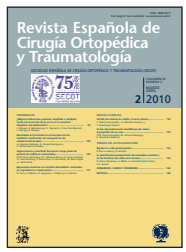
Rev esp. cir. ortop. traumatol. 2010;**54(2)**:111-115

Revista Española de Cirugía Ortopédica y Traumatología

www.elsevier.es/rot



ORIGINAL ARTICLE

Meniscal repair with absorbable screws: Medium-term follow-up

R. Calvo*, P. Meleán, D. Figueroa, I. Villalón and A. Vaisman

Knee surgery and Arthroscopy Unit, Traumatology and Orthopaedics Department, Faculty Santiago German Clinical Medicine, University of Development (UDD), Santiago, Chile

Received June 25, 2009; accepted September 27, 2009
Available on the internet from February 12, 2010

KEYWORDS
Meniscal lesion;
Meniscal repair;
Resorbable screw;
Arthroscopy

Abstract
Purpose: To analyze the results obtained by patients subjected to meniscal suturing with absorbable screws as well as the characteristics of the meniscal lesions present.
Patients and methodology: This is a prospective clinical assessment of a consecutive series of 35 patients with meniscal lesions treated exclusively with absorbable screws over an 8 year period. We assessed patient evolution on the basis of the Barrett, Lysholm, IKDC and Tegner rating scales. Mean follow-up was 35 months and mean age 26 years. 73%of our patients were male; 62%of patients presented with a tear in their anterior cruciate ligament, which was reconstructed during the same surgical procedure. 1.8 screws were placed in each patient. 62.9%of sutures were applied in the medial meniscus and 37.14% in the lateral meniscus. 69%of the screws were placed in the posterior horn, 21%in the middle third and the posterior horn, 8%in the middle third and 2%in the anterior horn, middle third and posterior horn.
Results: The percentage of retears confirmed by MRi was 10% Post-operative scores were: Lysholm 95.9 points, IKDC 90.8 and Tegner 6.09 points.
Conclusions: Meniscal repair with resorbable screws offers good to excellent clinical results in a high proportion of cases.

PALABRAS CLAVE
Lesión meniscal;
Reparación meniscal;
Tornillo reabsorbible;
Artroscopía

Reparación meniscal con tornillos absorbibles: resultados de seguimiento a medio plazo

Resumen
Introducción: El objetivo del presente estudio es analizar a los pacientes que reciben sutura meniscal con tornillos absorbibles y las características de las lesiones.

*Corresponding author.
E-mail: rcalvo@alemana.cl (R. Calvo).

1888-4415/$ - see front matter

Pacientes y metodología: Evaluación clínica prospectiva de una serie consecutiva de 35 pacientes con lesiones meniscales tratadas solamente con tornillos absorbibles durante 8 años. Evaluamos la evolución con los criterios de Barrett, la escala Lysholm, el International Knee Documentation Committee (IKDC) y Tegner. El seguimiento medio fue de 35 meses y la edad de 26 años; el 73%de pacientes varones. Un 62%de los pacientes presentó asociada una rotura del ligamento cruzado anterior reconstruida en el mismo acto quirúrgico. Se colocaron 1,8 tornillos por paciente. Un 62,9%de las suturas fueron en el menisco interno y el 37,14%en el menisco externo. El 69%de los tornillos se colocó en el cuerno posterior, el 21%en el tercio medio y el cuerno posterior, el 8%en el tercio medio y el 2%en el cuerno anterior, el tercio medio y el cuerno posterior.
Resultados: El porcentaje de rerrotura confirmado con resonancia magnética fue del 10% Las puntuaciones postoperatorias fueron Lysholm de 95,9 puntos, IKDC de 90,8 puntos y Tegner de 6,09 puntos.
Conclusiones: La reparación meniscal con tornillos reabsorbibles ofrece de buenos a excelentes resultados clínicos en un alto porcentaje de casos.

