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Review Articles

Similar Outcomes at Early Term After Arthroscopic or Open Repair of Chronic Ankle Instability: A Systematic Review and Meta-Analysis

Yu-Jie Song, MSc[1], Ying-Hui Hua, MD, PhD[2]

[1] Surgeon, Department of Sports Medicine, Huashan Hospital, Fudan University, Shanghai, China
[2] Professor, Department of Sports Medicine, Huashan Hospital, Fudan University, Shanghai, China

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ABSTRACT

Although the open modified Broström technique remains widely accepted as the gold standard for operative treatment of ankle instability, use of the arthroscopic repair technique has been rapidly increasing. Our aim is to conduct a comparative systematic review and meta-analysis of the data to determine whether there is a significant difference in clinical outcomes between arthroscopic and open repair for lateral ankle instability. A systematic literature review was performed using PubMed, Web of Science, the Cochrane Library, and EMBASE from 1980 to March 2018 to identify all English-language studies (level of evidence 1 to 3) comparing functional outcomes of arthroscopic versus open repair of lateral ankle instability. Four studies (1 level 1, 3 level 3) involving 207 patients met inclusion criteria. Of those, 97 participants were treated with arthroscopic repair, and 110 were treated with open repair. All of the subjective outcomes were improved for both groups across the 4 studies, without a significant difference in improvement between groups, except in 1 study, in which time to return to daily activity was significantly shorter in arthroscopic group ($p < .05$). Overall, this review demonstrated no statistically significant difference in outcome measures between arthroscopic versus open repair, both of which reported favorable and satisfactory outcomes, and produced equivalent clinical results. Additional randomized controlled studies of larger numbers of patients with longer follow-up times, however, are required to confirm whether arthroscopic repair leads to earlier recovery.

Lateral ankle sprain is 1 of the most common lower limb injuries in sports activities (1−3). The most commonly damaged ligament is the anterior talofibular ligament (ATFL), followed by the calcaneofibular ligament (CFL) (4−7). Based on the number of structures injured, ankle sprains can be classified into 3 grades: grade 1 injuries entail only a tear in the ATFL, grade 2 injuries consist of the CFL, and grade 3 injuries involve complete disruption of the entire lateral complex (8−10). Thus, treatment can be guided accordingly.

Conservative treatment is initially recommended, with either bracing or functional rehabilitation. However, approximately 10% of patients cannot fully recover with nonoperative therapy and continue to experience a feeling of giving way and eventually develop chronic ankle instability (11−13). In these cases, surgery is required (13,14).

Various operative interventions have been reported and are divided into 3 main categories: anatomic repair, anatomic reconstruction, and nonanatomic reconstruction. Anatomic repair is indicated if a remnant of the lateral ligament is preserved with good quality (5,15,16). In anatomic reconstruction, an alternative graft such as an autograft or allograft of a tendon is applied when the ligaments are attenuated (17−19). However, in nonanatomic reconstruction, local tissue or tendon is sacrificed to correct the structure laxity, so it may result in a gradual deterioration of the joint (20−23).

Among several operative procedures, the modified Broström operation remains the gold standard for repair of the lateral ankle ligament, which was first proposed by Broström (24) in 1966 and was modified with reinforcement of the inferior extensor retinaculum by Gould et al (25) in 1980. In 1988, Karlsson et al (26) advocated reattaching the ATFL and CFL through drill holes because the ligaments were often found to be elongated and scarred but in continuity. Arthroscopic repair of the ATFL has developed and evolved since 1990s (27,28). Recently, there has been increased interest in using the arthroscopic technique for treating lateral instability of the ankle, because this innovative procedure is minimally invasive and simultaneously addresses the intra-articular pathology that is associated with ankle instability with a high ($\leq 93\%$) incidence (29−33). However, a wide range of complications is the major issue with arthroscopic repair (30,34−39).

To our knowledge, limited clinical studies directly compare open versus arthroscopic repair for chronic lateral ankle instability. The purpose of this study was therefore to determine the efficacy of these 2

techniques. Furthermore, we hypothesized that there would be no significant difference between them and that both repairs would provide equal and excellent outcomes.

