Modified Broström repair versus internal ankle bracing augmentation with modified Broström procedure in chronic lateral ankle instability: a systematic review and meta-analysis

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Background
Lateral ankle instability is a major orthopaedic challenge with Lateral ankle sprains accounting for almost 85% of all ankle sprains. Ankle sprains in the majority of patients settle with conservative treatment. However, 20–40% of patients usually develop recurrent sprains and chronic ankle instability (CAI). Limited results of the Broström procedure opened the gate for multiple modifications such as augmentation using a part of the extensor retinaculum (Broström-Gould technique) with the use of suture anchors or to re-enforce reconstruction with suture tape.
Objective
To conduct a systematic review and meta-analysis comparing the modified Broström repair (MBR) with the modified Broström procedure and internal ankle bracing augmentation as regards clinical outcomes, re-tear, and other complications.
Patients and methods
This study was conducted following the preferred items for systematic reviews meta-analysis (PRISMA) 6 guided items and a checklist to answer the question of which is better as regards improving clinical outcomes and complications between 1/1/2010 and 1/6/2022.
Results
This review included 5 studies, 3 of which were randomized control trials (RCT), 384 patients were included, 170 patients underwent the Internal ankle bracing augmentation with the modified Broström procedure, and 214 patients underwent the modified Broström procedure.
The results of the comprehensive review demonstrated that modified Broström repair using the internal brace augmentation was superior to solitary modified Broström repair and facilitated early recovery and restoration to the preinjury activity level in the majority of patients with no statistically significant difference.
Moreover, there was no significant difference between the two groups regarding the Foot and Ankle Outcome Score (FAOS), the Foot and Ankle Ability Measure (FAAM), Revision Surgery Rates, and Overall Complications.
Conclusion
Despite the anticipated mechanical stability for internal ankle bracing over modified Broström repair the current meta-analysis did not show statistically significant superiority of the internal ankle bracing over the modified Broström repair.

Keywords:
ankle instability, fiber tape, internal brace, modified broström, suture tape

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Introduction

Inversion injuries of the ankle that cause lateral ankle sprain are a common cause of referral and presentation to accident units [1]. Lateral ankle sprains constitute about 85% of all ankle sprains. Most patients with ankle sprains improve with conservative treatment. However, 20–40% of patients might develop recurrent sprains and CAI [2]. Complications of CAI include increased ligamentous laxity, proprioceptive deficits, and activity limitations affecting occupational and sports activity [3].

There are many surgical strategies to treat CAI, including tenodesis, anatomical reconstruction, and more combined surgical techniques [4]. The unsatisfactory results of Broström operations paved the way for further modifications, including augmentation with an extensor retinaculum (Broström-Gould method) and the use of anchors or suture tape to compel repair [5].

The modified Broström procedure, also known as the Broström-Gould technique, is a promising novel treatment option for CAI and is regarded as the most discussed approach [6]. The internal ankle bracing is a new surgical technique used to reinforce ligament strength. It acts as a secondary stabilizer after repair in the (Broström-Gould technique) and it utilizes the bridging concept that uses polyethene/polyester suture tape and knotless bone anchors [7].

Aim of the work

To conduct a systematic review and meta-analysis to compare the modified Broström procedure and internal ankle bracing augmentation with the modified Broström procedure regarding clinical outcomes, re-tear, and other complications.

Materials and methods

The Cochrane Handbook for Systematic Reviews of Interventions was followed in conducting the systematic review. The PRSIMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines were also followed.

Eligibility criteria

We included studies that met our following inclusion criteria:

(1) Population: Patients with chronic lateral ankle instability.
(2) Intervention: Internal ankle bracing augmentation with Modified Broström procedure
(3) Comparator: Modified Broström Repair
(4) Outcome parameters: clinical outcomes, re-tear and other complications.
(5) Study design: Clinical trials whether randomized or nonrandomized, prospective and retrospective comparative cohort studies, and case-control studies.

Inclusion criteria

The meta-analysis included patients who had chronic lateral ankle instability with failed conservative treatment. Randomized control trials (RCT), Cohort studies, case-control studies and other studies with level evidence 1–4, which were included. Literature in the English language only described chronic lateral ankle instability managed by modified Broström Repair versus Internal ankle bracing augmentation with modified Broström procedure.

Exclusion criteria

We excluded studies on animals, reviews, book chapters, thesis, editorial letters, and papers with overlapped datasets. Patients with hyperlaxity and neuromuscular disorder were also excluded. There were no restrictions on, race or sex.

