

## Original Research Article

# Clinical results of arthroscopic all-inside meniscal repair

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### ABSTRACT

**Background:** The meniscus plays a key role in normal knee function. Recently, meniscal repair has become an important mode treatment for meniscal tears. Compared to open surgery, arthroscopic meniscal repair has become popular because of shorter duration of the surgery, the smaller incision and better accessibility to the torn portion, which is particularly difficult during open surgery. Inside-out, outside-in, and all-inside arthroscopic techniques are widely used. Arthroscopy by all inside meniscal repair has the lowest neurovascular injury rate. In this study we have evaluated clinical outcomes of arthroscopic all inside meniscal repair technique.

**Methods:** This study prospectively evaluated 24 consecutively treated patients to determine the effectiveness of arthroscopic meniscal repair using the Fast Fix repair system. Average age of patients at the time of surgery was 24. The inclusion criteria for this study were: vertical full thickness tear >10 mm in length; location of the meniscal tear < 6 mm from the menisco-capsular junction, no former meniscus surgery; and no evidence of arthritis during arthroscopy, absence of complex meniscal tear. Anterior cruciate ligament (ACL) deficient knees were reconstructed using a hamstring autograft or BTB graft at the time of the meniscal repair. Follow-up examinations consisted of IKDC score, Lysholm knee score, Tegner activity score.

**Results:** After an average of 2 years follow-up, no symptoms of meniscal tears were found in 22/24 of the cases. For patients with isolated meniscal repair or concurrent ACL reconstruction, IKDC score, Lysholm and Tegner activity scores had significantly improved postoperatively. One patient had retear for which partial medial meniscectomy was done. No neurovascular or other major complications were directly associated with the use of this system.

**Conclusions:** Arthroscopic all-inside repair using the all inside device appears to be a safe and effective surgery to preserve meniscus.

**Keywords:** ACL, Arthroscopic meniscus, Neurovascular complications

### INTRODUCTION

The meniscus plays a key role in the normal knee function. Recently understanding of the anatomical structure and unique function of the meniscus has increased; hence preference for preserving more of the meniscus after injury has arisen. Meniscal repair was first performed more than 100 years ago by Annandale, but it did not become widely practiced until the last two decades.<sup>1</sup> Hiroshi Ikeuchi was the first orthopedic surgeon to perform meniscal repair using arthroscopic

techniques about forty years ago.<sup>2</sup> Compared to open surgery, arthroscopic meniscal repair has become popular because of the shorter duration of surgery, the smaller wound, and the improved accessibility to the tear portion, which is particularly difficult during open surgery.

In addition, improvements in arthroscopic techniques and instrumentation in recent years have simplified the procedure. Presently, three arthroscopic techniques are widely used, namely inside out, outside in, and all inside. 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 of development of grave neurovascular complications.<sup>3,4</sup> However, several reports have mentioned complications that are directly associated with these devices such as chondral injuries and synovitis.<sup>5-8</sup>

Another concern is the inferior strength of these devices compared with vertical sutures, which may be a critical factor that contributes to meniscal healing according to some previous biomechanical studies.<sup>9-11</sup> Currently, a plethora of devices for all-inside meniscal repair are being used. Most of these have been tested in vitro; however, clinical results are not available for the majority. One of the devices that have recently been introduced is the Fast-Fix meniscal repair system (Smith & Nephew, Andover, MA, U.S.A.). This system can be used for vertical, horizontal, or oblique meniscal tears. The goal of this study was to evaluate the clinical results and complications of arthroscopic meniscal repairs using the Fast-Fix meniscal repair system in a consecutive series of 24 patients at Sri Ramachandra Hospital. The study hypothesis was that arthroscopic all-inside meniscal repair with the Fast-Fix device would be a safe procedure and would provide excellent clinical results without major complications.

## METHODS

From January 2012 to March 2015, 24 arthroscopic meniscal repairs performed using the Fast-Fix Meniscal Repair Suture System (Smith & Nephew). In this prospective study, pre-operative evaluations included assessment of any effusion of the injured knee joint, the joint's range of motion, the stability of knee joint, the joint line tenderness, and an administration of the McMurray test. All patients had a magnetic resonance image study of the injury to the knee.