Materials and Methods

Search Strategy and Selection Criteria

A systematic review was carried out using PubMed, Web of Science, the Cochrane Library, and EMBASE databases from 1980 to March 2018, combining the following search terms: (lateral ankle ligament OR ankle instability) AND arthrosc* AND (open OR Broström). We included studies reported in English that directly compared arthroscopic repair of lateral ankle instability with open operative management (level of evidence 1 to 3). In addition, studies were excluded if they were noncomparative studies, nonclinical studies, reviews, case reports, or study protocols.

Quality Assessment

The methodologic quality of all eligible studies was independently assessed by 2 reviewers (Y.S., Y.H.). Risk of bias was assessed as low, unclear, or high using the *Cochrane Handbook* (40) for randomized controlled trial (RCTs). Cohort and case-control studies were evaluated using a modified version of the Newcastle-Ottawa scale (41), which accorded a maximum of 9 stars to each study, with ≥7 indicating low risk of bias. Disagreement was resolved by a consensus procedure.

Data Extraction

Two independent reviewers (Y.S., Y.H.) extracted and tabulated the data from each included publication. Data included the first author, year of publication, journal, level of evidence, study design, number of patients per group, mean age, mean follow-up, and operative time frame.

Outcome Measures

We considered clinical and functional outcomes including the American Orthopaedic Foot and Ankle Society (AOFAS) ankle-hindfoot score (42,43), visual analogue scale (VAS) score, Karlsson score, the Japanese Society for Surgery of the Foot (JSSF) scale score, Tegner activity scores, talar tilt angle, and anterior displacement of talus as the primary outcome measures. Complications, time to return to work/sports, and reoperation were secondary outcome measures.

Statistical Analysis

Statistical analysis was performed with Review Manager 5.3 (Cochrane Collaboration, London, UK). Continuous variables were analyzed by use of the weighted mean difference. When the range was given instead of a standard deviation, the standard deviation was obtained by contacting the corresponding author or calculated if possible using the available information and a previous method by Hozo et al (44). Heterogeneity among studies was quantified using the I^2 statistic. An I^2 value of $< 25\%$ was chosen to represent low heterogeneity and an I^2 value $> 75\%$ to indicate high heterogeneity. Random effects models were used when the I^2 value was $> 50\%$; otherwise, fixed-effects models were used.

Results

Search

The literature search yielded 278 citations. Of those, 4 studies met the inclusion and exclusion criteria, including 1 RCT, 1 prospective cohort study, and 2 retrospective cohort studies. The search results, reasons for exclusion, and selection process are summarized in the flowchart in Fig. 1. Table 1 details the findings for each of the included studies.
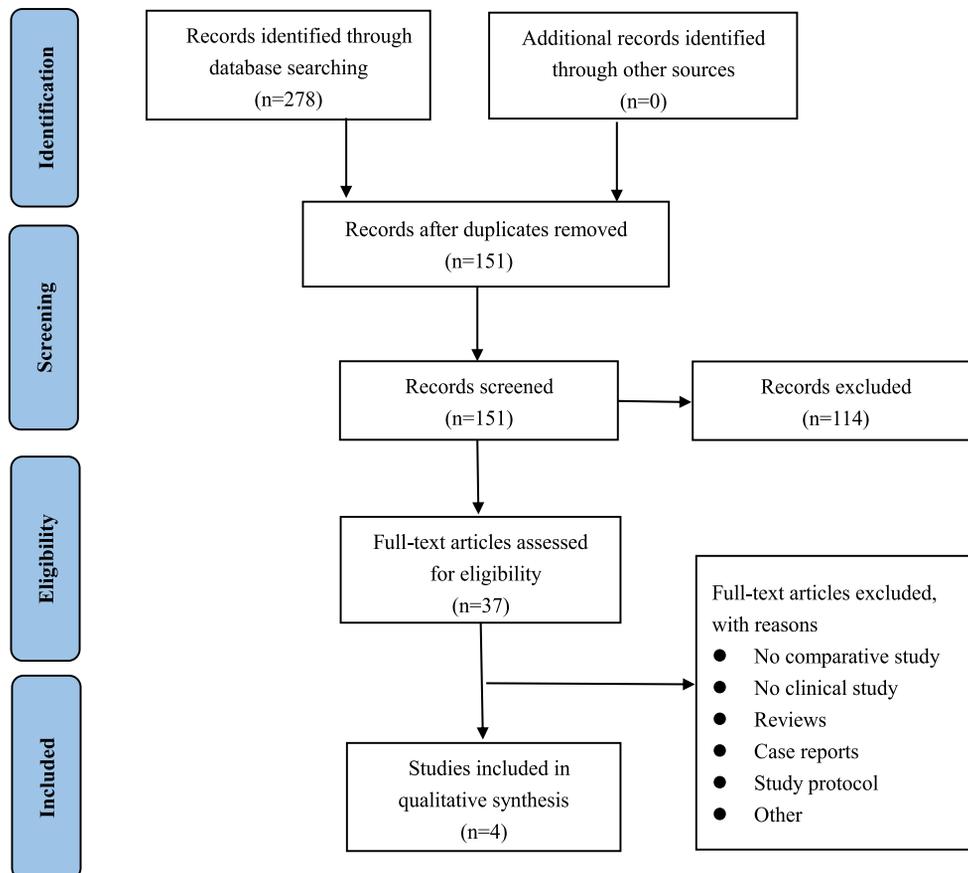