Search methods for identifying studies

We did this literature search on published studies between 1/1/2010 and 1/6/2022 using PubMed, Scopus, and Web of Science databases. **Using the following keywords:** 'Ankle instability'. 'Suture tape'. 'Fiber tape'. 'Internal brace'. 'Modified Broström During the Literature search, we used the following 'OR' and 'AND' operators: ('ankle instability') AND ('suture tape' OR 'fiber tape' OR 'internal brace' OR 'Modified Broström'). The identified citations were recovered using the Endnote X8 software package (Thompson Reuter, USA). Eligibility screening was conducted in a two-stepwise manner (title/abstract screening and full-text screening). Primarily the Endnote X8 tool (Thompson Reuter, USA) and manually screening titles and abstracts were used to weed out the duplicate articles.

Data extraction

We extracted the characteristics of each study as follows: study design, sample size, age, gender, duration of follow-up, and outcomes that were reported consistently in the included studies regarding early rehabilitation and early return to sports activity, Foot and Ankle Outcome Score (FAOS), Foot and Ankle Ability Measure (FAAM), recurrence of instability, irritation of peroneal nerve and overall complications.

Data synthesis and analysis

Statistical analysis was performed using Review Manager (version 5.3). We calculated the pooled Mean difference (MD), Odds ratio (OR), risk difference (RD) and 95% confidence intervals (CIs) for all outcomes using the Mantel-Haenszel method.

Testing for heterogeneity

The extent of heterogeneity was estimated with the I^2 measure, which describes the percentage of variation across studies that is due to heterogeneity, according to Cochrane Handbook about guidelines for conducting meta-analysis, an I^2 value below 50% means low heterogeneity so we used 50% as a cut of point for heterogeneity.

Pooled estimates

In the case of I^2 value below 50%, we used a fixed effect model while in an I^2 value above 50%, we used a random effect model to pool the data.

***P* value: level of significance:** $P > 0.05$: nonsignificant. $P \leq 0.05$: significant. $P \leq 0.01$: highly significant.

Results

We studied 183 articles from PubMed, 211 articles from Scopus, and 259 from Web of Science. 246 duplicated papers were excluded using the Endnote X8 program (Thompson Reuter, USA), 407 articles manually underwent titles and abstracts screening and 206 articles underwent full-text review as shown (Fig. 1). Finally, five studies met our inclusion criteria.

Included studies criteria

We identified 5 studies that compared modified Broström repair versus internal ankle bracing augmentation using the modified Broström procedure in chronic lateral ankle instability with a total of 384 patients. Studies consisted of 3 RCTs and 2 retrospective study designs. The summary of studies characteristics and summary of findings are shown in Tables 1, 2.

Parameters

Foot and ankle outcome score (FAOS)

Three studies evaluated FAOS with 85 cases in ankle bracing + modified Broström repair (A+MBR) group versus 127 cases in modified Broström repair (MBR) group. The effect estimate didn't favor A+MBR group or MBR group regarding FAOS (mean difference MD= -0.57, 95%CI = [-3.37, 2.23], I2 =0%, *P* value =0.69) (Fig. 2).

Foot and ankle ability measure (FAAM), sports activity scores

On the subscale of FAAM, sports activity scores, both groups performed equally (MD= 3.17, 95%CI = [-4.04, 10.38], I^2 =87%, *P* value =0.0004) (Fig. 3). In sensitivity analysis by excluding Cho at al 2017, A+MBR had higher score (MD= 6.40, 95%CI = [3.45, 9.34], I^2 =35%, *P* value =0.21)

