

## Clinical Outcome of Combined Inside-Out and Outside-in Technique in Miniscus Repair

Dr. Mohammad Arif Hossain<sup>1\*</sup>, Dr. Mohammad Khorshed Alam<sup>2</sup>, Dr. Tahera Sultana<sup>3</sup>, Dr. Gopal Verma<sup>4</sup>, Dr. Khandaker Ehtesam Ahmed<sup>5</sup>

<sup>1</sup>Junior Consultant Orthopedics Surgery, Department of Orthopedics, Sarkari Karmachari Hospital, Dhaka, Bangladesh

<sup>2</sup>Assistant Professor, Department of Orthopedics, Cumilla Medical College Hospital, Cumilla, Bangladesh

<sup>3</sup>Junior Consultant, Department of Obstetrics & Gynaecology, Mugda Medical College & Hospital, Dhaka, Bangladesh

<sup>4</sup>Consultant Orthopedics Surgery, Department of Orthopedics, Aichi Medical College and Hospital, Dhaka, Bangladesh

<sup>5</sup>Assistant Professor, Department of Orthopedics, Dhaka Medical College, Dhaka, Bangladesh

DOI: [10.36347/sjams.2023.v11i06.001](https://doi.org/10.36347/sjams.2023.v11i06.001)

| Received: 17.01.2023 | Accepted: 24.02.2023 | Published: 06.06.2023

\*Corresponding author: Dr. Mohammad Arif Hossain

Junior Consultant Orthopedics Surgery, Department of Orthopedics, Sarkari Karmachari Hospital, Dhaka, Bangladesh

### Abstract

### Original Research Article

**Introduction:** The meniscus, a fibrocartilaginous tissue, is essential to the proper operation of the knee joint. Treatment for meniscal injuries depends on a number of factors, including the patient's age, the kind of tear, and the location of the injury. Meniscal tears should be treated as often as practical owing to their critical function in knee biomechanics. Meniscus repair techniques include inside-out, outside-in, and all-inside strategies. The inside-out technique has been the gold-standard technique for meniscal repair. It entails making an incision either posteromedially or posterolaterally to gain access to the posterior capsule and allow sutures to be passed through the menisci with long needles in a vertical or horizontal mattress configuration while being viewed under an arthroscopic microscope. This technique, known as outside-in, involves passing sutures across the rip from the outside to the interior of the joint using a spinal needle. Knots are formed on the intraarticular end of the sutures and used to lessen the meniscal tear. The aim of the study is to evaluate the results of meniscus tears repaired using combined inside-out and outside-in techniques. **Method and Analysis:** Using the outside-in approach for anterior meniscal tears and the inside-out technique for middle meniscal tears, a retrospective evaluation of patients with meniscus tears treated using combined procedures was conducted. Barrett's criteria and MRI were used to evaluate the clinical progress of meniscal repair. With a significance level of  $P = 0.05$ , the Wilcoxon Two Sample Test was employed as the statistical analysis tool together with SPSS 22. **Results:** 24 patients participated in the research, and their average age was 33.1 years old (range, 19-56 years old). A mean of 12.1 months passed between follow-ups. Complete meniscal healing was accomplished in all three patients except one who had ACL re-rupture. Tegner and Lysholm ratings were lower in patients after ACL reconstruction than in individuals with intact ACL, despite improvements from preoperative condition. **Conclusion:** We came to the conclusion that a meniscal repair strategy that combines inside-out and outside-in repair is effective in treating meniscus tears.

**Keywords:** Meniscal injury, arthroscopy, Inside-out technique, outside-in technique.

Copyright © 2023 The Author(s): This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY-NC 4.0) which permits unrestricted use, distribution, and reproduction in any medium for non-commercial use provided the original author and source are credited.

