Comparative study of the early functional outcome of anatomic reconstruction of chronic lateral ankle instability with polyester tape reinforcement versus anchor repair

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Purpose
This study aims to compare the early functional outcome of anatomic reconstruction of chronic lateral ankle instability with polyester tape reinforcement versus suture anchor repair.
Patients and Methods
Sixty patients suffering from chronic lateral ankle instability were included. Thirty patients were treated by anatomic reconstruction of the injured ligaments and reinforcement with polyester tape and the other half was treated by suture anchors in our institution with a minimum period of 6 months follow-up. The postoperative results were assessed according to the American Orthopedic Foot and Ankle Surgery (AOFAS) scoring system for hind-foot.
Results
AOFAS score is improved postoperatively in both techniques without statistically significant difference (P=0.084). The results of the two techniques were comparable without statistically significant difference regarding pain, walking distance, hindfoot motion, foot alignment, activity limitation and support requirement (P=0.602, 0.067, 0.582, 0.448, 0.606, respectively). All the studied cases returned to their original activity level.

Keywords:
Ankle instability, Polyester tape, Suture anchor

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Introduction

Injuries of the ankle ligaments are one of the most common injuries. They account for nearly 25% of all injuries of the musculoskeletal system [1]. Most acute ankle sprains recover with conservative management, while 20% develop mechanical or functional defects leading to chronic ankle instability (CAI). CAI can lead to early degenerative changes in the ankle because of the unbalanced loading on the medial side of the ankle [2].

Many researchers have reported a relationship between chronic lateral ankle instability and the development of degenerative changes and suggested that altered kinematics is a contributing factor to the development of osteoarthritis after lateral ankle ligament injuries [3].

Chronic lateral ankle instability is one of the most common conditions in foot and ankle surgery. It may occur as an isolated entity or in conjunction with other concomitant pathology, making it important to appropriately diagnose other conditions that may need to be addressed as part of treatment [4].

The anterior talofibular ligament (ATFL) ligament has an important role in the supination position in plantarflexion, calcaneofibular ligament (CFL) also is important for pronation in plantarflexion, and the posterior talofibular ligament is an important stabilizer in dorsiflexion. Highest strains were observed for the ATFL at maximal plantarflexion. The largest strain for the CFL was found at maximum dorsiflexion combined with maximum eversion [5].

Lateral collateral ligaments could be reconstructed using a polyester suture [6]. It is a nonabsorbable suture which is braided to improvise the knot security, coated with silicone to minimize tissue adhesion and of high tensile strength [7]. Anatomical ligament reconstruction for chronic lateral ankle instability using a variant of the Gould-modified Broström procedure with suture anchors is another method of treatment.

The aim of our work was to compare the early results of anatomic reconstruction of lateral collateral ankle ligaments with polyester tape reinforcement versus anchor repair in chronic lateral ankle instability.

Patients and methods

This was a retrospective comparative study that included patients with chronic lateral ankle instability in the period between 2021 and 2023. All patients gave written informed consent. The material of this study included 60 patients, who were suffering from chronic lateral ankle instability. Inclusion criteria included patients with more than 3 months of continued pain after a history of ankle sprain, sense of giving way or instability when walking on uneven ground or during sports activity, failure of conservative treatment for at least 3 months, postural standing varus deformity less than 5º (corrected by laying on examination table) and no associated lesions as impingement, osteochondral defects, or syndesmotic injuries. Exclusion criteria include patients with associated lesions (impingement, osteochondral defects, and syndesmotic injuries), fixed hindfoot varus deformity and cavovarus foot, generalized ligamentous laxity, peripheral neuropathy (diabetic neuropathy) and peripheral vascular disease (chronic ischemia).

