligament reconstruction, chronicity of injury did not affect the clinical outcome.

Conclusion: Our results showed that acceptable midterm results are expected from submeniscal horizontal out-in repair technique. This technique is cheap, safe and has the advantage of avoiding chondral abrasion caused by solid implants and suture materials placed over the meniscus.

Keywords: Clinical result, Meniscus, Repair, Suture technique

Introduction

The menisci play several critical functions in the knee and have an important role in preventing osteoarthritic changes (1, 2). Hence, it is essential to try to preserve the menisci via repair whenever feasible. Although it is critical to perform meniscal repair on young patients in an attempt to decrease the eventual articular cartilage wear, meniscal repair can also be successful in older patients (3). Numerous repair techniques are available, and suture repair seems to provide superior biomechanical stability (4). Regarding its strength, vertical sutures are commonly considered the gold standard. According to different models, the strength of vertical sutures were found to be in a range from about 60 N to more than 200 N (5, 6). Horizontal sutures lie in between the circumferential fibre bundles and yield a lower failure load because they are pulled through those fibres as they are loaded (7).

Oblique sutures have similar construct stiffness during cyclic testing compared to vertical sutures and may combine the beneficial characteristics of vertical (superior biomechanical strength) and horizontal (ease

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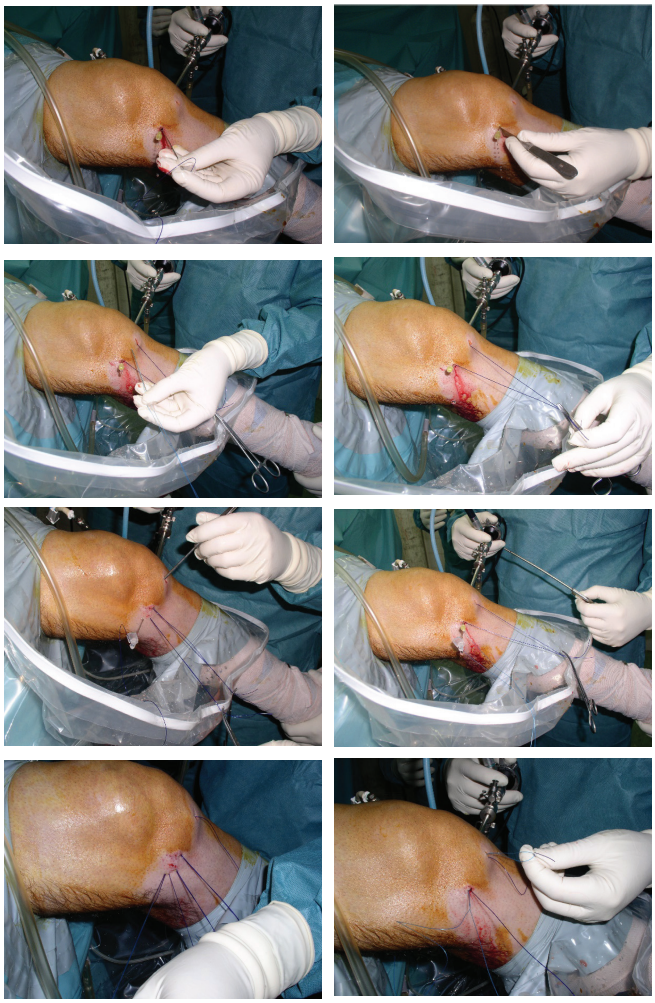

Figure 1. Out-in submeniscal passage of cannula and sutures.

of application, longer sutures with a tendency to cover a larger meniscal tissue area) suture-repair techniques (8). However, the clinical success rate does not correlate well with the mechanical strength of the repair technique and the available data do not support the assumption that stronger repairs are accompanied by better outcomes (9). A technical problem during meniscal repair is placing the sutures in the far posterior region of the meniscus. Submeniscal horizontal suture is an acceptable technique to overcome this problem and reach this part of the menisci without any additional incisions.

Another issue concerning meniscal repair is the possible abrasion of joint cartilage and synovium by the repair materials. Parts of the implants that surmount the surface of the meniscus can wear down the cartilage in the contact zones and cause chronic synovitis (9-11). The suture materials placed over the meniscus may abrade the cartilage of the femoral condyles during weight bearing and range of motion (12). The rationale for using submeniscal sutures is to prevent this potential hazard.