## INTRODUCTION

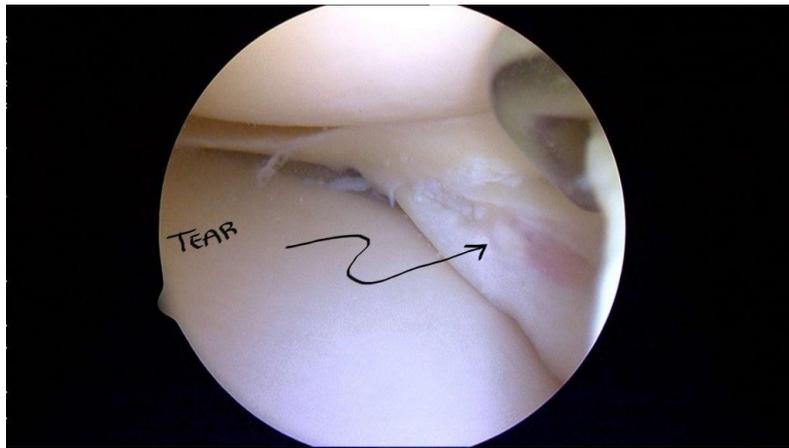
The fibrocartilaginous tissue known as the meniscus is crucial to the functioning of the knee joint. Meniscal injuries may result in long-term degenerative joint alterations because of the crucial function they play in the biomechanics of the knee. Meniscal repair rather than meniscectomy has been the primary focus of therapy as arthroscopy methods and instruments have improved [1, 2]. Meniscal injuries to the knee are frequent, with an annual incidence of 60 to 70 per

100,000 people [3]. The knee joint is made up of incongruent articular surfaces, therefore it depends on other tissues, including the menisci, the capsule, the muscles that cross the joint, the anterior and posterior cruciate ligaments, the medial and lateral collateral ligaments, and the latter two. The tibia, femur, and patella are joined by two wedge-shaped (in cross-section), semilunar fibrocartilage structures known as the menisci. While the lateral meniscus is more "O" shaped, the medial meniscus appears to be "C" shaped [4].

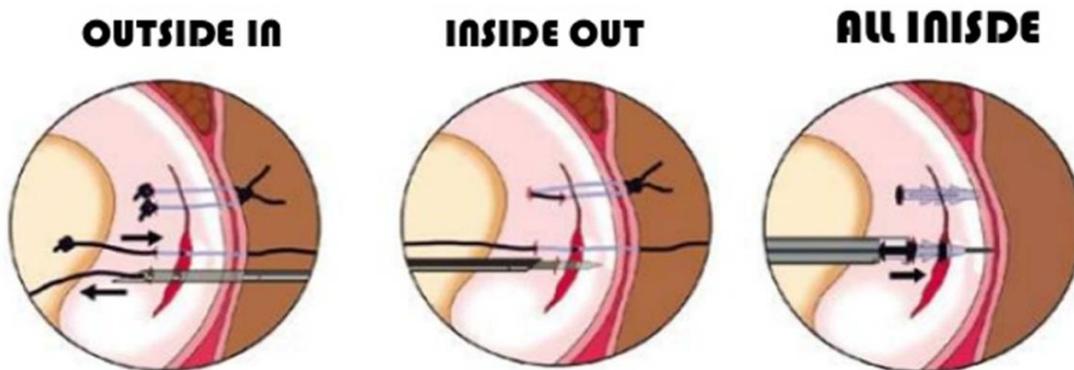
**Citation:** Mohammad Arif Hossain, Mohammad Khorshed Alam, Tahera Sultana, Gopal Verma, Khandaker Ehtesam Ahmed. Clinical Outcome of Combined Inside-Out and Outside-in Technique in Miniscus Repair. Sch J App Med Sci, 2023 Jun 11(6): 984-989.

Meniscal injuries (Fig 1) are treated based on a variety of parameters, including the location, kind of tear, and age of the patient [2, 5]. As often as feasible, meniscal tears should be treated due to their crucial role in knee biomechanics. Inside-out, outside-in, and all-inside approaches are a few well-known methods for meniscus repair [6, 7] (Fig 2). There is currently no agreement on the best suture approach since it can be inferred that no one meniscal repair technique or device is optimal in every circumstance however, the inside-

out method is easy to employ and has been put to good use for a very long time [1]. The all-inside approach was created because meniscal injuries in the posterior region have a higher risk of neurovascular complications. The all-inside technique has become more popular due to its ease of use, lack of the need for an accessory incision, low rate of complications, and shortened recovery time [8]. However, there are some drawbacks, including higher cost, chondral injury, implant-related pain, synovitis, and parameniscal cyst.