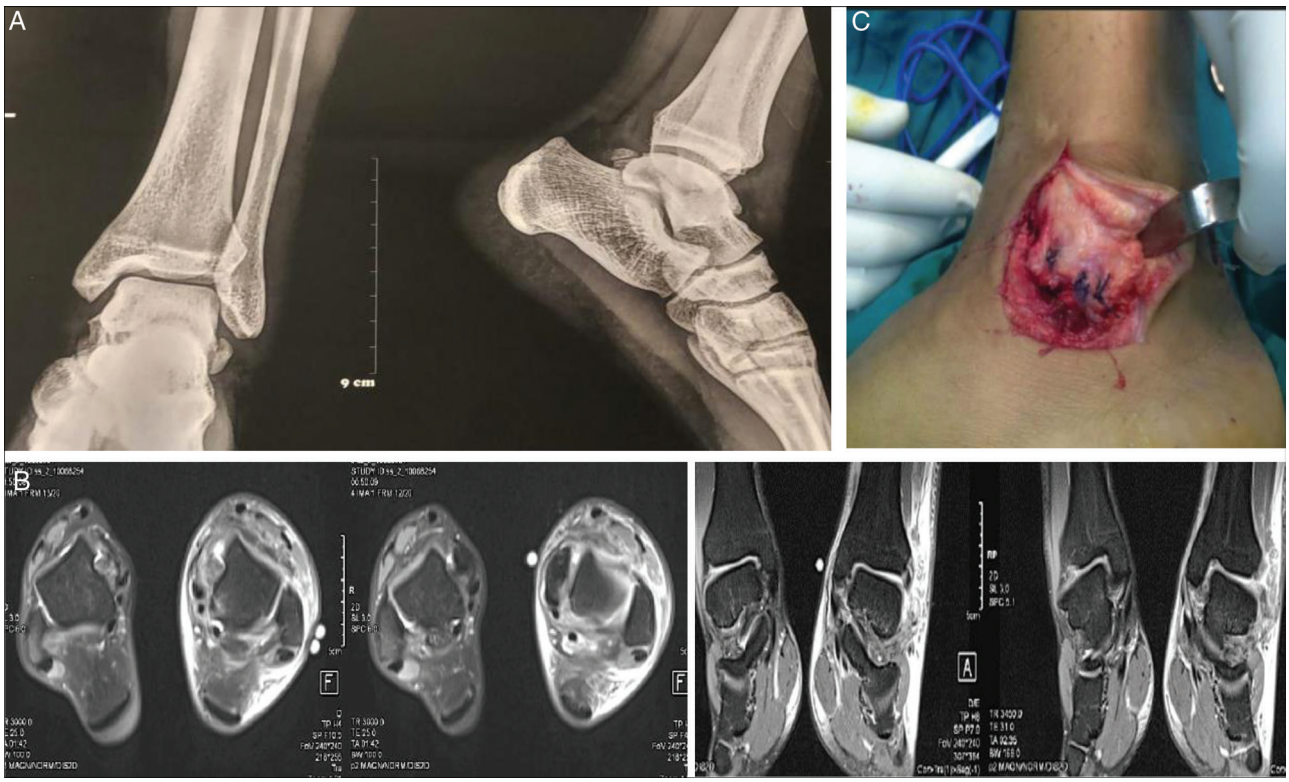
All patients had plain radiography (standard AP, lateral, and mortice views) and MRI of the ankle (to assess associated pathologies intra and/or extra- articular) done. Each patient was given scores according to American Orthopedic Foot and Ankle Surgery (AOFAS).

In this study, we used polyester tape to augment the anatomical reconstruction in 30 patients. The augmentation was in the form of an O figure, connecting from a drill hole over the distal fibula and the inferior extensor retinaculum. Thus, this technique allowed the protection of the anatomically reconstructed ligament (Fig. 1) [6]. After the operation, the ankle was secured in a hinged ankle brace with a full range of plantar and dorsiflexion allowed for the first 3 weeks under physiotherapy supervision with both isometric contraction exercise and weight bearing starting from postoperative day 1. At three weeks passive stretch exercises were allowed. At 6 weeks, weight-bearing without the brace was allowed. Heavy work and sports activity were allowed after 6 months.