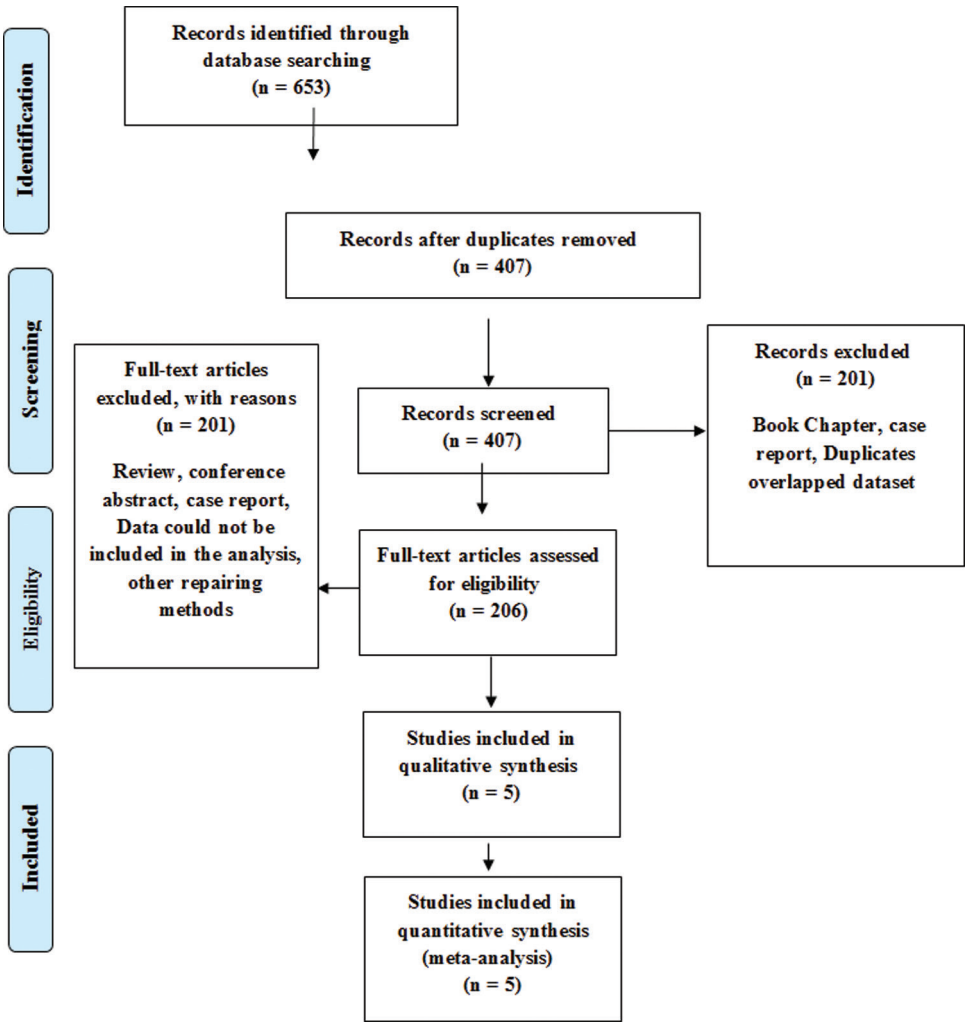
Foot and ankle ability measure (FAAM), activities of daily living

According to the subscale of FAAM, daily living activities, the A+MBR group had comparable results to the MBR group (MD= 0.45, 95%CI = [-1.32, 2.23], I^2 =55%, *P* value =0.11) (Fig. 4).

Overall complications

The overall reported complications showed no statistically significant difference between both

Figure 1



Flow diagram showing the protocol of study selection.

Table 1 Characteristics of the included studies

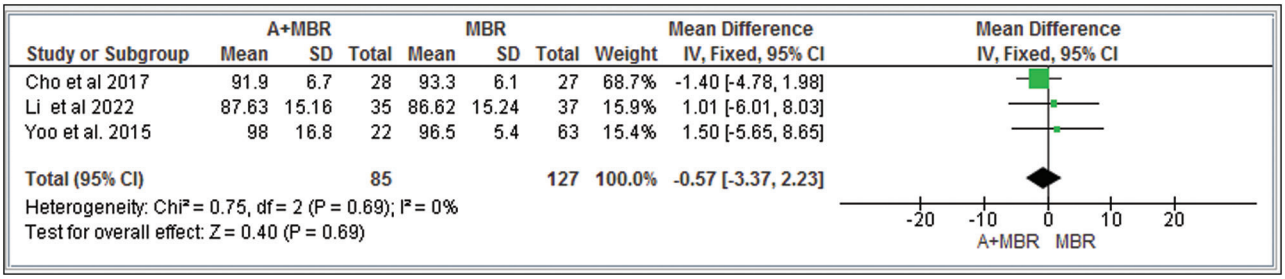
Study	Year	Study design	*N*	Groups, N	(M/F), N	Age, years Mean, SD\\ Range	Follow-up time, months Mean, SD\\Range	Journal
Cho *et al.* [8]	2017	RCT	55	A+MBR 28 MBR 27	(0/28) (0/27)	26.6 (16–40) 28.1 (17–39)	34.6 (24–45) 33.8 (24–44)	The journal of foot and ankle surgery
Xu *et al.* [9]	2019	Retrospective clinical study	53	A+MBR 25 MBR 28	NA	26.7 ± 17.8 28.1 ± 19.4	24	Orthopaedic Surgery journal
Yoo *et al.* [10]	2015	Retrospective clinical study	85	A+MBR 22 MBR 63	(22/0) (63/0)	23 (19–44)	7.4 (6–9)	Journal of orthopedics and traumatology
Kulwin *et al.* [11]	2021	RCT	119	A+MBR 60 MBR 59	(27/32) (13/46)	36.3 ± 15.5 41.4 ± 14.0	NA	Foot & Ankle International (FAI)
Li *et al.* [12]	2022	RCT	72	A+MBR 35 MBR 37	(22/0) (63/0)	31:2 ± 6:3 28:3 ± 5:7	27:5 ± 10:7 30:6 ± 9:4	BioMed Research International

