

# Results of Meniscal Repair Using a Bioabsorbable Screw

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**Purpose:** With most all-inside arthroscopic meniscal repair devices, the surgeon has no need for additional incisions or arthroscopic knot tying, and surgical time is decreased compared with traditional suture repair. Although previous studies have examined the pullout strength of various all-inside devices, clinical data is lacking and has been presented for only a few implants. This study evaluates the clinical results of meniscal repair using a bioabsorbable screw. **Type of Study:** Retrospective case series. **Methods:** Twenty-five patients underwent 26 all-inside meniscal repairs using this device. Patient interviews were performed as was retrospective evaluation of patient records. Complications and repeat surgeries were noted. **Results:** The average age of the patients was 28.8 years (range, 15 to 44). The surgeries included 19 medial meniscus repairs and 7 lateral meniscus repairs; 12 patients underwent concomitant anterior cruciate ligament (ACL) reconstruction. We found 11 isolated meniscal repairs in stable knees and 2 isolated meniscal repairs in ACL-deficient knees. An average of 3.6 screws (range, 1 to 6) were used during the meniscal repairs. Eighteen of 25 patients were contacted at an average of 106 weeks (range, 70 to 189) postoperatively. The mean Tegner score was 5, and the mean modified Lysholm score was 84. Three repeat surgeries were performed for failure of meniscal healing, and one repeat surgery was performed for migration of an implant. An additional patient who underwent medial meniscal repair noted a painless mild prominence on the medial aspect of the knee approximately 8 weeks after surgery. This prominence resolved completely over 6 months and did not require a second surgery. **Conclusions:** The bioabsorbable screw appears to be a safe and effective device for meniscal repair. Rare complications occurred that involved implant migration and transient inflammatory responses. Clinical success appears comparable to reported results with other methods of meniscal repair. **Level of Evidence:** Level IV, case series. **Key Words:** Meniscus—Repair—Bioabsorbable screw—Arthroscopy.

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The first reported meniscal repair was performed in 1883 by Thomas Annandale at the University of Edinburgh.<sup>1</sup> However, despite success with this procedure, the prevailing sentiment of the time remained that total meniscectomy was the standard of care. It was not until the classic articles by King<sup>2</sup> and Fairbank<sup>3</sup> that evidence emerged that total meniscectomy

led to degeneration of the articular cartilage. Subsequent investigation has documented the importance of the meniscus in load transmission, shock absorption, lubrication, and joint congruity in the knee.<sup>4-11</sup> Today, the repair and preservation of suitable meniscus tears is universally accepted as the goal of surgery.

After the successful results of open meniscal repair in the 1970s and early 1980s, various arthroscopic techniques, such as the inside-out<sup>12-14</sup> and outside-in<sup>15,16</sup> suture repair methods, were developed. These techniques expanded the scope of meniscal pathology that could be addressed with repair. Successful healing of meniscal tears has been reported at 50% to 98% of cases,<sup>17-33</sup> with a multitude of factors responsible for the variability of success.

More recently, a proliferation of absorbable meniscal repair implants that are designed to be inserted all-arthroscopically, without the need for additional

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FIGURE 1. Bioabsorbable meniscal screw.

incisions, has occurred. With the majority of these devices, arthroscopic knot tying is not required, and surgical time can be decreased compared with traditional suture repair. Although a number of studies have examined the pullout strength of various all-inside devices *in vitro*,<sup>34-39</sup> clinical results comparing these devices to suture repair methods are scarce, and studies have been reported for only a few implants.<sup>40-45</sup>

The purpose of this study was to evaluate the results of meniscal repair using an all-inside bioabsorbable screw technique and to compare the clinical outcomes and complications to published results for other repair methods.

## METHODS

We performed a retrospective review of all patients undergoing meniscal repair at our institution between May 1999 and March 2001. Twenty-five patients underwent 26 arthroscopic all-inside meniscus repairs using the Clearfix (Mitek Products, Norwood, MA) meniscal screw (Fig 1). The implant is a cannulated screw made of poly-L-lactic acid (PLLA) and has a variable thread pitch to compress the meniscus tissue at the site of the tear. The implant measures 2 mm in diameter and 10 mm in total length. All repaired tears were longitudinal tears located within the red-red or red-white zones of the meniscus, which could be anatomically reduced.

The surgical technique includes abrasion of the synovium above and below the tear. The tear is reduced and held stable with an arthroscopic cannula. While the reduction is maintained, the tip of the guidewire is used to puncture the superior surface of the meniscus, followed by screwing the implant across the tear into the peripheral body of the meniscus until the end is flush with the meniscal surface (Fig 2). The variable thread pitch of the implant holds the reduction of the meniscal tissue. A unique feature of this implant is that even after insertion, the depth of penetration can be adjusted by screwing or unscrewing the device as desired. It is even possible to quite easily remove the entire implant if the location is not optimal. The procedure is repeated until proper fixation is achieved.