**Fig. 1: Meniscus tear**



**Fig. 2: Various technique to repair tears**

The inside-out technique, which involves making an incision either posteromedially or posterolaterally to gain access to the posterior capsule and enable sutures to be passed through the menisci with long needles in a vertical or horizontal mattress configuration under arthroscopic visualisation, has been the gold-standard method for meniscal repair [1]. The requirement for an auxiliary incision, probable damage to the saphenous vein medially and the peroneal nerve or popliteal neurovascular bundle laterally are issues unique to this method [9]. Technically challenging and requiring extra help in the operating room, this procedure may lengthen the length of the operation. Although the all-inside method eliminates the need for an additional incision, it comes at a higher cost and increases the risk of damaging the neurovascular bundle in posterior lateral rips [10]. Warren invented the

outside-in approach in 1984 to reduce the danger to neurovascular systems. Using a spinal needle, sutures are passed across the tear from the outside to the inside of the joint using this approach. On the intraarticular end of the sutures, knots are made and utilized to decrease the meniscal tear. The remaining suture ends are then knotted over the joint capsule. This approach is mainly suitable to meniscus injuries in the anterior and middle thirds [11].

In the present investigation, the inside-out approach was used in the center of the meniscal tears and the outside- in technique in the anterior meniscal tears as a "combined meniscal repair" (CMR). The purpose of this research was to examine the efficacy of this approach and the incidence of complications in patients who received surgery for a meniscus tear.

## METHOD AND ANALYSIS

Patients who had arthroscopic repair of a meniscus tear between 2020 and 2022 were evaluated retrospectively. Patients who had horizontal, transverse, or complicated meniscus tears in the past (those lasting more than 12 weeks), as well as any signs of arthritis, were excluded from the study. Before surgery, MRI was performed on each patient to help the surgeon make a choice. Meniscal repair was recommended for tears in the red-red or red white zones without evident deterioration. When doing the end button meniscal repair, anterior cruciate ligament (ACL) deficient knees were rebuilt utilizing hamstring autograft or allograft. 24 patients (14 male, 1 female) were included in the research based on these criteria. The median age was 33.1 years; the range was 19 to 56. In this investigation, patients with a minimum follow-up of 24 months were included. A patient's age, follow-up length, time between the injury and surgery, cause of damage, any related ligamentous or chondral injuries, need for subsequent surgery, location of the tear, and degree of preoperative activity were all acquired from the patient file. The average number of days between the first injury and surgery was 12.1. Six patients who played professional sports had allograft-assisted ACL surgery, whereas the remaining patients underwent autograft-assisted ACL reconstruction.

A conventional arthroscopy was done to establish the existence of a torn meniscus. As soon as this tear was found and deemed repairable, the tear edges were smoothed using a meniscal rasp and shaver. The Ultra FasT-Fix meniscal repair method was used with one or two sutures depending on the extent of the tear in the front portion of the torn meniscus. If concurrent ACL repair had to be undertaken, the meniscal suture was placed before to the tibial fixation. The inside-out approach was used using non-absorbable No. 2-0 Ticron sutures, and the inside-out meniscus repair was positioned in the centre of the meniscal tear. If there was any difficulty passing the guide or suture through the tear, such as flipping over, a horizontal or vertical matrix suture was first given to the junction of the posterior and medial portion of the meniscus through the suture guide to aid suturation. Then, the ends of the knotted sutures were extended, and sutures were put to the front portion of the meniscus tear. From the mini-incision, the suture ends were taken outside the joint capsule and knotted over the capsule. If ACL surgery was ruled out, microfracture was applied via the intercondylar notch to encourage the meniscus' healing response. The ACL was reconstructed using anatomic one-bundle reconstruction using the endobutton method.

With the help of a physiotherapist, postoperative therapy was initiated. As soon as the patient was able, isometric quadriceps workouts were started in the early phase. The rehabilitation program

was carried out in conjunction with an ACL rehabilitation program if the ligament had been rebuilt. In this program, a hinged knee brace was employed to protect the graft from excessive stresses, and mobility was introduced such that 90 degrees of knee flexion could be achieved four weeks following surgery. The brace was then removed. The patients were instructed to walk on toe touch crutches for six weeks. The patients were permitted to walk with full weight-bearing after six weeks. The patients were urged to return to their normal activities after 12 to 20 weeks, although sports were limited for six months. In meniscus repairs without ACL surgery, an accelerated training program was adopted, with mobility limitation up to 90 degrees for 4 weeks, no postoperative bracing, limited rotational and pivoting motions of the knee, and toe touch weight-bearing for 6 weeks.