Introduction

Meniscal tears are one of the most frequently encountered knee injuries, and generally occur in young individuals in relation to sport activities, and also in older patients as a result of degenerative lesions from daily activities without evident trauma.[1-5] It has been shown that the partial or total loss of meniscal tissue produces degenerative changes that damage joint functioning,[6-8] for which the treatment priority in these injuries is the highest possible preservation of the meniscus.[5]

In accordance with precise guidelines, meniscal repair with sutures has provided good results, especially in patients with meniscal tissues in good health (no degeneration) but with traumatic longitudinal tears in the vascular or red-red zones, and within the 3 peripheral mm of the meniscus and in the capsulomeniscal junction.[6-13]

Meniscal repair with reabsorbable screws is a method of meniscal repair that takes place from the interior of the joint with the advantage of being quick and easy to place, they compress the tissues upon tightening, and, unlike other implants, their position can be changed when necessary.[9,14] However, we cannot forget that biomechanical studies show little promise for this technique in comparison with traditional vertical sutures.[15-17] This surgical technique can achieve clinical results comparable to those from traditional meniscal sutures, and the objective of the present study is to perform a prospective analysis of clinical and functional results in a consecutive study of patients with meniscal injuries repaired with reabsorbable screws.

Methods

We evaluated 35 patients, 25 men (71.4%) and 10 women (28.6%), who received operations for meniscal tears using Clearfix® (Mitek, Norderstedt, Germany) screws between August 1999 and January 2007. Mean patient age was 26 years (13–44) at the time of surgery. The mean follow-up period was 35 months (6–96). Fifty-two percent of injuries occurred in the right knee.

Inclusion criteria were the presence of reparable meniscal injuries in a red-red or red-white zone with or without a simultaneous tear in the anterior cruciate ligament (ACL) and with or without chondral lesions. Exclusion criteria were the use of another suture method associated with Clearfix® screws, multiple ligament instabilities, or degenerative meniscal injuries.

Once the meniscus was repaired, a knee immobilizer was put into place with a limit of 60° flexion, and partial weight bearing was allowed with 2 walking sticks for 3 weeks. When we performed a microfracture or an associated autogeneous osteochondral graft, we used a similar protocol, but the partial weight-bearing period lasted 6 weeks.

The most frequent mechanism of injury was sport activities. The mean time passed between the meniscus injury and the surgery was 22 days (range: 3–60 days).

We repaired 22 internal and 13 external meniscuses. In our study, 19 patients presented with an associated ACL tear (54.3%), in which an ACL reconstruction was performed along with the meniscal repair. Additionally, 13 patients presented with associated chondral lesions (37.1%) that were treated in the same procedure as the meniscal repair with distinct techniques for the chondral tissue (table 1). In accordance with the anatomical localization in the meniscus, 28 repairs were performed on the posterior horn, 6 were performed on tears that extended from the posterior horn to the meniscal body, and in one case, a tear was repaired that went from the body to the anterior horn (table 2). The most frequent type of meniscal tear was vertical peripheral (94.4%), 87%of which were located in the red-red zone and 13%in the red-white zone. The second most frequent type was horizontal tears (5.6%).

The average length of the tears repaired was 12.44 mm (range: 10–16) and an average of 1.8 screws (range: 1–4) were placed in each patient.

We evaluated the patients postoperatively using the Lysholm scale, the International Knee Documentation Committee (IKDC) scale, and Tegner activity level, reinstatement, and subjective scales. This last scale involved preoperative and postoperative evaluations.

Table 1 Chondral injuries and surgeries using Clearfix® screws

Outerbridge classification	Internal femoral condyle	External femoral condyle	Patella	Associated surgery
I	2	0	1	Mechanical chondroplasty
II	3	2	2	Mechanical chondroplasty
III	0	1	1	Microfractures
IV	1	0	0	Mosaicplasty

Table 2 Meniscal repair failure using Clearfix® screws

	Age, years	Associated injury	Damage, months	Meniscus	Region	Zone	Size, mm
	14	ACL	2	EM	PH	RW	14
	35	_	4	IM	PH	R	12
	21	ACL	8	IM	Body to AH	RW	11
	19	IFC (Outerbridge II)	8	EM	PH	R	16
Average	22	_	5	_	_	_	13.25

AH: anterior horn; IFC: internal femoral condyle; PH: posterior horn; ACL: anterior cruciate ligament; EM: external meniscus; IM: internal meniscus; RW: red-white zone; R: red-red zone.

We performed physical exams using the Barrett[10] criteria in order to determine whether or not the patient presented changes in the last control performed. The existence of effusion, interline pain, or positive McMurray or Apley signs signify a positive Barrett criteria, indicating a repair failure. All cases with positive Barrett criteria were evaluated using magnetic resonance imaging (MRI). The MRI instability criteria were displacement of the repaired meniscal fragment greater than 1mm and a hyperintense signal on the T2 sequence in the repaired area; all of the failures that were observed in this study presented both positive MRI criteria.

