Arthroscopic Lateral Ligament Repair for Treatment of Chronic Ankle Instability: A Systematic Review

Amr T. Younis, Emad Eldin Esmat, Mohamed S. Singer

Department of Orthopaedics, Benha faculty of medicine, Banha University, Egypt.

Correspondence to: Amr T. Younis, Department of Orthopaedics , Benha faculty of medicine, Banha University, Egypt.

Email:

dr_atawfik28@yahoo.com

Received: 7 October 2019

Accepted: 21 November 2019

Abstract:

The purpose of the current study is to conduct a systematic review of the literature on techniques and functional outcome of arthroscopic lateral ankle ligament repair in chronic ankle instability. Methods: A systematic search of MEDLINE, EMBASE, and Cochrane Library databases was performed during August 2019. Included studies were evaluated with regard to level of evidence (LOE) and quality of evidence (QOE) using the Coleman Methodology Score. Thirteen studies from a total of 506 studies were included, a single level I study and one level II four level III, six level IV and one level V study according to established criteria. The QOE in all studies was of poor or fair quality. Preoperative American Orthopedic Foot and Ankle Society (AOFAS) showed an improvement from average score (range, 41.2 to 69.9) to average postoperative score (range, 89.2 to 98), the average improvement in AOFAS score (range, 22.8-54.2) at a mean follow-up for 18.6 months. Seven studies used Karlsson -Peterson (K-P) scores, with an average postoperative scores (range, 76.2 to 93.6) at a mean follow-up of 19.2 months. The comparative studies showed similar clinical outcomes between arthroscopic and open procedures. All studies reported a mean complication rate of 11.7% with patients treated with arthroscopic repair.

Keywords: Arthroscopy, lateral, ankle, ligament repair, instability.

Introduction

Ankle sprains are common musculoskeletal injuries, with the majority of cases affecting the lateral ligaments of the ankle and of those the most commonly injured ligament is the anterior talo-fibular ligament (ATFL), followed by the calcaneo-fibular ligament (CFL) (1).

Although conservative therapy is often successful in treating these injuries, about 5-20% of ankles may not respond to conservative therapy and develop chronic ankle instability (2).

The diagnosis of chronic ankle instability is based on a careful assessment of the history of the triggering event and further recurrent episodes. Physical examination should evaluate the presence of any foot and ankle malalignment. Palpation should elicit pain and tenderness particularly around the lateral gutter. The two most important tests for the evaluation of the ankle instability are the anterior drawer test and the talar tilt test (3).

Magnetic Resonance Imaging (MRI) is a useful tool to evaluate additional pathologies such as osteochondral lesions, often associated with instability, but it has limitations in the assessment of ligamentous injuries. Although this tool is extremely specific (100% for ATFL and 83% for CFL), it has a relatively low sensitivity (56% for ATFL and 50% for CFL(4).

While a variety of surgical techniques have been reported, such as the Evans, the Chrisman–Snook, the Watson–Jones (5) and the Castaing procedure. These aimed to stabilize the lateral ankle by tenodesis of a portion of the peroneal tendons. These procedures are characterized by extensive exposures of the operative field, are technically demanding and require prolonged immobilization. Moreover, the sacrifice of the peroneal tendons with a development of non-anatomical forces across the ankle joint may cause a possible future ankle degeneration (6).

The open Broström-Gould procedure is generally accepted as the gold-standard treatment when the quality of local tissues is adequate and when the hind-foot is well aligned. Recently, an arthroscopic lateral ankle ligament repair techniques has become increasingly popular in an effort to reduce postoperative pain and facilitate early recovery (7).

Despite the increased popularity of arthroscopic lateral ankle ligament repair and the expanding number of techniques and research analyzing the technical details of fixation, there is no consensus about the effectiveness of this procedure. The purpose of the current study is to conduct a systematic review of the literature on functional results of arthroscopic lateral ankle ligament repair in chronic ankle instability.