A+MBR Internal ankle bracing augmentation with modified Broström procedure, MBR Modified Broström procedure; N, number; NA, not available; RCT, Randomized controlled trial.

Table 2 Summary of findings

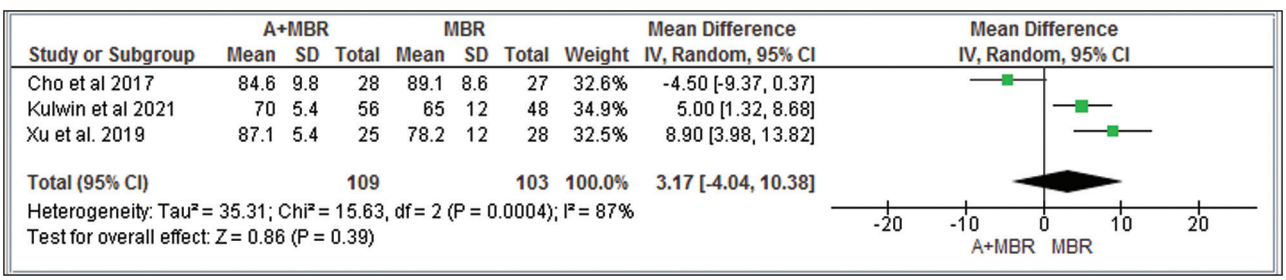
Study	Year	Findings
Cho *et al.* [8]	2017	For young female patients with chronic ankle instability, lateral ankle ligament augmentation using suture tape (ST) showed similar clinical results but lower cost-effectiveness than modified Broström repair.
Xu *et al.* [9]	2019	Further study is required, yet the modified Broström repair with augmentation employing a suture tap for chronic lateral ankle instability produces a superior result.
Yoo *et al.* [10]	2015	Patients who received an internal brace were able to pick up their activities and sports right away. We think this procedure could be a good surgical alternative for patients with persistent lateral ankle instability who need to return to activities and sports quickly
Kulwin *et al.* [11]	2021	According to the findings of this multicenter, prospective, randomized experiment, Suture tape augmentation speeds up return to preinjury level of activity more quickly than MB alone. Suture tape augmentation did not lead to an increase in problems or morbidity and may assist in effective accelerated recovery.
Li *et al.* [12]	2022	For the treatment of persistent lateral ankle instability, MBR with or without ST might produce positive effects. Combining with ST may be more efficient in promoting rehabilitation in the short run than the popular MBR.

Figure 2



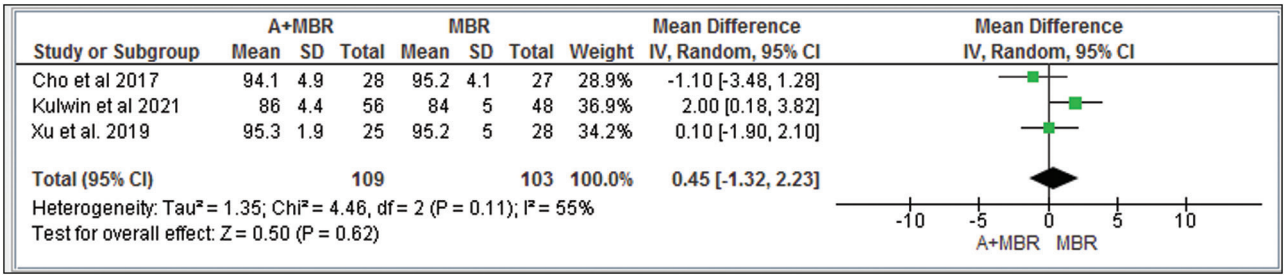
The meta-analysis results for A+MBR versus MBR group regarding FAOS. The vertical line denotes that there is no difference between the two treatment groups. Pooled odds ratios were calculated from fixed effects with the Mantel-Haenszel method.