We evaluated Tegner scores using a statistical analysis application through paired sample T-tests, since our sample size was small, and an estimation of the standard deviation instead of the true value, in order to document the differences.

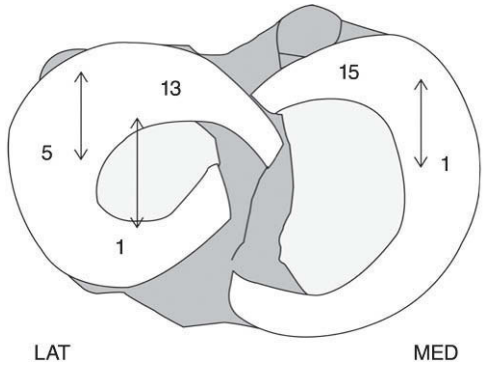


Figure Characterization of meniscal repair failures with reabsorbable screws. LAT: lateral; MED: medial.

Results

The postoperative Lysholm mean score was 95.9 points (range: 70–100), the mean postoperative IKDC score was 90.8 (range: 60–100), the preoperative mean score on the Tegner activity scale was 6.82 (range: 5–7) and the postoperative mean was 6.09 (range: 4–7), but no statistically significant differences were found.

During the clinical follow-up period, we encountered 4 failed sutures, according to the Barrett criteria, which were confirmed by MRI, representing 11.4% of the total of patients.

Subsequent tears occurred at a mean of 5 months following the surgery (range: 2–8); 2 of these were treated simultaneously with ACL reconstruction (a handle cube in the red-white zone of the internal meniscus and one in the posterior horn of the red-white zone of the exterior meniscus) and the other two failed repairs were isolated (both were in the posterior horns of the red-red zone of the internal and external meniscus) (fig.). In one of the tears, we observed extensive chondral damage from the implant. One of the screws protruded from the meniscal ridge, producing a groove-shaped chondral lesion in the external femoral condyle in the patient classified as Outerbridge III. All of the tears were resolved by partial arthroscopic meniscectomies. There was no difficulty in removing the implant, and in most cases, this process only required shaving.

Discussion

Among the weaknesses inherent to this study, we must mention the high number of associated injuries that were surgically treated using different techniques, which could

modify the final interpretation of the clinical results obtained; we must be cautious in analyzing these results since our study has a low number of patients and failures, and we highlight that this analysis and our report were developed in a short period of time. According to Greiss et al,[11] the results obtained from short-term follow ups underestimate tear percentages, and recommend using a 2 year minimum follow-up time in order to perform an adequate evaluation of the results of these surgeries. Our oldest cases had 8 years of evolution, but constitute a small percentage of the total number of repairs.

The procedure of choice for the treatment of meniscal injuries continues to be partial meniscectomy.[1,4,5] However, several clinical and laboratory studies have documented a degenerative progression in the knee following meniscectomy.[2-5] As such, we recommend a conservative treatment for meniscal injuries in order to preserve the greatest possible amount of meniscal tissue during the surgical procedure, and repair of these lesions with sutures under precise indications.[4,18]

This "inside-out" technique is the procedure of choice.[6-8,11] However, this is not a technically easy procedure, owing to risks of producing neural or vascular injury during the surgery.[19,20] As a result, several implants have been developed that allow the surgeon to approach meniscal injuries by the easier "all-inside" technique, which requires less time in surgery and presents a lower risk level for associated injuries.

Meniscal repairs carried out with reabsorbable materials and "all-inside" techniques have produced good results, in short-term follow ups, with reabsorbable meniscal arrows, and the results are comparable to those from the "inside-out" suture technique.[21-23] Considering simultaneous meniscal repair and ACL reconstructions, Gill et al[23] obtained similar results in meniscal repair with those from traditional "inside-out" techniques.