Methods

Search Strategy

Two independent reviewers (M Singer, A Tawfik) performed the systematic review search in July 2019, according to PRIMSA

guidelines (Preferred Reporting Items for Systematic Reviews and Meta-Analyses), using the Cochrane database of systematic reviews, the Cochrane central register of controlled trials, PubMed, and MEDLINE as database for search. *Search keywords* will be a combined "arthroscopic" and either lateral ankle instability or lateral ankle ligament or talo-fibular studies which included in the systematic review range from 2011 to 2019.

Inclusion criteria:

- Clinical studies with at least 12 months of follow up.
- English literatures only.

Exclusion criteria:

- Cadaveric and non-human studies.
- Reviews, commentaries, and general discussion papers not presenting data on impacts.
- Articles describing techniques only.

There was no time limit given to publication date. Once titles and abstracts were selected, the full text of the studies was then reviewed. Differences between reviewers were discussed until agreement was achieved, and the senior author (E Esmat) was consulted in the event of persistent disagreement.

Data Extraction and Analysis

Two reviewers (M Singer, A Tawfik) independently extracted data from each study. After isolating the papers to be included in the systematic review, the following data were extracted: total number of patients, patient age, follow-up time, gender ratio, surgical technique, surgical complications, complication rate, recurrent instability or revision rate, and clinical outcome measures.

Statistical Analysis

Statistical analysis for the overall cohort of studies was performed using a commercially available statistical software package (SAS 9.3; SAS Institute, Cary, NC).

Results

The electronic database search yielded 501 studies, additional 5 studies were identified by search through references and other sources; resulting in 506 studies.

256 studies were duplicated so removed, and 250 were screened according to inclusion and exclusion criteria. Only 16 studies were eligible, so included in qualitative synthesis, and only 13 studies were included in the current systematic review (fig 1).(8-20)