All of the postoperative exams were carried out by an experienced surgeon (YS). Both MRI and Barrett's criteria indicated that the meniscus repair had healed. According to Barrett's standards [12], a repaired meniscus was deemed healed if, at the last follow-up, there was no joint-line discomfort or effusion and a negative McMurray test. If there was no fluid signal within the meniscus or the signal only contacted one articular surface, the meniscus was regarded as healed. The meniscus was regarded as unhealed if the signal hyperintensity crossed across from one articular surface to the other [13]. If any of these factors were present, the outcome was deemed a failure. With the use of the Lachman and pivot-shift tests, knee stability was assessed. The Lysholm and Tegner activity ratings were used to evaluate how well the knee performed during everyday activities, leisure activities, and competitive sports. At the last follow-up, an MRI was used to evaluate the meniscus and ACL's radiographic healing status.

We used the SPSS 22 software for statistical analysis and the Wilcoxon Two Sample Test as the significance test, with a significance threshold of P value 0.05.

## RESULTS

Table 1 showed the demographic variables of patients. The mean age of the patients were 33.1 (range from 19- 56). 58.33% were male and 1.67 was female. The average time from injury was 12.1 day. Most of the patients underwent right side operation (66.67%). 11 patients (45.83%) had medial meniscus involvement, whereas 9 patients (37.5%) had lateral meniscus involvement. 4 patients (16.67%) had both medial and lateral meniscal repair. 6 meniscal tears (25%) were located in the red-white zone and 18 tears (75%) were located in the red-red zone. 19 patients (79.17%) had simultaneous anatomic one bundle ACL repair. Five patients with Grade 1 injuries to the medial collateral ligament were treated conservatively. The average

duration of follow-up was 33.1 months (range: 12 to 24 months). No patient displayed discomfort along the joint line, complained of pain, or clicked on the McMurray test. At the follow-up MRI, all meniscal tears had healed. Nonetheless, 3 individuals were hospitalised for mild trauma over the duration of follow-up. A rerupture of the anterior cruciate ligament (ACL) was discovered in a patient who suffered a minor fall three months after ACL repair with a meniscus that had healed, necessitating revision ACL

reconstruction using allograft. The second patient who played football 4 months after surgery was diagnosed with ACL elongation and unhealed meniscus rupture. In addition to revision ACL repair using allograft, this patient had partial meniscectomy. The Lachman test was Grade 1 in 55% of patients, yet there were no knee symptoms. The pivot-shift test was negative in all ACL rerupture patients. The average number of sutures used during repair was 4.3 (2.3 for inside-out and 3 for outside-in). There were no infections reported.

**Table 1: Demographic variable of the patients**

Variables	N= 24	%
<b>Mean age</b>	33.1 (19-56)	
<b>Gender</b>		
Male	14	58.33
Female	10	41.67
<b>Operation time from injury</b>	12.1 days (range, 4 days-2 weeks)	
<b>Operation side</b>		
Right	16	66.67
Left	8	33.33
<b>Meniscus side</b>		
Medial	11	45.83
Lateral	9	37.5
Both meniscus	4	16.67
<b>Location of tear</b>		
Red-red zone	18	75
Red-white zone	6	25
<b>The mechanism of injury</b>		
Football injuries	9	37.5
Other sports injuries	7	29.17
Jump from height	4	16.67
Others	4	16.67
<b>Associated ACL reconstruction</b>	19	79.17

Table 2 shows the Preoperative and most recent follow-up Lysholm knee scores and Tegner activity levels in patients having meniscus repair. The mean Tegner score had increased from 3.4 before

surgery to 6.7 at the last follow- up visit ( $p < 0.001$ ). The mean Lysholm score increased from 49.3 before surgery to 81.2 after surgery ( $p < 0.001$ ).