On the other hand, failures in meniscal sutures using the "all-inside" technique and reabsorbable materials performed in the vascularised zone are attributed to lower resistance of these implants in comparison with classical sutures.[16,24,25] Miller et al,[26] in a randomized prospective experimental study in goats produced meniscal injuries and treated them with 3 different "all-inside" suture techniques, comparing their results with those previously described in the medical literature,[27,28] using the same animal model, from meniscal injury sutures with the habitual "inside-out" technique. The animals were sacrificed at 6 months, and the authors found that the macroscopic results of the meniscal repairs using the 3 "all-inside" techniques were inferior to those from "inside-out" sutures. Additionally, reabsorbable materials produced chondral lesions in 75–100% of cases repaired with the "all-inside" techniques.

Publications on Clearfix® screws indicate a 79% of good and excellent clinical results, without the use of any associated sutures, and use MRI and Barrett clinical criteria, which indicate that repairs of peripheral tears within a 3mm margin of acute lesions and in the external meniscus produce better results. These criteria are more important for these authors than the type of implant used. Frosch et al[14] observed an 82% success rate in meniscal repairs using Clearfix® in isolated injuries in stable knees, and a 100% excellent results when associated with ACL reconstruction.

Our selection criteria for a torn meniscus needing repair are tears in the peripheral red-red zone, both longitudinal and vertical, greater than 0.7mm, unstable with over 3mm subluxation within the joint, in patients under 45 years old and with structurally sound tissues. When we observe degenerative tears, we opt for a partial meniscectomy and attempt to improve the local characteristics of the injury and perform a peripheral synovial cruentation or trephination of the meniscal tear.[10,29] Evaluation of the results from meniscal repairs is clinical and based on the Barrett[10] criteria, and these results are confirmed by MRI. We evidenced good and excellent results in 88.5% of patients, comparable to the results from other meniscal repair studies that employed the different techniques available.[7,11,30-33] In our study, we encountered 11.4% repair failure, which occurred following a traumatic episode from playing sports.

The medical literature documents better clinical results using meniscal sutures in association with an ACL reconstruction,[33-35] but our failures were distributed equally in 2 patients associated with ACL reconstruction and another 2 cases without ACL reconstruction.

Meniscal repair using reabsorbable Clearfix® screws in our experience has produced good or excellent results in clinical evaluations in 88.5% of patients, and under these conditions, can be considered as a valid alternative as long as the established indications are followed.

Conflict of interest

The authors of this work declare that they have no conflicts of interest with any public or private persons or institutions.

References

1. Greis P, Bardana D, Holmstrom M, Burks T. Meniscal injury: I. Basic science and evaluation. J Am Acad Orthop Surg. 2002;10:168-76.
2. Fairbank TJ. Knee joint changes after meniscectomy. J Bone Joint Surg (Br). 1948;30-B:664-70.
3. Lutfi AM. Morphological changes in the articular cartilage after meniscectomy-an experimental study in the monkey. J Bone Joint Surg (Br). 1975;57-B:525-8.
4. Sommerlath K, Gillquist J. Knee function after meniscus repair and total meniscectomy: A 7-year follow-up study. Arthroscopy. 1987;3:156-66.
5. Jorgensen U, Sonne-Holm S, Lauridsen F, Rosenklint A. Long-term follow-up of meniscectomy in athletes. J Bone Joint Surg (Br). 1987;69-B:80-3.
6. Koski JA, Ibarra C, Rodeo SA, Warren RF. Meniscal injury and repair: Clinical status. Orthop Clin North Am. 2000;31:419-36.
7. Stone RG, Frewin PR, Gonzales S. Long-term assessment of arthroscopic meniscus repair: A two- to six-year follow-up study. Arthroscopy. 1990;6:73-8.
8. Miller DB. Arthroscopic meniscal repair. Am J Sports Med. 1988;16:315-20.
9. Hantes M, Kotsovolos E, Mastrokalos D, Ammenwerth J, Paessler HH. Arthroscopic meniscal repair with an absorbable screw:

