International Journal of Orthopaedics Sciences

E-ISSN: 2395-1958
P-ISSN: 2706-6630
IJOS 2022; 8(2): 91-94

www.orthopaper.com
Received: 07-01-2022
Accepted: 10-02-2022

Kshitij Mody
Welcare Hospital, Vadodara, Gujarat, India

Aashay Mody
Welcare Hospital, Vadodara, Gujarat, India

Corresponding Author:
Kshitij Mody
Welcare Hospital, Vadodara, Gujarat, India

Clinical outcomes of all-inside meniscal repair using pre-loaded suture anchors

Kshitij Mody and Aashay Mody

DOI: https://doi.org/10.22271/ortho.2022.v8.i2b.3118

Abstract
Purpose: This prospective study aims to evaluate clinical results of arthroscopic repair of meniscal tears using clinical scores and functional outcome measures while establishing clinical evaluation as a dependable method of evaluating the healing process of a repaired meniscus.
Methods: From June 2019 to October 2020, 203 patients with a mean age of 24 (range, 18-54) years with 203 meniscal tears underwent arthroscopic all-inside meniscal repair using a pre-loaded suture anchor. All tears were located in either the red-red or red-white zone. Simultaneous anterior cruciate ligament reconstruction was performed in 170 (84%) of the patients. Postoperatively, patients were evaluated based on clinical examination using Barrett's criteria wherein the presence of locking, joint-line tenderness, swelling or positive McMurray test were considered to indicate clinical failure. Further, we also used the International Knee Documentation Committee score, Lysholm score and Short-Form 36 score for postoperative evaluation.
Results: At average of 1.2 years follow-up, the success rate of arthroscopic meniscal repairs in this series was 94% (191 clinically healed menisci out of 203) according to the criteria of Barrett *et al*. The IKDC, Lysholm and SF-36 scores had significantly improved postoperatively.
Conclusions: Arthroscopic all-inside repair using a pre-loaded suture anchor (FastFix 360) is a safe and effective procedure for treating meniscal tears, and clinical evaluation was found to be a dependable method of evaluating the results of a healed, repaired meniscus.

Keywords: Meniscal tear, arthroscopy, all-inside meniscal repair, FastFix

Introduction
The intact meniscus has a key role in the functioning of the knee joint. As the understanding of the anatomical structure and unique function of menisci has improved, a preference for preserving as much of the meniscus as possible after injurythe has arisen. Although the meniscal repair was first performed more than 100 years ago by Annandale [1], it did not become widely practiced until the last two decades. Hiroshi Ikeuchi was the first orthopaedic surgeon to perform meniscal repair using arthroscopic techniques about 40 years ago [2]. There has been a paradigm shift in the treatment of meniscal tears, from open meniscal repair to arthroscopic meniscal repair, because of the shorter operation time, smaller wound, and the improved accessibility to the torn portion, which is particularly difficult during open surgery.
Currently, three arthroscopic techniques are being widely used, namely inside-out, outside-in, and all-inside technique. Furthermore, the use of biodegradable products for the all-inside approach has become very popular because it is less time-consuming and reduces the risk the of development of grave neurovascular complications [3, 4]. Currently, a plethora of devices for all-inside meniscal repair is being used. Most of these have been tested in vitro; however, clinical results are not available for the majority. One of the recently introduced devices is the FasT-Fix meniscal repair system (Smith & Nephew, Andover, MA, U.S.A.). This device combines the advantages of the all-inside technique with biomechanical solid properties [5, 6] and is a modification of the previous Smith & Nephew T-fix device. This system can be used for vertical, horizontal, or oblique meniscal tears. This study aimed to evaluate the clinical results and complications of arthroscopic meniscal repairs using the FasT-Fix meniscal repair system in a consecutive series of 203 patients. The study hypothesis was that arthroscopic all-inside meniscal repair with the FasT-Fix device would be a safe procedure and would provide

good clinical results without major complications.

Materials and Methods

From June 2019 to October 2020, 203 arthroscopic meniscal repairs were performed using the FasT-Fix Meniscal Repair Suture System and the arthroscopic technique described below.