**Table 2: Preoperative and most recent follow-up Lysholm knee scores and Tegner activity levels in patients having meniscus repair**

The measured scores	Preoperative	Postoperative	p value
<b>Tegner score</b>	3.4±2.1	6.7±1.9	
ACL reconstructed	2.6±0.2	4.1±1.7	<0.001
ACL intact	4.12±2.0	5.5±1.7	
<b>Lysholm score</b>	49.3±12.9	81.2±3.2	
ACL reconstructed	45.1±4.1	91.9±4.4	<0.001
ACL intact	69.1±18.2	99.1±5.0	

Table 3 shows the comparison of the most recent follow-up ratings for meniscus repair patients with ACL reconstruction and intact patients. Those with

ACL reconstructions had lower Tegner and Lysholm scores than patients with intact ACLs ( $p=0.032$  and  $p=0.012$ , respectively).

**Table 3: A comparison of the most recent follow-up ratings for meniscus repair patients with ACL reconstruction and intact patients**

Postoperative scores	ACL reconstructed	ACL intact	P value
Tegner score	4.1±1.7	5.5±1.7	0.032
Lysholm score	91.9±4.4	99.1±5.0	0.012

## DISCUSSION

In our research, the combined meniscal repair approach for a torn meniscus was effective. With the exception of one patient who had an ACL re-rupture, all meniscus tears had healed. In order to reduce the risk of neurovascular complications, inside-out and outside-in approaches were combined in this research. As a result, the posterior portion of meniscal rips was treated entirely with the inside-out technique, and the middle portion with the inside-out technique. Meniscal repair success rates ranged from 66.1% to 100%, according to reports [14-17]. The present study's high success rate may be attributed to a number of elements, including fixation strength, concurrent ACL restoration, and the meniscus's vascularity. Red-red and red-white zone tears were seen in the participants in this investigation. Meniscal repair is often recommended only in certain circumstances. These factors rely on the location of the tears, such as those in the red-red or red-white zone with strong vascular supply, the size of the tear, and the form of the rip, with longitudinal vertical tears and bucket handle tears often being more repairable. Candidates who meet these requirements are often younger ( < 65 years old), have Kellgren-Lawrence grades I-II and fewer than 3 degrees of varus malalignment, persistent symptoms after conservative therapy, and are likely to adhere to a 6-week partial weight bearing restriction [18, 19]. Degenerative tears also lower the success rate; hence, these individuals weren't included in the research. The all-inside method has been employed in all combination repairs documented in the literature for posterior meniscal injuries. However, meniscal fixation devices have been documented to have poor success rates in posterior medial meniscal rips. This has been attributed to issues with the posteromedial meniscus's ability to repair [15].

According to findings in the literature, a number of characteristics, including young age, acute tear, rim width less than 3mm, lateral meniscus tears, and concurrent ACL reconstruction at the time of meniscal surgery, favorably impact the success of meniscal repair [2, 5]. In the patients in our investigation, there was no difference in the Lysholm ratings between red-red and red-white zone tears. Majewski *et al.*, on the other hand, examined 88 patients and contrasted the results of outside-in meniscal restoration to the contralateral unharmed knee. 21 patients had re-rupture followed by meniscectomy, and three individuals experienced postoperative problems. Although the patients' mean Tegner and Lysholm scores were both good (6 and 94 points, respectively), 46 of the patients' knees revealed osteoarthritic alterations, as opposed to 27 of the contralateral, unharmed knees. The consequences on osteoarthritis remain unclear, and it is challenging to link these changes to the meniscal healing [20]. Although meniscal repair patients who also had ACL reconstruction saw good healing rates, their Lysholm

and Tegner ratings were lower than those of patients who had an undamaged ACL. This was believed to be caused by the extensive rehabilitation regimen, a potential increase in discomfort following surgery, and the associated atrophy brought on by disuse in patients after ACL reconstruction. Additionally, the rehabilitation procedure was more stringent in patients with related ACL reconstruction tears, which may have influenced the functional ratings.

## CONCLUSION

We came to the conclusion that a meniscal repair strategy that combines inside-out and outside-in repair is effective in treating meniscus tears.