Fig. 1. Flowchart of the literature selection.

Table 1
Characteristics of included studies

Study (year)	Journal	Level of Evidence	Type of Study	No. of Patients (arthroscopic/open)	Mean Age, Years	Mean Follow-Up, Months	Operative Time Frame
Yeo et al (2016) (37)	Foot Ankle Int	1	RCT	48 (25/23)	Arthroscopic, 35.2 Open, 34.3	All patients, 12	2012 to 2014
Matsui et al (2016) (38)	Arch Orthop Trauma Surg	3	Retrospective cohort	37 (19/18)	Arthroscopic, 28 Open, 24	All patients, 12	2013 to 2014
Li et al (2017) (36)	Am J Sports Med	3	Prospective cohort	60 (23/37)	Arthroscopic, 30.3 Open, 28.7	Arthroscopic, 39.7 Open, 35.5	2012 to 2014
Rigby et al (2018) (39)	Foot Ankle Surg	3	Retrospective cohort	62 (30/32)	Arthroscopic, 47.9 Open, 37.7	Arthroscopic,15 Open, 43	2009 to 2013

Abbreviations: Am J Sports Med, American Journal of Sports Medicine; Arch Orthop Trauma Surg, Archives of Orthopaedic and Trauma Surgery; Foot Ankle Int, Foot & Ankle International; Foot Ankle Surg, Foot and Ankle Surgery; RCT, randomized controlled trial.

Quality Assessment

According to the *Cochrane Handbook* (40) and the Newcastle-Ottawa scale evaluation criteria (41), the quality assessment of RCT and nonrandomized studies, including risk of bias, is outlined in Table 2. The RCT did not state the blinding of clinical outcome assessment, and 2 (8%) patients were lost to follow-up in 1 group, but no performance, selective outcome reporting, and other sources of bias, and therefore there was a moderate risk of bias. Regarding nonrandomized studies, 2 studies scored 9 stars, indicating a low risk of bias, whereas 1 study scored 7 stars because the authors did not state any differences between groups for establishing comparability such as age and follow-up time.

Studies

Yeo et al (37) used a randomized design to compare arthroscopic repair with open repair for the lateral instability of the ankle. In total, 48 patients, who had >6 months of instability and in whom physical therapy, bracing, or immobilization failed, were ultimately enrolled in this study with a mean age of 35.2 ± 11.8 (range 19 to 54) years and 34.3 ± 14.1 (range 17 to 52) years in the arthroscopic (n = 25) and open (n = 23) groups, respectively. At the final follow-up, which was 12 months, the AOFAS, VAS, and the Karlsson scores were improved significantly in both groups ($p < .001$). However, when comparing the final follow-up postoperative clinical scores between the 2 groups, there was no statistically significant difference in the AOFAS, VAS, or the Karlsson score ($p = .736, .577$, and .5, respectively). In addition, no significant difference was found in radiologic outcomes including the anterior talar translation and talar tilt angle ($p = .39$ and .436, respectively).