Figure 3



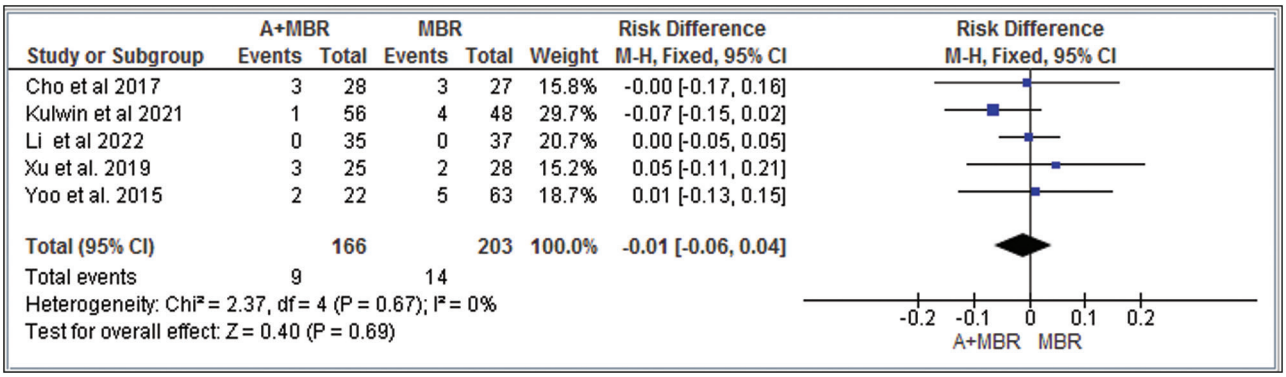
Results of meta-analysis for A+MBR versus MBR group regarding FAAM, sports activity scores. The vertical line denotes no difference between the two treatment groups. Pooled odds ratios were calculated from random effects with the Mantel-Haenszel method.

Figure 4



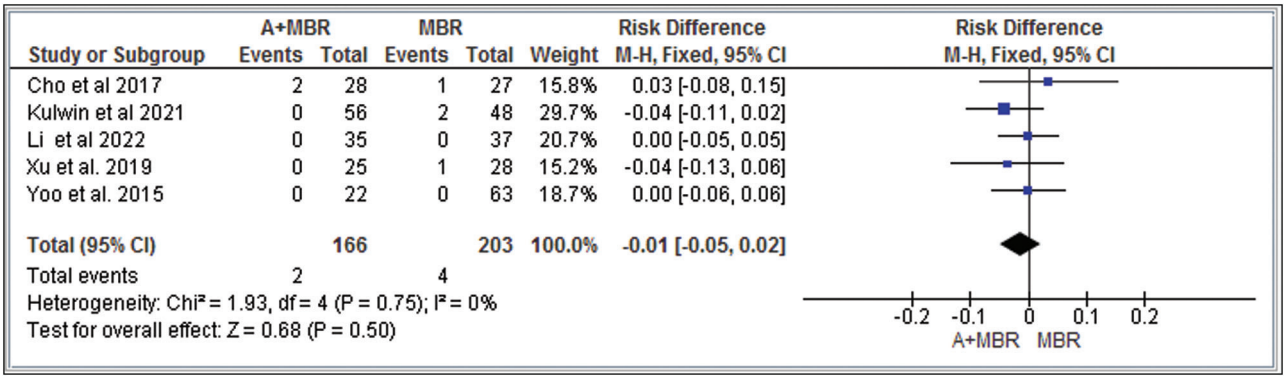
Result of meta-analysis for A+MBR versus MBR group regarding FAAM, Activities of daily living. The vertical line indicates that there is no difference between the two treatment groups. Pooled odds ratios were calculated from random effects with the Mantel-Haenszel method.

Figure 5



The Results of the meta-analysis for the A+MBR versus MBR group regarding overall complication, the vertical line indicates that there is no difference between the two treatment groups. Pooled odds ratios were calculated from fixed effects with the Mantel-Haenszel method.

Figure 6



Result of meta-analysis for A+MBR versus MBR group regarding recurrence of instability rates, the vertical line indicates no difference between the two treatment groups. Pooled odds ratios were calculated from fixed effects with the Mantel-Haenszel method.

groups (RD=−0.01, 95%CI = [−0.06, −0.04], I^2 =0%, *P* value =0.67) (Fig. 5).