In this prospective study, pre-operative evaluation included assessment of any effusion of the injured knee joint, the joint's range of motion, the stability of knee joint, joint line the enderness, and an administration of the McMurray test. All patients had a magnetic resonance image (MRI) study of the injured knee. The inclusion criteria for this study were (1) a vertical full-thickness tear greater than 10 mm in length, (2) the location of the meniscal tear being less than 6 mm from the menisco-capsular junction [7], (3) fixation of the meniscus solely with the FasT-Fix system, (4) no former meniscus surgery, (5) concomitant anterior cruciate ligament (ACL) injuries without any other ligament injuries and (6) no evidence of arthritis during arthroscopy. Isolated ACL deficient knees without concomitant collateral ligamentous injuries were reconstructed using a hamstring autograft at the time of meniscal repair.

Institutional Review Board approval was obtained before initiating the study. All patients gave their informed consent to participate.

The International Knee Documentation Committee (IKDC) questionnaire, Lysholm questionnaire and SF-36 forms were administered to every patient prior to surgery, at 6 months and 12 months post-operatively.

The all-inside meniscal repair and concurrent anterior cruciate reconstruction was performed where indicated. ACL reconstruction was performed in 170 (84%) of the patients.

Two orthopaedic surgeons performed all the surgeries and the same operative protocol was followed.

Surgical Technique

After diagnostic arthroscopy, the morphology of the meniscus tear was determined. The tear length and the rim width were recorded at the time of surgery.

Meniscal tear site preparation was done using rasps and/or arthroscopic shavers to abrade and excoriate both sides of the tear and the peri-meniscal synovium. The meniscal depth probe was used to determine the desired depth limit by placing the tip at the meniscosynovial junction and width ofthe the meniscus was measured at the desired entry point for the delivery needle. The laser marks on the tip of the needle were used as a reference to adjust the length.

The FasT-Fix device contains two 5-mm Poly-L-Lactide Acid (PLLA) suture T-bar anchors with a pre-tied self-sliding knot comprised of No. 0 nonabsorbable USP braided polyester suture material.

FasT-Fix 360 delivery needle was inserted into the joint through the appropriate arthroscopic portal.

For a vertical mattress suture repair, the first implant (T1) was placed on the capsular side of the tear. The suture delivery needle was inserted into the capsule or into any remaining meniscal tissue on the *capsular* side of the tear. Keeping the delivery needle in position, the deployment slider was pushed forward to deploy T1. A "clicking" sound accompanied proper deployment of the implant. The deployment slider was then released and slowly withdrawn out of the meniscus. The entry point for a second (T2) implant was at least 5 mm from the tear site.

For a horizontal mattress suture repair, the first implant (T1) was placed at the posterior location and the delivery needle was placed perpendicular to the tear at a minimum of 5 mm from the tear site on the inner meniscal fragment. The delivery needle was positioned more anteriorly along with the meniscal tear site for the insertion of the second limb of the horizontal mattress suture. A minimum width of 8 mm between the two insertion points was maintained.

The delivery needle was removed from the knee by pulling ththe e free end of suture out of the joint and advancing the sliding knot to reduce the meniscal tear, following which the knot was tightened.

Continuing to hold the suture taut,the suture cutter tip was pushed against the knot and the suture cut. The suture repair was now completed and closure was done. Sterile dressing over portal sites were applied and a long leg knee brace was applied over the operated limb before shifting the patient out of the Operation Theatre.

If the patient had an ACL tear, arthroscopic reconstruction was performed simultaneously using hamstring tendon grafts.

Post-operative rehabilitation

After the operation, patients with isolated meniscal repair starnon-weight-bearing motion immediately and full weight bearing was permitted at 6 weeks postoperatively. For patients who had meniscal repair with an ACL reconstruction, a hinged brace was used, a non-weight bearing motion was restricted to 0–60° for the first two weeks and the range of motion was increased to 0–90° for the next two weeks. Full weight-bearing and a full range of motion were permitted at 6 weeks. Jogging was permitted after 10 weeks. Unrestricted activity was permitted at 6 months for patients with isolated meniscal repair and at 9 months for patients with meniscal repair and an ACL reconstruction.