The strengths of this study include that it was a randomized trial and that sample size calculation and power analysis were performed. However, the sample size was small, so it is still susceptible to beta error. In

addition, although the follow-up rate was >92% in each group, permuted block randomization was conducted in this study, which created uneven numbers between groups initially. In addition, the follow-up time was relatively short. Last, the authors mentioned that subjective satisfaction was not evaluated.

Matsui et al (38), using a retrospective case-control design, evaluated the functional outcomes between arthroscopic repair and open repair of lateral ankle instability before and at 12 months after surgery. Thirty-seven patients with a mean age of 24 (range 13 to 56) years in the open group (n = 18) and 28 (range 8 to 59) years in the arthroscopic group (n = 19) were ultimately studied. Patients were included if they had symptoms after ankle sprain for several months despite nonoperative treatment. The JSSF scale score significantly improved from 69.9 to 98.0 in the arthroscopic group and from 70.8 to 95.4 in the open group ($p < .01$). However, no significant difference was noted in the preoperative and postoperative JSSF scale scores between groups. At 3 days after surgery, the mean VAS score was significantly lower in the arthroscopic group (33.4 points) than in the open group (46.6 points) ($p < .05$). At 2 weeks after surgery, however, no difference in the mean VAS score was found in the groups ($p = .40$). In addition, the talar tilt angle and displacement of the talus on stress radiography were significantly improved after surgery in both groups ($p < .01$). In addition, these parameters revealed no significant difference between the groups. Unique to this study was that the authors also evaluated the duration of surgery and time to return to daily activities, both of which were significantly shorter in the arthroscopic group ($p < .05$). Although there was no significant difference in mean time to return to sport activities between groups ($p = .07$), these data indicated that arthroscopic ATFL repair enabled early recovery. Additionally, it is the only study in this review that demonstrated the time to return to activities of daily living and sports.

The limitations of this study include that it was a retrospective and nonrandomized case-control study with a small number of patients and

Table 2
Quality assessment of randomized controlled trial and nonrandomized studies

Randomized Controlled Trial					
Author	Selection Bias	Performance Bias	Detection Bias	Attrition Bias	Reporting Bias	Other Bias
Yeo et al (37)	Low	Low	Unclear	Low	Low	Low

Nonrandomized Studies		
Author	Selection	Comparability	Outcome
Matsui et al (38)	fx1	fx2	fx3
Li et al (36)	fx1	fx2	fx3
Rigby et al (39)	fx1		fx3

Abbreviations: fx1, 1 star; fx2, 2 stars; fx3, 3 stars.

short follow-up period. In addition, the authors concluded that the arthroscopic procedure resulted in early return to daily activities, which was not confirmed. To make a firm statistical conclusion, higher-level and longer-term studies with a large number of patients are required. Additionally, efficacy and safety should be confirmed that covers all patients with or without comorbidities.

Rigby et al (39) also used a retrospective case-control study to compare the effects of minimally invasive surgery with open surgery. Magnetic resonance imaging (MRI) findings of disrupted lateral ankle ligament structures were used to diagnose ankle instability in 62 patients who had clinical reports of instability and mechanical instability with clinical stress maneuvers, including 30 patients with a mean age of 47.9 (range 14 to 83) years in the arthroscopic group and 32 patients with a mean age of 37.7 (range 9 to 72) years in the open group. Statistical analysis revealed no statistically significant difference between the 2 groups for any of the outcome scores, such as the AOFAS, Karlsson, and VAS scores, before and after surgery. In addition, 97% patients in both groups returned to full activity, which included sports for athletic patients.

This study had several limitations, including its retrospective nature. Additionally, the mean follow-up time for the open group was 3.7 (range 1.3 to 5.3) years; however, the follow-up time for the arthroscopic group was 1.3 (range 0.7 to 1.7) years. The mean age in the arthroscopic group was 10.2 years older than in the open group. The authors did not state whether those factors would affect the comparability. This study did not perform stress radiography, and functional outcomes were subjectively reported by the patient at the final visit for both the preoperative and postoperative scores. Another shortcoming was that objective findings were noted by the authors; thus, it might have potential bias.