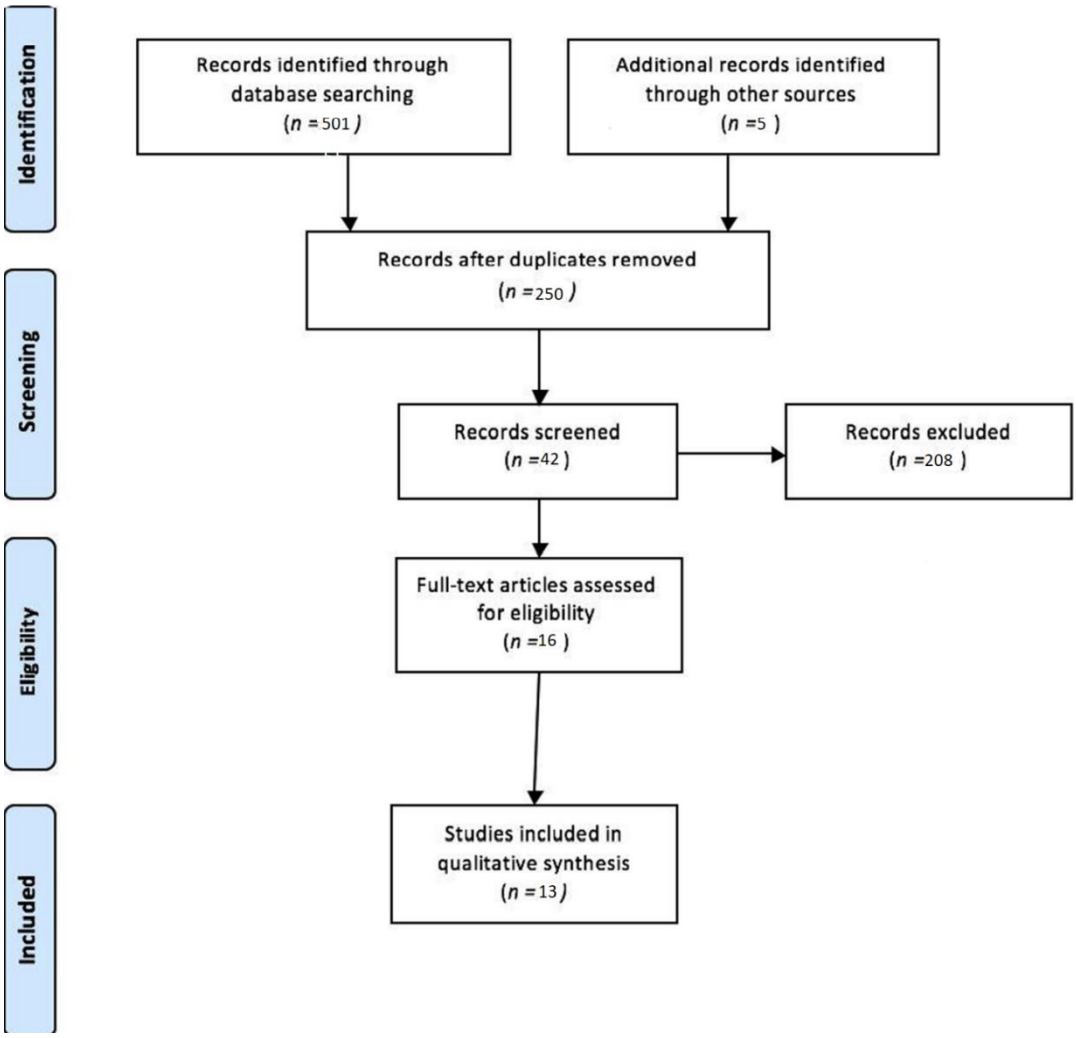

Fig 1. PRISMA flowchart outlining the systematic review.

After full-text review, a total of 725 ankles were identified. The mean follow-up was 21.14 months (range, 12-40 months). All included studies of arthroscopic lateral ankle ligament repair are summarized in Table 1.

Clinical Outcomes

Clinical outcomes data using different scores showed significant improvement (Table 1).

Nine studies that recorded both preoperative and postoperative American Orthopaedic Foot and Ankle Society (AOFAS) showed an improvement from average preoperative score of 60.5 (range, 41.2 to 69.9) to average postoperative score of 93.5 (range, 89.2 to 98), so the average improvement in AOFAS score was 33.1 points(range , 22.8-54.2) at a mean follow-up for 18.6 months.(9-11, 13-15, 17, 19, 20) .

Seven studies used Karlsson -Peterson (K-P) scores, with an average postoperative scores of 86.9 (range, 76.2 to 93.6) at a mean

follow-up of 19.2 months.(8-10, 13, 14, 20); only 4 studies reported preoperative K-P score with average of 47.5 (range 28.3 to 61.8). one study used K-p score as the primary outcome score and showed an increase from 28.3 preoperatively to 90.2 postoperatively(8).

Only 4 studies measured the visual analogue scale (VAS) to evaluate patient pain. Preoperative VAS scores ranged from 5.2 to 8.2, and postoperative VAS scores improved in 4 out of 4 studies and ranged from 0.57 to 1.7 at a mean follow-up of 17.02 months.(9, 10, 17, 20)

Three comparative studies of open and arthroscopic repair procedures have been included, with 2 Level III studies(13, 15) and one Level I study.(20) The mean follow-up time was one year in 2 studies(15, 20) and 3 years in one study.(13) No significant difference was found in the clinical outcome scores between the arthroscopic repair and open repair procedures in each study.

However, one study (15)showed lower VAS score at 3 days after surgery and shorter time to return to daily activity in arthroscopic group, but Yeo found no difference in VAS score at 12 months postoperatively(20).

Return to Sport Activity at Previous Level

Overall, two studies (11, 19) reported patients returning to sport and demonstrated that 100% of patients returned to sport at the preinjury level. One study (14) comparing reconstruction (done for professional athletes) and repair (done for recreational athletes) showed that 80% of the first group and 80% of the second group were able to return to the same preinjury level of sports.

Li 2017 (12) reported 21 patients out of 31 patient in the two-anchor group practiced sport activities at the preinjury level, and the other 10 patients changed to non-weight-bearing recreational sport activities (cycling and swimming) for fear of re-injury. In the one-anchor group, 6 patients out of 20 patient returned to sport activity at a level equal to or higher than their preinjury activity, and 14 patients returned to non-weight-bearing recreational sport activities for fear of re-injury. At the final follow-up, patients in the two-anchor group had a significantly higher percentage (68%) of sport participation than those in the one-anchor group (30%) ($p = 0.01$)(12).