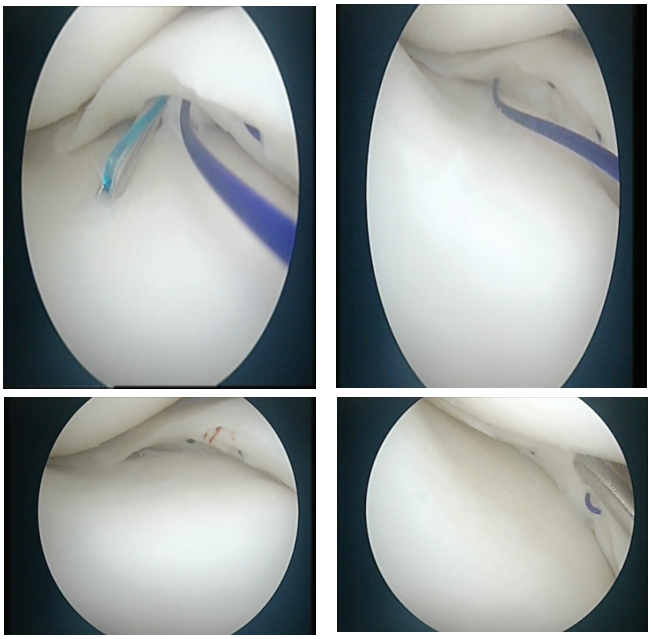

Figure 2. Arthroscopic view of horizontal submeniscal sutures.

The goal of this prospective study was to evaluate the mid-term results of arthroscopic meniscal repair using submeniscally placed out-in horizontal sutures.

Methods

Between Jan 2009 and Feb 2012, 107 patients aged 16 to 45 years (mean: 27 years) underwent arthroscopic meniscal repair using submeniscal horizontal out-in PDS sutures. Concurrent anterior cruciate ligament reconstruction was performed in 78 patients (76%). Our indications for meniscal repair were all longitudinal tears in the red-red and red-white zones with acceptable tissue quality. At final follow-up, all patients were evaluated by Barrett et al.'s criteria (3) . Criteria for clinical success included absence of joint-line tenderness, locking, swelling, and a negative McMurray test. Clinical evaluation also included the Tegner and Lysholm Knee Scores. In addition, all patients were evaluated preoperatively with an MRI and their age, gender, and mechanism of injury were recorded. SPSS software was used to analyze the data. Significance was set at $P < 0.05$.

Technique

Spinal anesthesia was used in all patients. After diagnostic arthroscopy, the morphology of the meniscus tear was determined and in case of a locked bucket-handle tear, reduction was performed. Tear edges were refreshed with a meniscal rasp and multiple perforations were made using a needle in the meniscus rim to produce vascular channels and bleeding. After locating the best entry point and making a small skin incision, a cannula threaded with a free-end No. 1 polydioxanone (PDS; Ethicon, Somerville, NJ) suture was passed through the capsule and across the tear and exited from the undersurface of the meniscus. The suture was advanced

until the end of the suture was seen within the joint [Figure 1]. The free end of the suture was pulled out through the anteromedial portal using a grasp. Anterior to the entry point, a second cannula threaded with a nylon 2-0 suture loop was passed through the same incision and again exited through the inferior surface of the meniscus [Figure 2]. During these passages care should be taken to prevent scratching the tibial cartilage. Outside the knee joint, the free PDS suture was passed through the suture loop. Pulling on the suture loop from its entry point drew the free suture back into the joint and out of the skin. The two free ends of the PDS suture were then tied with five to six simple knots. According to the tear size, two to six sutures were placed along the joint line in the same way.

Postoperatively, the patients used a hinged knee brace for 6 weeks. The range of motion was restricted between 0° and 70° for the first 2 weeks with partial weight bearing, followed by another 2 weeks with an increase of range of motion between 0° and 90°, and progressed to full range of motion by postoperative week 8 and full weight bearing by week 10.

Results

Two of the 107 patients were lost to follow-up and two patients had a new trauma. Consequently, all four were excluded from the study and 103 patients (103 menisci) constituted the subjects of this report. Ninety-four men (91%) and nine women (9%) were included in the study population. The average age at the time of meniscal repair was 27.2 years (range: 16 to 45 years). The medial meniscus was affected in 93 cases and the lateral meniscus in 10 cases. The time from injury to meniscal repair ranged from 2 days to 390 days (median: 96 days). The mean follow-up period was 19 months (range: 14 to 40 months).

At the last follow-up 89 (86.5%) patients had no symptoms of meniscal tears. Seven patients had tenderness on the joint-line palpation, three patients had tenderness on the joint-line palpation plus effusion and four patients had locking episodes. These 14 cases (13.5%) were considered as failures. Revision arthroscopy was needed in 8 cases that included 6 partial menisectomies and 2 re-repairs. There were no neurovascular complications or infections in this study.