## REFERENCES

1. Johnson, D., & Weiss, W. M. (2012). Meniscal repair using the inside-out suture technique. *Clinics in Sports Medicine*, 31(1), 15-31.
2. Tengrootenhuysen, M., Meermans, G., Pittoors, K., Van Riet, R., & Victor, J. (2011). Long-term outcome after meniscal repair. *Knee surgery, sports traumatology, arthroscopy*, 19, 236-241.
3. Greis, P. E., Bardana, D. D., Holmstrom, M. C., & Burks, R. T. (2002). Meniscal injury: I. Basic science and evaluation. *JAAOS-journal of the american academy of orthopaedic surgeons*, 10(3), 168-176.
4. Greys, P. E. (2003). Lesioni Meniscali: scienza di base e valutazione. *J AAOS*, 8(2), 5-16.
5. Barrett, G. R. (1998). Clinical results of meniscus repair in patients 40 years and older. *Arthroscopy: The Journal of Arthroscopic & Related Surgery*, 14(8), 824-9.
6. Choi, N. H., Kim, T. H., & Victoroff, B. N. (2009). Comparison of arthroscopic medial meniscal suture repair techniques: inside-out versus all-inside repair. *The American Journal of Sports Medicine*, 37(11), 2144-2150.
7. Grant, J. A., Wilde, J., Miller, B. S., & Bedi, A. (2012). Comparison of inside-out and all-inside techniques for the repair of isolated meniscal tears: a systematic review. *The American journal of sports medicine*, 40(2), 459-468.
8. Kotsovolos, E. S., Hantes, M. E., Mastrokalos, D. S., Lorbach, O., & Paessler, H. H. (2006). Results of all-inside meniscal repair with the FasT-Fix meniscal repair system. *Arthroscopy: The Journal of Arthroscopic & Related Surgery*, 22(1), 3-9.
9. Small, N. C. (1986). Complications in arthroscopy: the knee and other joints: committee on complications of the Arthroscopy Association of North America. *Arthroscopy: The Journal of Arthroscopic & Related Surgery*, 2(4), 253-8.
10. Kotsovolos, E. S., Hantes, M. E., Mastrokalos, D. S., Lorbach, O., & Paessler, H. H. (2006). Results of all-inside meniscal repair with the FasT-Fix

- meniscal repair system. *Arthroscopy: The Journal of Arthroscopic & Related Surgery*, 22(1), 3-9.
11. Warren, R. F. (1985). Arthroscopic meniscus repair. *Arthroscopy: The Journal of Arthroscopic & Related Surgery*, 1(3), 170-2.
  12. Barrett, G. R. (1998). Clinical results of meniscus repair in patients 40 years and older. *Arthroscopy: The Journal of Arthroscopic & Related Surgery*, 14(8), 824-9.
  13. van Trommel, M. F., Simonian, P. T., Potter, H. G., & Wickiewicz, T. L. (1998). Different regional healing rates with the outside-in technique for meniscal repair. *The American Journal of Sports Medicine*, 26(3), 446-452.
  14. Choi, N. H., Kim, T. H., & Victoroff, B. N. (2009). Comparison of arthroscopic medial meniscal suture repair techniques: inside-out versus all-inside repair. *The American Journal of Sports Medicine*, 37(11), 2144-2150.
  15. Feng, H., Hong, L., Geng, X. S., Zhang, H., Wang, X. S., & Jiang, X. Y. (2008). Second-look arthroscopic evaluation of bucket-handle meniscus tears repairs with anterior cruciate ligament reconstruction: 67 consecutive cases. *Arthroscopy: The Journal of Arthroscopic & Related Surgery*, 24(12), 1358-1366.
  16. Brown, G. C., Rosenberg, T. D., & Deffner, K. T. (1996). Inside-out meniscal repair using zone-specific instruments. *The American Journal of Knee Surgery*, 9(3), 144-150.
  17. Venkatachalam, S., Godsiff, S. P., & Harding, M. L. (2001). Review of the clinical results of arthroscopic meniscal repair. *The Knee*, 8(2), 129-133.
  18. Laible, C., Stein, D. A., & Kiridly, D. N. (2013). Meniscal repair. *JAAOS-Journal of the American Academy of Orthopaedic Surgeons*, 21(4), 204-13.
  19. Erggelet, C., Grosse, C., Henche, H. R., & De Koning, B. (1998). Arthroscopic meniscus repair: Clinical and isokinetic results. *Diagnostic and therapeutic endoscopy*, 4(3), 119-25.
  20. Majewski, M., Stoll, R., Widmer, H., Müller, W., & Friederich, N. F. (2006). Midterm and long-term results after arthroscopic suture repair of isolated, longitudinal, vertical meniscal tears in stable knees. *The American journal of sports medicine*, 34(7), 1072-1076.