Results and surgical technique. Knee Surg Sports Traumatol Arthrosc. 2005;13:273-9.
10. Barrett GR, Field MH, Treacy SH, Ruff CG. Clinical results of meniscus repair in patients 40 years and older. Arthroscopy. 1998; 14:824-9.
11. Greis P, Holmstrom M, Bardana D, Burks R. Meniscal injury: II. Management. J Am Acad Orthop Surg. 2002;10:177-87.
12. Henning CE, Lynch MA, Yearout KM, Vequist SW, Stallbaumer RJ, Decker KA. Arthroscopic meniscal repair using an exogenous fibrin clot. Clin Orthop Relat Res. 1990;252:64-72.
13. Eggli S, Wegmuller H, Kosina J, Huckell C, Jakob RP. Long-term results of arthroscopic meniscal repair: An analysis of isolated tears. Am J Sports Med. 1995;23:715-20.
14. Frosch K, Fuchs M, Losch A, Sturmer M. Repair of meniscal tears with the absorbable Clearfix screw: Results after 1–3 years. Arch Orthop Trauma Surg. 2005;125:585-91.
15. Barber FA., Herbert MA. Meniscal repair devices. Arthroscopy. 2000;16:613-8.
16. Darvin GF, Downing JW, Keene GCR, McBride DG. Failure strengths of suture versus biodegradable arrow for meniscal repair: An in vitro study. Arthroscopy. 1997;13:296-300.
17. Rankin CC, Lintner DM, Noble PC, Paravic A, Greer E. A biomechanical analysis of meniscal repair techniques. Am J Sports Med. 2002;30:492-7.
18. Arnoczky SP, Warren RF. The microvasculature of the meniscus and its response to injury: An experimental study in the dog. Am J Sports Med. 1983;11:131-41.
19. Small NC. Complications in arthroscopic meniscal surgery. Clin Sports Med. 1990;9:609-17.
20. Rodeo S, Forster R, Weiland A. Neurological complications due to arthroscopy. J Bone Joint Surg (Am). 1993;75-A:917-26.
21. Al-Othman AA. Biodegradable arrows for arthroscopic repair of meniscal tears. Int Orthop. 2002; 26:247-9.
22. Ellermann A, Siebold R, Buelow JU, Sobau C. Clinical evaluation of meniscus repair with a bioabsorbable arrow: A 2- to 3-year follow-up study. Knee Surg Sports Traumatol Arthrosc. 2002;10:289-93.
23. 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.
24. Boenisch UW, Faber KJ, Ciarelli M, Steadman JR, Arnoczky SP. Pull-out strength and stiffness of meniscal repair using absorbable arrows or Ti-Cron vertical and horizontal loop sutures. Am J Sports Med. 1999;27:626-31.
25. Rankin CC, Lintner DM, Noble PC, Paravic V, Greer E. A biomechanical analysis of meniscal repair techniques. Am J Sports Med. 2002;30:492-7.
26. Miller M, Kline A, Jepsen K. "All-Inside" meniscal repair devices: An experimental study in the goat model. Am J Sports Med. 2004;32:858-68.
27. Miller MD, Ritchie JR, Gómez BA, Royster RM, DeLee JC. Meniscal repair: An experimental study in the goat. Am J Sports Med. 1995;23:124-8.
28. Ritchie JR, Miller MD, Bents R, Smith DK. Meniscal repair in the goat model: The use of healing adjuncts on central tears and the role of MR arthrography in repair evaluation. Am J Sports Med. 1998;26:278-84.
29. Zhang Z, Arnold JA, Williams T, McCaan B. Repairs by trephination and suturing of longitudinal injuries in the avascular area of the meniscus in goats. Am J Sports Med. 1995;23:35-41.
30. Eggli S, Wegmuller H, Kosina J, Huckell C, Jakob RP. Long-term results of arthroscopic meniscal repair: An analysis of isolated tears. Am J Sports Med. 1995;23:715-20.
31. Albrecht-Olsen PM, Bak K. Arthroscopic repair of the bucket-handle meniscus: 10 failures in 27 stable knees followed for 3 years. Acta Orthop Scand. 1993;64:446-8.
32. Morgan CD, Wojtys EM, Casscells CD, Casscells SW. Arthroscopic meniscal repair evaluated by second-look arthroscopy. Am J Sports Med. 1991;19:632-8.
33. Tenuta JJ, Arciero RA. Arthroscopic evaluation of meniscal repairs: Factors that affect healing. Am J Sports Med. 1994;22:797-802.
34. Cannon WD, Vittori JM. The incidence of healing in arthroscopic meniscal repairs in anterior cruciate ligament-reconstructed knees versus stable knees. Am J Sports Med. 1992;20: 176-81.
35. Buseck MS, Noyes FR. Arthroscopic evaluation of meniscal repairs after anterior cruciate ligament reconstruction and immediate motion. Am J Sports Med. 1991;19:489-94.