Li et al (36) used a cohort study design to assess the effectiveness of function of 2 operative procedures. A total of 60 patients were included. Of these, 23 patients were in the arthroscopic group, and 37 patients were in the open group with a mean age of 30.3 ± 10.1 years and 28.7 ± 8.7 years, respectively. Patients underwent the open modified Broström procedure if arthroscopic ATFL repair was impossible. Both the arthroscopic and open groups showed improvement in the AOFAS, Karlsson, and Tegner activity scores ($p < .001$) at a mean follow-up of 39.7 ± 10.3 months and 35.5 ± 9.9 months, respectively. However, no significant difference was noted in these 3 outcomes between the arthroscopic group and the open group after surgery. In addition, MRI scanning was conducted at follow-up, because MRI is a useful tool to assess additional pathologic features. In addition, the mean signal-to-noise ratio (SNR) value of the ATFL between the 2 groups revealed no significant difference (9.1 ± 2.7 vs 8.8 ± 2.3; $p = .39$).

The study was limited by having a nonrandomized study, investigating ATFL only, not analyzing whether concomitant procedures affected the outcomes, and not performing stress radiography. However, the authors stated that if no significant difference was found regarding the incidence of osteochondritis dissecans or osteophytes, then it was presumed that a concomitant procedure would not affect the comparison. In addition, stress radiographs, which are more accurate to evaluate anterior translation, were not performed. The authors explained that the anterior drawer test of all ankles was normal at the follow-up, which means that the side-to-side difference of tibiotalar translation was < 5 mm. Therefore, the stress radiogram was not necessary. Briefly, the patient-reported outcomes and complications in identified studies are summarized in Tables 3 and 4.

Statistical Analysis

In total, 3 cohort studies were analyzed quantitatively. The postoperative AOFAS score did not reveal any difference with arthroscopic

Table 3
Patient-reported outcomes in identified studies

Study	AOFAS Score		VAS Score		Karlsson Score		Talar Tilt Angle		Anterior Displacement of Talus, mm	
	Arthroscopic	Open	Arthroscopic	Open	Arthroscopic	Open	Arthroscopic	Open	Arthroscopic	Open
Yeo et al (37)	22.8 (67.5 to 90.3)	19.3 (69.9 to 89.2)	−3.5 (5.2 to 1.7)	−2.4 (4.4 to 2.0)	31.2 (45.0 to 76.2)	24.9 (48.6 to 73.5)	−3.4 (7.3 to 3.9)	−1.6 (5.4 to 3.8)	−1.7 (8.4 to 6.7)	−1 (7.8 to 6.8)
Matsu et al (38)	NR	NR	(12.4) Maximum of 100 before surgery	(19.2) NR	NR	NR	−6.8 (10.0 to 3.2)	−7 (9.9 to 2.9)	−5.6 (8.4 to 2.8)	−6.2 (9.1 to 2.9)
Li et al (36)	24 (69.3 to 93.3)	23.2 (69.2 to 92.4)	NR	NR	28.5 (61.8 to 90.3)	29.7 (59.7 to 89.4)	NR	NR	NR	NR
Rigby et al (39)	60.2 (35.1 to 95.3)	58.1 (35.4 to 93.5)	−6.7 (8.2 to 1.5)	−6.1 (7.3 to 1.2)	(91.8) Preoperative	(93.4) NR	NR	NR	NR	NR

Abbreviations: AOFAS, American Orthopaedic Foot and Ankle Society; NR, not reported; VAS, visual analogue scale.
Parameters are reported as a mean value of improvement from preoperative to postoperative assessments (mean preoperative value to mean postoperative value).

Table 4
Patient-reported complications in identified studies

	Complications	
Author	Arthroscopic Technique	Open Technique
Yeo et al (37)	Two (8%) patients had SPN injury; 2 (8%) patients had knot pain; 1 (4%) patient had sural nerve injury.	Two (8.7%) patients had SPN injury; 1 (4.4%) patient had an abscess.
Matsui et al (38)	Two (10.5%) patients had temporary numbness of the SPN.	Three (16.7%) patients had wound irritation; 1 (5.6%) patient had temporary numbness of the SPN.
Li et al (36)	One (4.3%) patient complained of no improvement in functional scores after surgery.	Two (5.4%) patients complained of no improvement in functional scores after surgery.
Rigby et al (39)	One (3.3%) patient had DVT; 1 (3.3%) patient had neuritis of the sural nerve.	Two (6.3%) patients had neuritis of the SPN.