Complications

All studies reported a mean complication rate of 11.7%, with 85 total complications reported among 725 patients treated with arthroscopic repair.(8-20)

Complications varied but included peroneal nerve Injury , sural nerve injury, peroneal tendonitis, tenderness of scar, deep vein thrombosis, infection, portal site irritation, delayed wound healing, and recurrent

instability .The most common complication encountered was nerve damage (i.e., neuritis, nerve ,injury, or numbness) at 6% of all cases (Table 2)..(8-20)

The weighted mean rate of revision was 0.9% at a mean of 25.5 months in 4 studies that reported revision data.(8, 13, 15, 19) In the 3 comparative studies, there was no significant difference in complication rate between arthroscopic and open procedures (Table 3) (13, 15, 20).

Table 1. Summary of Outcomes in Studies .AOFAS, American Orthopaedic Foot and Ankle Society; IER, inferior extensor retinaculum; K-P, Karlsson -Peterson; NA, not applicable; VAS, visual analogue score.

Study	Level of Evidence	Technique	Patients no	Age	Gender	Follow up/mo	Outcome			Complication count	Complication rate %	Recurrent instability %	Revision rate %
							Scores	Preop	post op				
Acevedo and Mangone2015	IV ,Retrospective	2 anchors reinfrced with IER	73	35	24\49	28	AOFAS K-P	NA 28.3	NA 90.2	9	12	NA	1.4
Colton and Rigby (2013)	IV ,Retrospective	2 anchors reinfrced with IER	40	45.6	13\27	12.1	AOFAS K-P VAS	41.2 NA 8.0	95.4 93.6 0.6	3	7.5	NA	NA
Colton et al.(2016)	IV ,Retrospective	2 anchors reinfrced with IER	45	44.6	18\27	14	AOFAS K-P VAS	48.7 NA 8.2	95.4 87 1.1	3	6.7	NA	NA
Kim et al. (2011)	IV ,Retrospective	1 anchor: no inforcement noted	28	38.6	6\22	15.9	AOFAS	60.8	92.5	7	14.3	NA	NA
Li et al . (2017)	III ,prospective	1-2 anchors :reinforced with IER	23	30.3	18\5	39.7	AOFAS K-P	69.3 61.8	93.3 90.3	1	4.3	0	0
Matsui et al .(2016)	III ,retrospective	2 anchors reinfrced with IER	19	28	12\7	12	AOFAS	69.9	98	2	15.8	0	0
Vega et al (2013)	IV ,Retrospective	1 Anchor: no inforcement noted	16	29.3	10\6	22.3	AOFAS	67	97	1	12.5	0	0
Yeo et al (2016)	I Prospective	1 anchor: reinforced with IER	25	35.2	7\18	12	AOFAS K-P VAS	67.5 45 5.2	90.3 76.2 1.7	5	20	NA	NA
SONG et al (2017)	IV retrospective	2 anchors +semitendenosis graft	28	NA	NA	30	AOFAS VAS	60.1 5.2	93.6 0.57	1	8.3	0	0
Ronny (2018)	III, prospective	115 ligament repair 171 ligament reconstruction	286	32.4	160 \126	9.6	AOFAS Karlesson	62.1 55	89.2 87.1	55	19	29	NA
Hong li et al (2019)	III retrospective	repair with one or 2 anchors	51	20 one anchor 31 two anchors	11\9 23\8	37 40	AOFAS Karlesson	NA NA	90.5 84	0	0	0	0
Tekin 2019	II, PROSPECTIVE, RANDOMIZED	31 Brostrom repair 30 suture tape augemtation	61	ABR 27.8 AST 28.6	NA	37	FAOS ABR AST FAMM ABR AST	66.2 67.1 58.7 58.2	90.6 91.5 89.3 93	ABR 3 AST 1	9.7 3.3	2 1	2 NA
Manuel et al (2019)	V ,Prospective	2 anchor :no reinforcement	30	31	18\12	NA	NA	NA	NA	1	3.3	0	0