### *Inclusion criteria*

- A vertical full-thickness tear greater than 10 mm in length,
- The location of the meniscal tear being less than 6 mm from the meniscocapsular junction,
- Fixation of the meniscus solely with the Fast-Fix system,
- No former meniscus surgery, and
- No evidence of arthritis during arthroscopy.

Isolated anterior cruciate ligament (ACL) deficient knees without concomitant collateral ligamentous injuries were reconstructed using a hamstring autograft or BTB graft at the time of the meniscal repair. All patients gave their informed consent to participate in the study.

### *Surgical technique*

General anesthesia was administered to all patients. A diagnostic arthroscopy is performed initially; to note the

morphology of the meniscus tear, tear length and the rim width, at the time of surgery.

Reduction was performed in patients with a dislocated bucket-handle tear. Tear edges were freshened with a meniscus rasp and shaver. Each Fast-Fix device contains two 5-mm polymer suture bar anchors with a pre-tied self-sliding knot of No. 0 non-absorbable USP braided polyester suture material. In addition, a split cannula facilitates easy insertion of the device into the knee joint, and functions as a depth penetration limiter, and a knot pusher–suture cutter.

Using a meniscal depth probe, the desired length of penetration was determined and the depth limiter was trimmed accordingly; this was followed by introduction of the Fast-Fix delivery needle through the split cannula. The needle was then withdrawn from the meniscus using a smooth motion.

The trigger was then slid forward to advance the second implant. After the second implant had been inserted, the delivery needle was removed from the knee joint, such that the ends of the sutures were left free. The pre-tied self-sliding knot was tensioned with the aid of the knot pusher-suture cutter. If the patient had experienced an ACL injury, arthroscopic reconstruction was conducted after the meniscus repair-using hamstring tendon or BTB graft.

### *Postoperative rehabilitation*

After the operation, all the patients who underwent meniscal repair started non-weight-bearing walking immediately and full weight bearing was permitted at 6 weeks postoperatively. Knee brace was used for all patients for the first 10 days. Non-weight-bearing motion was restricted to 0–60° from the tenth post op day until 6 weeks. Full weight bearing and a full range of motion was permitted after 6 weeks. Jogging was permitted after week 10. 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*

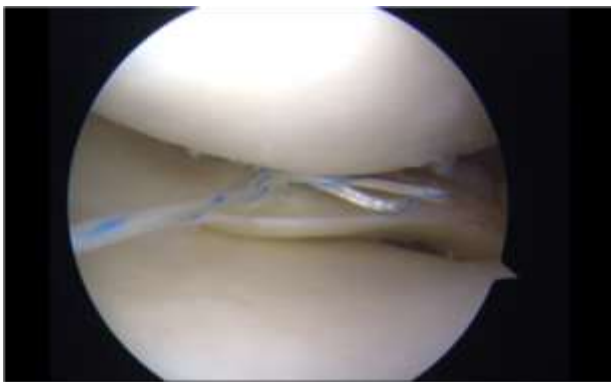
Each patient received follow-up, which included both clinical and radiographic evaluations, at regular intervals. All patients had been evaluated preoperatively and this was repeated postoperatively at one month, three months, six months and one year, and annually thereafter.

According to Barrett's criteria, 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.<sup>12</sup> If one or more of these criteria was not met, the technique was classified as a failure. The follow-up examination employed the following scoring systems: Lysholms score, Tegner

activity score and the International Knee Documentation Committee (IKDC) guidelines.<sup>13,14</sup>

## RESULTS

The prospective series consisted of 24 patients. No patient loss occurred during follow-up in this series. The average age at the time of meniscal repair was 24 years (range, 17-31years). The average follow-up period was 30 months (range, 10-50 months). Eleven (46%) meniscal tears were rated acute (injury-to-repair interval  $\leq 3$  weeks), and 13 (54%) tears were rated chronic (injury-to-repair interval  $>3$  weeks). There were 6 (25%) isolated meniscal tears, and 18 (75%) tears were combined with arthroscopic ACL reconstruction. The number of Fast-Fix anchors used averaged 1.8 (range, 1-3).