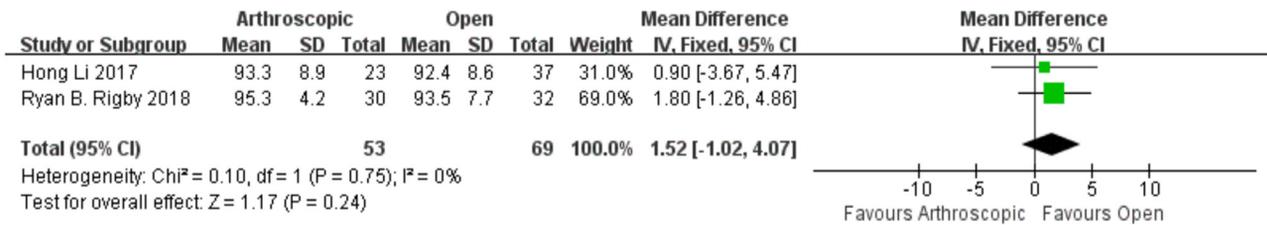Abbreviations: DVT, deep vein thrombosis; SPN, superficial peroneal nerve.

Fig. 2. Forest plot of the postoperative American Orthopaedic Foot and Ankle Society score for arthroscopic versus open repair.
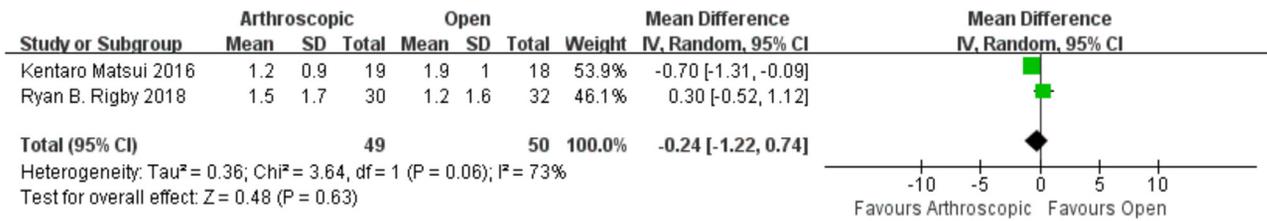

Fig. 3. Forest plot of the postoperative visual analogue scale score for arthroscopic versus open repair.
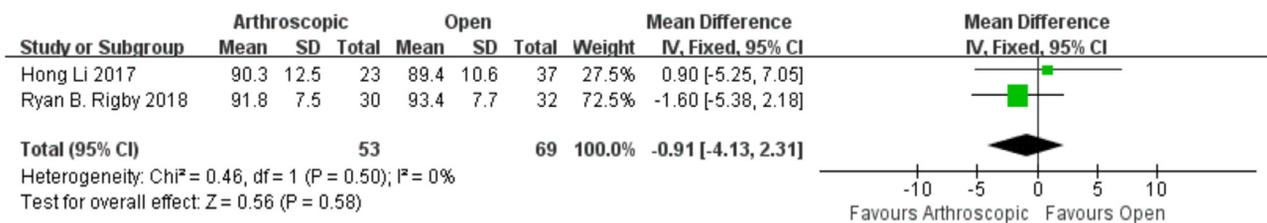

Fig. 4. Forest plot of the postoperative Karlsson score for arthroscopic versus open repair.

repair compared with open repair for chronic ankle instability ($p = .24$; Fig. 2). The VAS score at last follow-up for arthroscopic repair was no different than that for open repair ($p = .63$; Fig. 3). In addition, there were no differences in the Karlsson score with arthroscopic repair versus open repair after surgery ($p = .58$; Fig. 4).