Postoperatively, patients were treated with crutches and encouraged to bear weight as tolerated. Patients were restricted from deep knee flexion activities and squatting for 3 months postoperatively.

After we obtained Institutional Review Board (IRB) approval, 18 of 25 patients were contacted by telephone and agreed to participate in the study. Patients were questioned about the presence or absence of clinical symptoms such as swelling or joint line pain, as well as mechanical symptoms like catching, locking, or clicking. They also were specifically questioned about subsequent surgical intervention. Modified Lysholm and Tegner knee scores<sup>46</sup> were obtained. A review of the office and hospital records, including the surgical reports, was performed to collect other historic data. Results were analyzed collectively and after patient records were separated into groups with and without concomitant anterior cruciate ligament (ACL) reconstruction.

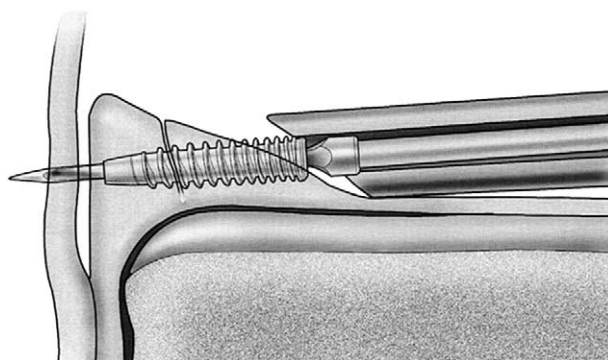


FIGURE 2. Insertion of implant.

**TABLE 1.** *Knee Functional Scores*

	Mean Tegner Score (range)	Mean Modified Lysholm Score (range)
With ACL reconstruction (n = 9)	5 (3-6)	86 (61-100)
Without ACL reconstruction (n = 9)	5 (3-10)	84 (52-100)
Total (n = 18)	5 (3-10)	84 (52-100)

ACL, anterior cruciate ligament.

## RESULTS

Between May 1999 and March 2001, 26 meniscal repairs were performed in 25 patients, including 16 men and 9 women. The average age at the time of surgery was 28.8 years (range, 15 to 44). Surgeries included 19 medial meniscus repairs and 7 lateral meniscus repairs, and 12 patients underwent concomitant ACL reconstruction using patellar tendon autograft. Of the remaining patients, 11 had isolated meniscal repairs in ACL-stable knees, and 2 had isolated meniscal repairs in ACL-deficient knees. An average of 3.6 screws (range, 1 to 6) were used during the repairs.

In the 18 patients successfully contacted, the mean time from surgery to follow-up evaluation was 106 weeks (range, 70 to 189). Nine patients underwent concomitant ACL reconstruction, and 9 did not. Tegner and modified Lysholm scores were not significantly different between these 2 groups (Table 1).

## Complications

Three patients required further surgery for failure of meniscal healing. One of these underwent a concomitant ACL reconstruction at the index surgery, and this patient was successfully treated with repeat repair using sutures. The 2 other patients underwent isolated meniscal repairs and were treated with subsequent partial meniscectomy (Table 2).

One patient who underwent lateral meniscus repair complained of persistent clicking in the knee 6 weeks after surgery. A second-look arthroscopy showed meniscal healing; however, a screw had migrated out of the meniscus into the posterolateral aspect of the compartment. The screw was removed arthroscopically. Inspection of the articular cartilage revealed no significant chondral damage as a result of this loose implant, and the patient recovered uneventfully. A second patient who had undergone medial meniscus repair noted a painless prominence on the medial

aspect of the knee 8 weeks after surgery. This presumably was secondary to migration of one of the implants, but the swelling resolved completely over 6 months, and the patient did not require a second surgical procedure. No postoperative infections were noted.

## DISCUSSION

That preservation of the meniscus when possible should be the goal of arthroscopic knee surgery is now widely accepted. Various meniscal repair techniques have been published, such as the inside-out<sup>12-14</sup> and outside-in<sup>15,16</sup> methods. However, the additional incisions required are accompanied by risk of injury to the saphenous and common peroneal nerves, as well as increased surgical time. Recently, a multitude of different absorbable meniscal repair devices have become available. These implants are designed to be inserted all-arthroscopically, without the need for ancillary incisions. Most of these new implants are bioabsorbable and are designed to gradually lose their strength by degradation over time, as more and more of the stress is transferred from the implant to the healing meniscal tissue.