Follow-up evaluation

All patients had been evaluated preoperatively and this was repeated postoperatively at 6 months and 1 year. All patients were examined by an independent observer (first author) who was not involved in the surgery. According to Barrett's criteria [8], a repaired meniscus was considered healed if no joint-line tenderness or effusion was observed, and if the McMurray test was negative at the most recent follow-up. If one or more of these criteria was not met, the result was classified as a failure. The follow-up examination employed the following scoring systems: Lysholm Score, IKDC Score and SF-36 Score. These were used to assess the functional outcome of our patients at every follow up.

Statistics

Statistical analysis was conducted by an independent statistician who was not associated with the surgical team. A paired t test was used to compare the preoperative and postoperative IKDC scores, Lysholm scores and SF-36 component scores while the Wilcoxon signed rank test was used to compare VAS scores. A value of $p< 0.05$ was considered statistically significant.

Results

This prospective series consisted of 203 patients (149 men and 54 women). No patient loss occurred during follow-up in this series. The average age at the time of meniscal repair was 24.7 years (range, 18-54 years). The average follow-up period was 14 months (range, 12-16 months). There were 33 (16%) isolated meniscal tear repairs, and 170 (84%) tear repairs were combined with arthroscopic ACL reconstruction. 126 (62%)

meniscal tears were located within a rim width of less than 3 mm (red–red zone), whereas 77 (38%) were within a rim width of 3-6 mm (red-white zone). The meniscal tear morphologies were primarily vertical or vertical oblique configurations. Out of the 203 meniscal tears repaired, 182 of the tears were located in the posterior horn (89.7%), 18 were in the body (8.9%) and 3 were in the anterior horn (1.5%). There were 96 right knees (47%) and 107 left knees (53%). The medial meniscus was affected in 125 cases (62%) and the lateral meniscus in 78 cases (38%). At the most recent follow-up, no symptoms of meniscal tear as per Barrett's criteria were observed in 195 (96.1%) cases. 8 cases (3.9%) were considered as failures. Of these, 4 patients reported tenderness on joint-line palpation, 1 patient had locking episodes and 3 patients had a positive McMurray's test. However, no revision arthroscopy was determined to be necessary for these patients. Overall, the Lysholm score increased to a mean value of 85.39 (SD 12.97), which was statistically significant when compared with the preoperative mean value of 58.26 (SD 12.30) ($p< 0.0001$). 180 patients (88.6%) had an excellent or good outcome and 23 patients (11.4%) had a fair result. Preoperatively, the mean IKDC score was 37.38 (SD 7.01) whereas the postoperative mean value was 67.33 (SD 16.38), which was a statistically significant difference ($p< 0.0001$). A significant difference was observed between mean SF-36 component scores during the pre-operative phase compared to 6 months and 1 year post-operatively. All patients had returned to full-time work.

Intra-operative complications occurred in 2 patients. One patient had a FasT-Fix fixation failure during meniscal repair that was caused by a technical error; this was corrected by refixing with new FasT-Fix instrumentation during the same surgery. Another patient had tiny chondral injuries during the fixation procedure. There were no neurovascular or other major complications directly associated with the device. No complications were observed during the postoperative period.

Discussion

The meniscus plays an important role in load transmission across the knee joint. In knee flexion and extension, nearly 85% and 50% of the respective compressive loads are transmitted through the menisci [9]. Partial meniscectomy dramatically increases the contact pressures in the knee. The contact pressure increases 350% if 15% to 34% of the meniscus tissue is removed [10]. Moreover, the meniscus contributes to knee proprioception, lubrication and cartilage nutrition, and provides secondary anteroposterior knee joint stability [11-13]. Thus, surgeons should preserve as much of the meniscal tissue as possible, because even partial meniscectomy is associated with early degenerative osteoarthritis [14, 15].