Table 2. Complications

	Li et al. (2017)	Matsui et al. (2016)	Yeo et al. (2016)
Follow-up, yrs	3	1	1
Postop metric			
American Orthopaedic Foot and Ankle Society			
Arthroscopic	93.3	98	90.3
Open	92.4	95.4	89.2
Karlsson Ankle Functional Score			
Arthroscopic	90.3		76.2
Open	89.4		73.5
Visual analogue score			
Arthroscopic		3.3 (3 days postop)* 1.2 (2 weeks postop)	1.7
Open		4.7 (3 days postop)* 1.9 (2 weeks postop)	2
Complication rate, %			
Arthroscopic	4.3	10.5	20.0
Open	5.4	22.2	13.0

Table 3. Summary of Outcome in Comparative Studies

Study	Acevedo et al (2015)	cottom &Rigby (2013)	Cottom et al (2016)	Kim et al (2011)	Li et al (2017)	Masuti et al (2016)	Vega et al (2016)	Yeo et al (2016)	Song et al (2017)	Ronny et al (2018)	Hong li et al (2019)	Tekin et al (2019)	Manuel et al (2019)	Complication rate, %
Patient n	73	40	45	28	23	19	16	25	28	286	51	61	30	
Anterior diplacement >3mm				3										0
Delayed wound healing			3	4			1			7		1		2
Deep venous thrombosis		1								3				1
Fibular fracture		1												0
Neuritis , nerve injury,numbness	5	1				2		3	3	26			4	6
Persistant pain	3				1								1	1
Recurrent instability	1											3		1
Tenderness \pain or scar								2		10				2
Total														11.7

Discussion

Although multiple techniques for the treatment of lateral ankle instability have been described in literature, the anatomical repair of the lateral ligament complex is still considered the gold-standard in the treatment of chronic ankle instability (21).

For many years, repair was done through open procedures like Brostrom procedure or its modifications. The arthroscopic repair of ATFL was firstly introduced in the 90s by *Hawkins* and *Ferkel*. These techniques did not gain popularity for many reasons: higher complexity, more complications, longer surgical time and controversial results when compared to open techniques (22).

In the last ten years, a new impetus in arthroscopy led surgeons to develop arthroscopic lateral ligament repair procedures. Arthroscopic procedures are minimally invasive procedures that may reduce postoperative pain and subsequent recovery times. Moreover, arthroscopy allow assessing and treating other intra articular pathologies often associated with chronic instability, such as osteochondral lesions, synovitis and loose bodies. Previously, many authors showed that intra articular lesions are present in 63–95% of the cases of chronic ankle instability. These lesions are considered to be the cause of persistent symptoms in 13–35% of symptomatic patients despite a successful open ligament reconstruction (6).

In the current systematic review studies, we included the results of 13 studies of arthroscopic lateral ligament repair, including a total of 725 arthroscopic ankle repairs, with a mean follow-up of 21.14 months (range, 12-40 months). The most important finding in the current study was excellent clinical outcomes of arthroscopic lateral ligament repair. AOFAS showed an improvement from average preoperative score of 60.5 (range, 41.2 to 69.9) to average postoperative score of 93.5 (range, 89.2 to 98) in 9 studies.

Comparative studies have attempted to evaluate whether the potential advantages of arthroscopic lateral ligament repair techniques provide better outcomes than traditional open repairs. In a recent systematic review study, showed excellent efficacy of open and arthroscopic surgical procedures in the treatment of the chronic ankle instability, with more complications reported in arthroscopic surgeries(23).

The current review, included 3 comparative studies that compared arthroscopic with open ATFL repair (1 level I study, and 2 level II). These studies showed similar clinical outcomes between the 2 groups.(13, 15, 20)

Theoretically as the arthroscopic approach is less invasiveness, the minimal subcutaneous dissection may provide relatively quicker recovery and postoperative rehabilitation. However, Itis important to note that these results are limited to only short-term follow-up. Therefore, further randomized controlled trials with large cohorts of patients and long-term outcomes are required to determine the effectiveness of the arthroscopic technique compared with the open technique for lateral ankle instability (24).