Postoperatively, the majority of the patients had no restrictions in sports activities. The mean

Lysholm Knee Score significantly improved from 39.6 preoperatively to 84.5 postoperatively (P<0.001).

Eighty five patients (82.5%) had an excellent or good result according to the Lysholm Knee Score. The Tegner Activity Score improved significantly (P<0.01) from an average of 3.4 (range: 2-6) preoperatively to 5.9 (range: 5-8) postoperatively. Statistical analysis showed that age, simultaneous anterior cruciate ligament reconstruction, and chronicity of injury did not affect the clinical outcome.

Discussion

The rationale for using submeniscal sutures is to avoid any direct contact between suture materials and possible condylar cartilage abrasion. In this study, the clinical results of 103 repaired menisci with the submeniscal out-in sutures with an average follow-up of 19 months are presented. Our results showed that arthroscopic meniscal repair with submeniscal out-in sutures provided a high rate of meniscus healing (86.5%, 86 clinically healed menisci out of 103) according to Barrett et al.'s criteria, and 85 patients (82.5%) had an excellent or good result according to the Lysholm Knee Score (3). Literature review shows that in the vast majority of the studies the evaluation of meniscal healing after meniscal repair is performed using these or similar clinical criteria (13-20). It is acknowledged that only second-look arthroscopy can verify healing of the meniscus and a meniscal repair without postoperative symptoms does not always reflect the true status of the meniscus (13). Albrecht-Olsen et al. stated that the healing rate of the repaired menisci after second-look arthroscopy is lower than the clinical estimation (21). On the other hand, Morgan et al. showed that clinical examination seems to be a reliable method of evaluating the status of repaired menisci (22). The second-look arthroscopy predisposes the patient to an additional anesthesia and surgery and is costly. In the present study, we did not use a routine second-look arthroscopy and this is one of our limitations.

Clinical reports similar to those in our study have been reported in other studies with meniscal repair devices. The healing rate with the T-Fix system has been reported to be nearly 90% (13, 16). The success rate for the Meniscus Arrow ranged from 88% to 95% according to the most recent studies (14, 20). Laprell et al. reported a success rate of 86% with the Mitek meniscal repair system (18). However, comparison is not always possible because the several study groups used a different evaluation system (13).

Suture techniques are afflicted with a relatively long operating time and problems to reach the far posterior regions of the meniscus. Therefore, implants to be used without the need for additional incisions (all-inside) were developed. These implants are combinations of sutures and rigid parts and provide the convenience of the rigid implants while giving the strength of suture repair (9). These implants with solid components have the potential hazard of chondral wear down in the contact zones and may cause chronic synovitis (9-11). Additionally, the suture materials placed over the meniscus may abrade the cartilage of femoral condyles during weight bearing and range of motion. Finally, the cost of these implants should be taken into account especially when the health resources are limited.

The rationale for using submeniscal sutures is to prevent abrasion and chondral damage by eliminating contact zones. On the other hand, submeniscal horizontal out-in sutures have the ability to reach the far posterior part of the meniscus without the need for an additional incision. In contrast to the costly implants, suture materials used in our study are quite inexpensive. In the present study, we used routine suture materials and obtained acceptable results comparable to that of similar studies with the use of meniscal implants.

We evaluated our failed cases with MRI and repeated clinical examinations. In only 8 cases out of 14, we concluded that there was an actual failure of repair and all these cases underwent a revision surgery, including 6 partial menisectomies and 2 re-repairs. It was assumed that in the remaining 6 cases the origin of pain was chondral lesions or other intra articular problems.

Controversies exist regarding the effect of age, chronicity of tear and concurrent ACL reconstruction on meniscal healing. Our results are in agreement with those of other investigators who found no significantly different results between younger and older age groups chronicity of tear and simultaneous ACL reconstruction (3, 13, 23-25).

There are some limitations to our study. First, the follow-up period was relatively short (14-40 months) and although the early clinical healing rates of these repairs were encouraging, it is important for us to continue to follow up the patient cohort and report longer-term clinical healing rates and athletic activity levels. Secondly, we had no control group in our study to compare the submeniscal meniscal repair technique to another alternative method. It would be interesting if future studies compared this technique with traditional suture techniques or other meniscal devices. However, our study has the advantage of a consecutive series of patients, operated on by a single surgeon (AMN), using the same technique. Thirdly, our study does not include a second-look arthroscopy and lastly, we did not measure tear length in our cases but the number of sutures were recorded.

In conclusion, acceptable midterm results are expected from the submeniscal out-in repair technique that is comparable to those of all-inside implants. This technique is inexpensive, safe and has the advantage of avoiding chondral abrasion caused by solid implants and suture materials placed over the meniscus.

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