The arthroscopic all-inside technique for meniscal repair has the advantages of less surgical time and ease of performance. This technique has become the mainstay of a recent meniscus repair treatment. Many kinds of all-inside meniscal repair devices on the market including meniscal arrows, darts, screws, staples, and other suture devices. Jesus *et al*. have performed an evidence-based review of the outcomes of all-inside meniscal repair devices [16], and the failure rates were found to range from 0% to 43.5%. According to the most recent studies, the success rate for the Meniscus Arrow ranges from 88% to 95%, according to the most recent studies [17, 18, 19]. The healing rate with the T-Fix system has been reported to be nearly 90% [20]. Laprell *et al*. reported a success rate of 86% for the Mitek meniscal repair system [21].

Barber *et al*. used various all-inside meniscal repair devices in adult porcine menisci to compare biomechanical strength [5]. Both vertical or horizontal FasTFix devices showed the best results compared with the others, including Darts, RapidLoc, and Arthrotek sutures. Borden *et al*. used cadaver knees to test the biomechanical strength of FasT-Fix and Meniscal Arrows under cyclic loading [6]. FasT-Fix completed the cyclic loading with greater strength compared to the Meniscal Arrows. Yavuz *et al*. also had good results for biomechanical strength when using FasTFix in a cadaver study [22]. The results described above showed that FasT-Fix had greater strength and durability under cyclic loading compared to the other all-inside repair devices that are currently available. Kotsovolos *et al*. reported the clinical results of 61 menisci repaired using the FasT-Fix meniscal repair system after an average follow-up period of 18 months [23]. The success rate in their series was 90% (55 clinically healed menisci out of 61) according to the criteria of Barrett *et al*. [8], and 51 patients (88%) had an excellent or good result.

In the present series, evaluation of meniscal healing was done by clinical examination. However, strict criteria were used to identify a clinical result as a success (Barrets criteria). For example, patients who had occasional soreness or minor symptoms in our study population were classified as failures, although their symptoms were not intense enough to require revision surgery. Morgan *et al*. showed that a clinical examination is a reliable method of evaluating the status of repaired menisci [24]. In that study, clinical examination accurately predicted all failures identified by second-look arthroscopy, with no false positives.

In our study, we studied and analysed 203 meniscal repairs and found a statistically significant difference between the pre-operative and post-operative IKDC scores, Lysholm scores, SF-36 scores and VAS scores. The success rate of arthroscopic meniscal repairs in this series was 94% (191 clinically healed menisci out of 203) according to the criteria of Barrett *et al*. These results were comparable to results of existing literature on functional outcomes of arthroscopic meniscal repair.

An important finding in our study was that there were very low complication rates directly associated with the device in the present series, such as broken implants, synovitis, or migration of the implants, as compared to complication rates of other devices. Complications occurred in 2 of our patients in the series, but these were due to technical errors (fixation failure and mild chondral injury).

The strength of our study is the large series of prospectively recruited patients without any loss to follow-up, the surgery having been performed by the same two surgeons and the clinical results examined by an independent observer.

We acknowledge that the present study determines the early clinical results of all-inside meniscal repairs using the previously described device and technique, whereas clinical issues such as meniscal tears could possibly also have late implications like osteoarthritis in the medium-term (5 years) or long-term.

In conclusion, arthroscopic all-inside repair with the FasT-Fix device appears to be a safe and effective procedure with a high success rate. There were no neurovascular or other major complications directly associated with the use of the device.

On behalf of all authors, the corresponding author states that there is no conflict of interest.