**Figure 1: Intra operative picture.**

At the most recent follow-up, no symptoms of meniscal tears were observed in 22 (91%) cases. One patient reported tenderness on joint-line palpation. Another patient had re-tear following injury after surgery for which partial medial meniscectomy was done. No patient had exhibited any locking episodes. Overall, the Lysholm score increased to a mean value of 90.4 compared with the preoperative mean value of 65.7 ( $p < 0.0001$ ).



**Figure 2: 3 months post-operative outcome.**

22 patients (91%) had an excellent or good outcome, 1 patient (4.5%) had a fair result and one patient (4.5%) had poor result resulted in re-surgery. Preoperatively, the mean Tegner activity score was 3.5 whereas the

postoperative mean value was 6.2 ( $p < 0.0001$ ). IKDC score significantly increased from grade C preoperatively to grade A or B in 91% of patients. All patients had returned to full-time work. There were no neurovascular or other major complications directly associated with the device.

## DISCUSSION

The process of meniscal healing is mainly dependent on the blood supply to the meniscus. The peripheral 20- 30% of the medial meniscus and the peripheral 10- 25% of the lateral meniscus make up the vascular zone.<sup>15</sup> However, the inner 1/3 of each meniscus is an avascular zone and is nourished by synovial fluid diffusion. The middle 1/3 zone obtains nourishment from both the blood and synovial fluid. Recent studies have shown that the peripheral blood supply is able to produce a healing response similar to that of other connective tissues. This tissue gradually matures to fibrocartilage over several months following the completed healing process.<sup>16,17</sup>

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 recent meniscus repair treatment. There are 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, and the failure rates were found to range from 0% to 43.5%.<sup>18</sup>

The success rate for the Meniscus Arrow ranges from 88% to 95%, according to the most recent studies. The healing rate with the T-Fix system has been reported to be nearly 90% according to Asik M et al whereas in our study success rate was 91.6%.<sup>19</sup>

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.<sup>20</sup> The success rate in their series was 90% (55 clinically healed menisci out of 61) according to the criteria of Barrett et al, and 51 patients (88%) had an excellent or good result.<sup>12</sup> Andrew et al. used Fast-Fix for 47 meniscal tears in 37 patients with at least a 2-year follow-up.<sup>21</sup> Five of these cases were considered a clinical failure and there were no cases with intra-articular or extra-articular complications such as neurovascular injury.

Both prospective studies showed that all inside meniscal repair device is a safe with a high success rate. In the present series, evaluation of meniscal healing was difficult without magnetic resonance imaging or a secondary arthroscopic evaluation. We acknowledge that a meniscal repair without symptoms postoperatively does not always reflect the true status of the meniscus and that only second-look by arthroscopy can verify healing of the meniscus or not; this is a limitation of the present study.

However, strict criteria were used to identify a clinical result as a success (joint-line tenderness, McMurray test, effusion). Morgan et al. showed that a clinical examination is a reliable method of evaluating the status of repaired menisci.<sup>22</sup> In that study, clinical examination accurately predicted all failures identified by second-look arthroscopy, with no false positives. The clinical results of the present series were also similar to previous reports. Finally, postoperative Lysholm and Tegner activity scores had improved significantly compared to pre-operative data.

It has been reported that the risk of arthrofibrosis is increased in this type of surgery.<sup>23</sup> 18 patients in the present series underwent anterior cruciate ligament reconstruction at the same time as meniscal repair. None have complained of any episode of giving way, difficulty in motion, or unstable knee sensation. These results demonstrate that ACL reconstruction at the time of all inside meniscal repair is able to achieve successful knee function and stability. However, the principal disadvantages of the present study are the small case number, the lack of a control group and the limited observation period.

There were no complications directly associated with the device in the present series, such as broken implants, synovitis, or migration of the implants, as has been reported. This demonstrates that using the devices has a learning curve. Pre-measurement of the desired depth using a meniscal depth probe is required and should be followed by trimming of the depth-limitation device. Inappropriate use of the instrumentation may prolong surgical time and result in iatrogenic meniscal or cartilage injury. Therefore, it is important for every surgeon to use the instrument and devices correctly. Arthroscopic all-inside repair devices appear 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.

## CONCLUSION

Arthroscopic all-inside repair using the all inside device appears to be a safe and effective surgery to preserve meniscus.

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