Recurrence of instability rates

The rates of recurrence of instability showed no statistically significant difference between in both groups (RD= −0.01, 95%CI = [−0.05, 0.02], I^2 =0%, *P* value =0.75) (Fig. 6).

Discussion

This is a systematic review and meta-analysis comparing the modified Broström technique which is the most used technique for treating chronic lateral ankle instability versus the most recent technique, which is the internal ankle bracing, the latter is considered an augmentation of the modified Broström technique by using nonabsorbable sutures.

The hallmark outcome of this review is that there were no statistically significant differences regarding the clinical outcomes in both procedures. Complications were found to be the same in both techniques after treatment of Chronic lateral ankle instability. These findings are listed and concluded according to the five papers which are included in this systematic review.

According to the meta-analysis's findings, there is no difference between the two treatment groups in terms of the Foot and Ankle Outcome Score (FAOS), Foot and Ankle Ability Measure (FAAM), sports activity scores, and Activities of daily Living (ADL). The rates of instability recurrence and general complications also revealed no difference between the two treatment groups.

Wittig *et al*. performed a [13] systematic literature search using PubMed and Embase following PRISMA guidelines to compare the clinical outcomes and complication rates of both the modified Broström repair (MBR) technique and the suture tape augmentation. No major differences were detected between groups as regard FAAM sports activity scores, and FAAM activities of daily living. Additionally, Recurrence of instability tended to occur more frequently after modified Broström repair.

According to this systematic review and the studies that included Yoo *et al*. [10], Kulwin *et al*. [11] and Li *et al*. [12]. Internal bracing may help in early rehabilitation with no major difference between both groups as regard clinical outcome. According to Cho *et al*. [14] augmentation of the lateral ankle ligament with suture tape produced comparable clinical results to modified Broström repair performed alone.

Lewis and colleagues [15] conducted a systematic review discussing the use of suture tape augmentation to modified Broström repair and there was little proof that the modified Broström repair with suture tape augmentation produces superior functional results or lower recurrence rates.

Compared to modified Broström repair for patients with chronic ankle instability Yoo *et al*. [10], Kulwin *et al*. [11] and Li *et al*. [9] showed that combining modified Broström repair with inernal ankle bracing may be more efficient in promoting rehabilitation in early term.

Jain *et al*. [16] conducted a retrospective analysis study of patients with chronic lateral ankle instability who had a modified Broström repair with or without internal ankle bracing from November 2017 till October 2019. Satisfaction and return to preinjury activity were evaluated for all patients. They concluded that the use of internal brace augmentation with modified Broström repair has markedly better outcomes in early rehabilitation and return to preinjury activity level when compared to isolated MBR. The functional outcome was better in the internal brace group compared to the modified Broström group.

Similarly, in our systematic review according to Yoo *et al*. [10]. Patients who received an internal brace were able to pick up their activities and sports right away. We believe this technique could be a viable choice for surgically treating chronic lateral ankle instability in patients when an early return to activity and sports is required. Moreover, according to Kulwin *et al*. [11]. Suture tape augmentation enables earlier RTPAL (return to preinjury level of activity) than modified Broström alone, according to a prospective comparative study that was part of this systematic review. The successful faster rehabilitation that may be supported by suture tape augmentation did not lead to an increase in complications or morbidity.

The major limitations to the current work are the novelty of suture tape augmentation as a treatment option for Chronic lateral ankle instability and hence the scarcity of studies comparing it to the modified Broström repair, with only five studies included in total.

Additionally, all studies included a heterogeneous group of patients, and short follow-up periods, also there are only a limited number of studies that compare both techniques, as internal ankle bracing is considered to be a relatively novel procedure, and patients with ages between 16: 45 years were the main focus of all studies, although patients above 45 years also suffer from ankle instability and may need surgical interventions, return to sports was not calculated in all included studies, this study was till 2022 and we could not include the results of the studies that were done in 2023, only 3 studies from the 5 studies that we included are RCT.

Conclusion

According to the current meta-analysis there is no significant statistically difference between the two treatment groups regarding foot and ankle outcome score (FAOS), Foot and Ankle Ability Measure (FAAM), sports activity scores, Foot and Ankle Ability Measure (FAAM), and Activities of daily living.

Furthermore, there was no significant statistically difference between the two treatment groups regarding the recurrence of instability and overall complications.

So finally, Despite the anticipated mechanical stability for internal ankle bracing over modified Broström repair the current metanalysis did not show statistically significant superiority of the internal ankle bracing over the modified Broström repair

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Conflicts of interest
There is no conflict of interest.

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