References

1. Annandale T. An operation for displaced semiluminar cartilage. Br Med J. 1885;1:779.
2. Ikeuchi H. Surgery under arthroscopic control. Proceedings of Societe Internationale Arthroscopie. Rheumatology. 1975;14:57-62.
3. Asik M, Sener N. Failure strength of repair device versus meniscus suturing techniques. Knee Surg Sports Traumatol Arthrosc. 2002;10:25-9.
4. Albrecht-Olsen P, Kristensen G, Burgaard P, Joengersen U, Toerholm C. The arrow versus horizontal suture in arthroscopic meniscus repair. Knee Surg Sports Traumatol Arthrosc. 1999;7:268-73.
5. Barber FA, Herbert MA, Richards DP. Load to failure testing of new meniscal repair devices. Arthroscopy; 2004;20:45-50.
6. Borden P, Nyland J, Caborn DN, Pienkowski D. Biomechanical comparison of the FasT-Fix meniscal repair suture system with vertical mattress sutures and Meniscus Arrows. Am J Sports Med. 2003;31:374-8.
7. Arnoczky SP, Dodds JA, Wickiewicz TL. Basic Science of the Knee. In: McGinty JB, Caspari RB, Johnson RW, eds. Operative Arthroscopy. Philadelphia: Lippincott-Raven, 1996, 211-39.
8. Barrett GR, Field MH, Treacy SH, Ruff CG. Clinical results of meniscus repair in patients 40 years and older. Arthroscopy. 1998;14:824-9.
9. Briggs KK, Kocher MS, Rodkey WG, Steadman JR. Reliability, validity, and responsiveness of the Lysholm knee score and Tegner activity scale for patients with meniscal injury of the knee. J Bone Joint Surg Am; 2006;88:698-705.
10. Crawford K, Briggs KK, Rodkey WG, Steadman JR. Reliability, validity, and responsiveness of the IKDC score for meniscus injuries of the knee. Arthroscopy; 2007;23:839-844.
11. Barber FA, Schroeder FA, Oro FB, Beavis RC. FasT-Fix meniscal repair: mid-term results. Arthroscopy. 2008;24:1342-8.
12. DeHaan A, Rubinstein RA Jr, Baldwin JL. Evaluation of success of a meniscus repair device for vertical unstable medial meniscus tears in ACL-reconstructed knees. Orthopedics. 2009, 32.
13. Popescu D, Sastre S, Caballero M, Lee JW, Claret I, Nuñez M. Meniscal repair using the FasT-Fix device in patients with chronic meniscal lesions. Knee Surg Sports Traumatol Arthrosc. 2010;18:546-550.
14. Choi NH, Kim BY, Hwang Bo BH, Victoroff BN. Suture versus FasT-Fix all-inside meniscus repair at time of anterior cruciate ligament reconstruction. Arthroscopy. 2014;30:1280-1286.
15. Pujol N, Tardy N, Boisrenoult P, Beaufils P. Long-term outcomes of all-inside meniscal repair. Knee Surg Sports Traumatol Arthrosc. 2015;23:219-224.
16. Jesus L, Benjamin M, Dilworth C. All inside meniscus repair: A systemic review. Clin Orthop Relat Res. 2006;455:134-41.
17. Albrecht-Olsen P, Kristensen G, Törmälä P. Meniscus bucket-handle fixation with an absorbable Biofix tack: Development of a new technique. Knee Surg Sports Traumatol Arthrosc. 1993;1:104-6.
18. Gill SS, Diduch DR. Outcomes after meniscal repair using the Meniscus Arrow in knees undergoing concurrent anterior cruciate ligament reconstruction. Arthroscopy. 2002;18:569-77.
19. Huerel C, Mertens F, Verdonk R. Biofix resorbable Meniscus Arrow for meniscal ruptures: Results of a 1-year follow-up. Knee Surg Sports Traumatol Arthrosc. 2000;8:46-52.
20. Asik M, Sen C, Erginsu M. Arthroscopic meniscal repair using T-fix. Knee Surg Sports Traumatol Arthrosc; 2002;10:284-8.
21. Laprell H, Stein V, Petersen W. Arthroscopic all-inside meniscus repair using a new refixation device: A prospective study. Arthroscopy. 2002;18:387-93.
22. Yavuz K, Haw CC, David N. A biomechanical comparison of the Fast-Fix meniscal repair system and the RapidLoc device in cadaver meniscus. Arthroscopy. 2006;22:406-13.
23. Kotsovolos ES, Hantes ME, Mastrokalos DS. Results of all-inside meniscal repair with the FasT-Fix meniscal repair system. Arthroscopy. 2006;22:3-9.