Discussion

The most important finding of this review is that no statistically significant difference between arthroscopic and open repair for lateral instability of ankle regarding patient-reported outcomes and objective findings of radiologic outcomes was reported. The results of the current review are similar to a previous systematic review (45) in which only

retrospective case series without control groups were included. To our knowledge, this systematic review is the first report to compare clinical efficacy directly between the 2 techniques.

Although fully arthroscopic techniques for knee and shoulder instability have become the current standard (46−49), the concept of arthroscopic ankle ligament repair has gained increasing attention. The arthroscopic approach is theoretically associated with lower morbidity rates and faster recovery (50) because it is a minimally invasive method. Matsui et al (38) found that the duration of surgery and time to return to daily activity were shorter in the arthroscopic group, which supported this theory. However, no difference was noted in mean time to return to sport activities. Because the benefit is still not conclusive, more research that

evaluates these measurements is required. As mentioned previously, intra-articular features such as synovitis or osteochondral lesions (29,34,51) are frequently accompanied by ankle instability. Some surgeons prefer addressing the intra-articular pathology arthroscopically and then transitioning to an open Broström repair, but it is much more effective when both intra-articular pathology and ankle instability are addressed by an entirely arthroscopic technique than a combined approach (7,30,33,52,53). However, this innovative procedure is not without concerns. The injury of the superficial peroneal or sural nerve and pain or discomfort owing to a suture knot or prominent anchor are the most frequent complications reported (34,35). Because arthroscopic ankle stabilization technique demands a learning curve, it is acknowledged that nerve injury could only be avoided if the surgery is in experienced hands. In the study by Matsui et al (38), the authors pointed out that the duration of surgery in the first 6 cases was significantly longer, with a mean time of 57.2 (range 40 to 95) minutes, than the duration of surgery in the subsequent 13 cases, with the mean time of 29.6 (range 22 to 37) minutes ($p < .01$), although all surgeries were performed by a single well-trained and experienced surgeon. However, to date, 2 studies are working on defining the safe zones and structures at risk when arthroscopic ATFL repair is performed, which would be helpful in allowing surgeons to avoid potential pitfalls (54,55). Surgeons who perform arthroscopic ankle stabilization require sufficient training and awareness of safe zones. For anchors, all of these selected studies used 1 or 2 anchors during the procedure. It was said that inserting anchors into the fibula could avoid problems that might be caused by the prominent staples (56). The studies by Drakos et al (57) and Giza et al (58) stated that an approach using arthroscopic-assisted sutures as anchors could provide firm fixation and the same good results as an open repair. Nevertheless, because of the frequent incidence of complications that result from suture anchors, the anchor needs to be modified, such as with knotless anchors (59) or bioabsorbable anchors (34). As seen in the 4 studies of this review, complications of arthroscopic and open repair ranged from 1 (3.3%) to 5 (20%) and 2 (5.4%) to 4 (13.8%), respectively (Table 4). Nevertheless, it is noteworthy that such a wide range of complication rates did not relevantly affect the functional and clinical outcomes of patients after surgery.

Considering the operative methods, 1 consistency among the studies worth noting is that the authors repaired the ATFL alone through either the arthroscopic or the open approach, but all produced satisfactory results. In addition, they did not state whether the CFL was injured. However, Okuda et al (60) reported that it was unnecessary to reconstruct the CFL along with the ATFL for patients with combined injuries of both ligaments. Considering that the CFL is located under the peroneal tendons anatomically and the inferior extensor retinaculum reinforcement could cover the CFL vector theoretically, the single-ligament (ATFL) repair is feasible to achieve ankle instability. Recent studies have confirmed this theory. Biomechanical research reported that the modified Broström procedure only with ATFL reconstruction can provide as much initial stability as combined ATFL and CFL repair (61). Moreover, clinical studies performed by Lee et al (62) and Maffulli et al (63) demonstrated that the long-term results of the modified Broström procedure without the CFL repair for chronic lateral ankle instability were good to excellent with regard to functional, clinical, and radiographic outcomes. Repair of the CFL would increase the size of the operative incision and prolong the operative and recovery times. Thus, it is reasonable to repair the isolated ATFL in the primary procedure. However, it is known that the CFL, as an important structure, protects the subtalar joint from subluxation during ankle motion and reduces tension of the ankle (64). It remains a controversial issue whether the modified Broström

procedure without CFL repair would result in deterioration of the subtalar joint in the long term. To date, there are no reports that can reach a certain conclusion. Therefore, a clinical comparative study of single- versus double-ligament Broström repair with longer follow-up time is required.