The studies included in this review varied in the repair methods used. The most commonly used procedure in this review was one or 2 suture anchors introduced from

an accessory anterolateral portal to the distal fibular attachment of the ATFL (Table 1). However, suturing the ATFL with or without inferior extensor retinaculum reinforcement has significant variability in the description of the technique employed, and advanced arthroscopic skills are necessary to perform these procedures as the slight differences in these techniques complicate the conclusions of the studies, further studies should be directed to evaluate the difference between techniques in arthroscopic repair. (24)

The current study has found a relatively high complication rate of 11.7% (85 of 725) following the arthroscopic repair, in comparison with a 5.4% (36 of 669) complication rate with the open modified Broström-Gould procedure reported in a recent systematic review. The current study has shown that the arthroscopic procedure may be associated with a higher complication rate in regard to nerve damage, including superficial peroneal nerve injury, which was frequently reported. This may be due, in part, to variations in the technique employed (25).

To reduce the likelihood of nerve damage during arthroscopy, Acevedo (8) identified a "safe zone" at a distance of 1.5 cm from the tip of fibula in anatomical study. Awareness of this safe zone may allow for surgeons to avoid the potential risk of nerve injuries during the arthroscopic repair. Several studies acknowledged that the arthroscopic technique is technically demanding with a steep learning curve, and therefore it is only recommended for experienced surgeons or surgeons being trained by an expert in this technique to reduce the risk of complications associated with the procedure.(8, 11, 13, 15, 19, 26)

Limitations

This systematic review has several inherent limitations and potential biases. The criteria were limited to MEDLINE, PubMed, and Cochrane Library Database articles published exclusively in English. The comparative studies provided only short term clinical outcomes, and no study evaluated the long-term outcomes following arthroscopic repair. There is a strong possibility of bias within the studies themselves, as no study clearly separates the surgeon or author from the data collection, the data extraction was not performed in a blinded fashion, but rather was performed by 2 independent reviewers and later confirmed by the lead author.

Conclusion

The current systematic review included 13 studies demonstrated that arthroscopic

lateral ankle ligament repair yields favorable clinical outcomes in the short term. However, there is no clinical evidence to support the advantages of the arthroscopic procedure over the open procedure, and there are no long-term data currently available supporting an arthroscopic procedure over an open procedure.

References

١. DiGiovanni C, Brodsky A. (2006). Current concepts: lateral ankle instability. Foot Ankle Int. 27:854-66.

٢. Giovanni BD, Partal G, Baumhauer J. Acute ankle injury and chronic lateral instability in the athlete. Clin Sports Med. 2014;23:1-19.

٣. Usuelli F ,Mb L, Mrcs B, Frcs E, Grassi M, Maccario C. Foot and ankle surgery lateral ankle and hindfoot instability: a new clinical based classification. Foot Ankle Surg. 2014;20:231–6.

٤. Salat P, Le V, Veljkovic A, Cresswell M. Imaging in Foot and Ankle Instability. . Foot Ankle Clin. 2018;4:499-522.

٥. Becker H, Ebner S, Ebner D, Benesch S, ssler HF, Hayes A. 12-year outcome after modified Watson–Jones tenodesis for ankle instability. Clin Orthop Relat Res. 1999:194–204.

٦. Yasui Y, Murawski C, Wollstein A, Takao M, Kennedy J. Operative treatment of lateral ankle instability. J Bone Joint Surg Rev. 2016;4:1-11.

٧. Batista J, Vecchio JD, Patthauer L, Ocampo M. Arthroscopic Lateral Ligament Repair Through Two Portals in Chronic Ankle Instability. Open Orthop J. 2.32-11:617;2017.

٨ Acevedo J, Ortiz C, Golano P, Nery C. ArthroBroström lateral ankle stabilization technique: An anatomic study. Am J Sports Med. 2015;43:2564-71.

٩. Cottom J, Baker J, Richardson P. The “all-inside” arthroscopic Broström procedure with additional suture anchor augmentation: A prospective study of 45 consecutive patients. J Foot Ankle Surg. 2016;55:1223-8.