A number of studies have examined the in vitro pullout strength of various meniscal repair devices, comparing them to traditional suture repair techniques.<sup>34-39</sup> Results vary somewhat between studies, but for the most part, findings indicate that in vitro ultimate load to failure is significantly highest for the vertical mattress stitch. Some of the absorbable devices have pullout strengths equivalent to a 2-0 horizontal mattress stitch, whereas others seem to be significantly weaker than any suture repair.

The question, of course, is how much pullout strength is necessary to allow meniscal healing? It is difficult to answer this question because clinical studies on meniscal healing rates with these absorbable devices are scarce. Albrecht-Olsen et al.<sup>40</sup> reported on a prospective study comparing a bioabsorbable meniscal arrow to horizontal 0 Maxon suture repair. Their

**TABLE 2.** *Clinical Successes and Failures*

	Healing Failures, n	Successful Outcomes, %
With ACL reconstruction (n = 9)	1	89
Without ACL reconstruction (n = 9)	2	78
Total (n = 18)	3	83

ACL, anterior cruciate ligament.

follow-up evaluation was short (3 to 4 months), but no statistical difference was found in healing rates between the arrow group and the suture group as determined by repeat arthroscopy. Additionally, surgical time in the arrow group was half that of the suture group.

Hürel et al.<sup>43</sup> reported results using an absorbable meniscal arrow in a group of 25 patients with minimum 1-year follow-up. They found good to excellent outcomes in 88% of patients. Three patients underwent partial meniscectomy 5, 8, and 12 months after meniscal repair because of failure of meniscal healing. This seems comparable to the incidence of successful outcomes with traditional suture repair methods. Jones et al.<sup>44</sup> retrospectively reviewed results using the bioabsorbable arrow in 38 patients with a minimum follow-up of 2 years, and Petsche et al.<sup>45</sup> reported results using this same implant in 29 patients with a minimum follow-up of 12 months. In both these reports, the authors noted 7% failures, requiring subsequent arthroscopy and partial meniscectomy.

Complications with absorbable meniscal repair devices have been reported. Albrecht-Olsen et al.,<sup>40</sup> in their study comparing meniscal arrow with horizontal suture, found 2 patients in the arrow group with intermittent pain along an infrapatellar nerve branch, presumably from the tip of an arrow protruding through the capsule. In one case, the symptoms subsided after 5 weeks. In the other case, the tip of the arrow was cut off under local anesthesia and was seen to be impinging upon the peripheral nerve branch at the time.

Jones et al.<sup>44</sup> noted local soft-tissue complications in 31.6% of patients, including 2 with arrow migration through the skin. Petsche et al.<sup>45</sup> reported skin irritation from prominent arrow tips in 5 of 29 patients. Symptoms resolved in 3 to 7 months, with no surgical intervention required. Other authors have reported aseptic synovitis after meniscal repair using a biodegradable arrow<sup>47</sup> and chondral injury from the heads of the arrows rubbing on the femoral articular cartilage.<sup>48,49</sup>

To our knowledge, this is the first report on clinical results after meniscus repair using the Clearfix bioabsorbable screw. In our patients, 3 repeat surgeries were needed because of a failure of meniscal healing, representing 83% successful outcomes. In patients with concomitant ACL reconstruction, one failure (89% success) occurred, and in patients without ACL reconstruction, 2 failures (78% success) occurred.

Two patients experienced transient irritation from implant migration, but one patient's symptoms re-

solved without a second surgery. The other patient underwent repeat arthroscopy and removal of a loose implant. However, at the time, the meniscus tear was found to have healed. At follow-up evaluation, all other patients were free of symptoms such as catching, locking, swelling, or joint line pain.

Our study is a retrospective follow-up study of patients undergoing meniscal repair, with the inherent weaknesses of such studies. No attempt was made to differentiate large displaced bucket handle tears from smaller longitudinal tears. Finally, it is important to realize that our study examined clinical results without the use of repeat arthroscopy or magnetic resonance imaging to confirm meniscal healing. Albrecht-Olsen et al.<sup>40</sup> showed that second-look arthroscopy 3 months after meniscus repair revealed a number of clinically asymptomatic unhealed or partially healed menisci. Our clinically successful cases, therefore, may not accurately indicate complete meniscal healing. However, the significance and long-term prognosis of asymptomatic partially healed tears are unknown.

Although our follow-up evaluation is short-term, the clinical results appear promising and at least comparable to those of other repair methods, including suture repair and other absorbable devices. An obvious risk of using an easier and quicker repair technique compared with traditional suture method is a possible tendency toward attempting repair of doubtful lesions that would otherwise have been resected. This could lead to fewer successful outcomes long-term. Given the proper indications, however, the bioabsorbable screw appears to be safe and effective. A longer follow-up and observation time for biocompatibility issues are mandatory to evaluate the long-term efficacy of this technique.

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