Speaking of returning to activity, in this review, only Matsui et al (38) reported the mean time to return to daily and sports activity, and Rigby et al (39) demonstrated the rate of return to full activity. Lateral ankle sprains are the most common foot and ankle injuries in the athletic population, and Lievers et al (65) reported that this injury led to the greatest total time loss of all injuries, costing 12,726 days. Thus, it is important to evaluate return to sport activity in future studies. The way to achieve faster recovery and earlier return to sport requires not only surgical techniques but also postoperative rehabilitation. It is interesting to find that each study in this review had different postoperative management, especially in the time to allow weightbearing. Matsui et al (38) permitted weightbearing and active range of motion exercise the day after surgery. Patients of Yeo et al (37) remained non-weightbearing until the 2-week follow-up. Li et al (36) reported that weightbearing was permitted after 4 weeks. In addition, Rigby et al (39) started weightbearing at 3 days in the arthroscopic group because of their hypothesis that patients had less swelling and pain, whereas the open group resumed weightbearing after 3 weeks. As we can see, postoperative protocols varied in every study, and still no consensus of this issue exists in the literature. Therefore, further RCTs with large numbers of patients and long-term results are needed to determine the best time to start weightbearing.

Given the radiologic assessment, the study by Li et al (36) was the only study in this review that looked at objective MRI and SNR data, which was done at 35 (range 24 to 49) months and 36 (range 24 to 50) months after arthroscopic and open surgery, respectively. No ATFL tears were presented through MRI evaluation, and no significant difference was found in the mean SNR value, which quantifies the normalized signal intensity of the ATFL. As seen in the other 2 studies of this review, stress radiographs, which are supposed to be more accurate to evaluate anterior translation (66), were performed instead. Li et al (36) stated that stress radiographs were not necessary in their study because the anterior drawer tests of all ankles were normal. Whether this alternative is reasonable remains under debate. In general, MRI is used to evaluate the chronic morphologic and pathologic state of lateral ankle ligament complex and associated comorbidity (67), whereas stress radiographs are commonly used for objective evaluation in the clinical setting. However, some authors argue that stress radiographs lack reliability, especially in the diagnosis of ankle instability (68). Furthermore, Lee et al (69) explained that the data of stress radiographs were so variable and had the potential for false-negative errors because of the muscular contraction produced. Moreover, it is reported by Hertel (70) that patients with functional ankle instability might have normal stress radiographic findings. Considering that the specificity and sensitivity of stress radiography is doubtful, some authors compared the accuracy of MRI with stress radiography in ankle ligament injury (71−73); however, there are discrepancies among the study results. In all, if the preoperative radiologic evaluation is unreliable, the comparison between radiologic evaluation before and after surgery could be affected. Thus, the most capable radiologic evaluation for ankle instability is an issue to be addressed in future studies.

The strength of this systematic review is the exclusive use of comparative studies. We limited the number of potentially included studies that had a lesser level of evidence and lacked control groups. Consequently, this strategy only produced 4 articles meeting the criteria for this review. One limitation of this study is that although results were similar among the evaluated studies, the

mean patient age in each study was generally in the range of the late 20s to early 30s, except for 1 study by Rigby et al ([39](#)), in which the age of included patients ranged from 9 to 83 years with a short follow-up time in the arthroscopic group. It is still unknown whether old and inactive patients would benefit from both procedures or whether one approach is preferred over another. Additionally, the total number of patients in the selected studies was relatively small. In particular, 2 studies had a minimum follow-up of 1 year. Therefore, further research with regard to each issue is warranted.

In conclusion, both arthroscopic and open repair for lateral ankle instability demonstrate excellent and comparable clinical results. Patients undergoing either procedure can expect to experience equivalent functional outcomes. Although arthroscopic repair, a minimally invasive technique, might provide earlier recovery, an RCT of a larger number of patients with longer follow-up time is needed to make a firm statistical conclusion.

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