١٠. Cottom J, Rigby R. The “all inside” arthroscopic Broström procedure: A prospective study of 40 consecutive patients. J Foot Ankle Surg. 2013;52:568-74.

١١. Kim E, Lee K, Park J, Lee Y. Arthroscopic anterior talofibular ligament repair for chronic ankle instability with a suture anchor technique. Orthopedics. 2011;34.

١٢. Li H, Hua Y, Li H, Chen S. Anterior talofibular ligament (ATFL) repair using two suture anchors produced better functional outcomes than using one suture anchor for the treatment of chronic lateral ankle instability. Knee Surg Sports Traumatol Arthrosc. 2019 10.

١٣. Li H, Hua Y, Li H, Ma K, Li S, Chen S. Activity level and function 2 years after anterior talofibular ligament repair: A comparison between arthroscopic repair and open

repair procedures. Am J Sports Med. 2017;45:2044-51.

١٤. Lopes R, Andrieu M, Cordier G, Molinier F, Benoist. J. Arthroscopic treatment of chronic ankle instability: Prospective study of outcomes in 286 patients. Orthop Traumatol Surg Res. 2018;104:199-205.

١٥. Matsui K, MTakao, Miyamoto W, Matsushita T. Early recovery after arthroscopic repair compared to open repair of the anterior talofibular ligament for lateral instability of

the ankle. Arch Orthop Trauma Surg. 2016;136:93-100.

.١٦Pellegrini M, Sevillano J, Ortiz C, Giza E, Carcuro G. Knotless Modified Arthroscopic-Broström Technique for Ankle Instability. Foot Ankle Int. 2019;40(4):4.٨٣-٧٥

.١٧Song B, Li C, Chen N, Chen Z, Zhang Y, Zhou Y, et al. All-arthroscopic anatomical reconstruction of anterior talofibular ligament using semitendinosus autografts. Int Orthop. 2017;41(5):975-82.

.١٨Ulku T, Kocaoglu B, Tok O, Irgit K, Nalbantoglu U. Arthroscopic suture-tape internal bracing is safe as arthroscopic modified Broström repair in the treatment of chronic ankle instability. Knee Surg Sports Traumatol Arthrosc. 2019;10.

.١٩Vega J, Golano P, Pellegrino A, Rabat E, Pena F. All-inside arthroscopic lateral collateral ligament repair for ankle instability with a knotless suture anchor technique. Foot

Ankle Int. 2013;34:1701-9.

.٢٠Yeo E, Lee K, Sung I, Lee S, Lee Y. Comparison of allinside arthroscopic and open techniques for the modified Broström procedure for ankle instability. Foot Ankle Int. 2016;37.

.٢١Colville M. Surgical treatment of the unstable ankle. J Am Acad Orthop Surg. 1998;6:368-77.

.٢٢Hawkins R. Arthroscopic stapling repair for chronic lateral instability. 1987;4.

.٢٣Guelfi M, zamparetti M. Open and arthroscopic lateral ligament repair for treatment of chronic ankle instability: A systematic review. Foot Ankle Surg. 2016;5:315.

.٢٤Matsui K, Burgesson B, Takao M. Minimally invasive surgical treatment for chronic ankle instability: A systematic review. . Knee Surg Sports Traumatol Arthrosc. 2016;24:1040-8.

.٢٥Wang J, Hua Y, Chen S, Li H, Zhang J, Li Y. Arthroscopic repair of lateral ankle ligament complex by suture anchor. Arthroscopy. 2014;30:766-73.

.٢٦Yasui Y, Murawski C, Wollstein A, Takao M, Kennedy J. Operative treatment of lateral ankle instability. JBJS Rev. 2016;4:1-11.

To cite this article: Amr T. Younis, Emad Eldin Esmat, Mohamed S. Singer. Arthroscopic Lateral Ligament Repair for Treatment of Chronic Ankle Instability: A Systematic Review. BMFJ 2021; 38(orthopedic surgery): 11-21. DOI: 10.21608/bmfj.2021.17923.1088