In the other 30 patients, we used the suture anchor in the distal fibula at the site of attachment of the ATFL (Fig. 2). The remnants of the ATFL along with a capsular-periosteal flap were tied down to the suture anchor with the foot at neutral dorsiflexion and slight eversion. The extensor retinaculum was then repaired to the periosteum of the distal fibula to reinforce the repair [8]. Those patients were in a below-knee cast for 1 month followed by progressive rehabilitation under physiotherapy supervision.

The patients of the two groups had their sutures removed after 3 weeks (using a window in a cast in the suture anchor group) and were followed-up clinically to a minimum

Figure 1



(a) Preoperative radiography (b) Preoperative MRI (c) Intraoperative photo of a case with polyester tape.

Figure 2

(a) Preoperative radiography (b) Preoperative MRI (c) Intraoperative photo and postoperative radiography of a case with suture anchor repair.

period of 6 months. The postoperative results were assessed according to the AOFAS scoring system for hind-foot.

Statistical analysis

Categorical data are presented as percentage and continuous data as median (interquartile range [IQR]). Comparisons between categorical data were done by χ^2 test or Fisher's exact test, as appropriate. Mann–Whitney *U* test was used for continuous data. Reported *P* values are 2-sided and a *P* value less than 0.05 was considered statistically significant. The statistical analysis was performed using IBM SPSS Statistics 26 (IBM Corp, Armonk, NY, USA).

Results

Patient demographic data

The median age of the polyester tape group was 26 years (IQR 22–33) while it was 28.5 years (IQR 24 – 33) in the suture anchor group. Twenty-two patients were males in the polyester tape group and eight patients were females while 20 patients were males in the suture anchor group and 10 patients were females. Twenty-two patients of the polyester tape group had high demand work and eight patients had low demand work while 20 patients of the suture anchor group had high-demand work and 10 patients had low-demand work. The median duration of symptoms was 10.5 (IQR 8 –16.5) months in the polyester tape group and 11 months (IQR 7.75–21) in the suture anchor group (Table 1).

Preoperative assessment

The mean AOFAS score was 52 in both groups. Walking distance was 4 blocks in the polyester group while it was 3.5 blocks in the suture anchor group (8 blocks = 1 mile = 1.6 Km). Foot alignment was

Table 1 Baseline characteristics

	Polyester tape	Suture anchor	*P*
Age	26 (22–33)	28.5 (24–33)	0.407
Sex			
Female	8 (26.7)	10 (33.3)	0.573
Male	22 (73.3)	20 (66.7)	
Occupation			
High demand work	22 (73.3)	20 (66.7)	0.573
Low demand work	8 (26.7)	10 (33.3)	
Duration of symptoms (months)	10.5 (8–16.5)	11 (7.75–21)	0.271

Table 2 Preoperative assessment

	Polyester tape	Suture anchor	*P*
AOFAS	52 (50–54)	52 (51–54)	0.876
Walking distance (Blocks)	4 (3–4)	3.5 (2–4)	0.765
Foot alignment			
Fair (nonplantigrade foot, midfoot malalignment)	18 (60)	18 (60)	1
Good (plantigrade foot, midfoot well aligned)	12 (40)	12 (40)	
Walking on uneven surface			
Severe difficulty	24 (80)	23 (76.7)	0.745
Some difficulty	6 (20)	7 (23.3)	
Activity limitation and support requirement			
Limited activity/cane support	24 (80)	18 (60)	0.592
No limitations of daily activity, limitation of recreational activity, no support	6 (20)	12 (40)	

good in 12 patients and fair in 18 patients of the two groups. Twenty-four patients of the polyester group had severe difficulty in walking on uneven surface in comparison to 23 patients of the suture anchor group. Twenty-four patients had activity limitation and support requirements in the polyester tape group in comparison to 18 patients of the suture anchor group (Table 2).

Outcomes

The mean AOFAS score improved postoperatively in both groups with no statistically significant difference (*P*=0.084). It was 91 in the polyester tape group while it was 94 in the suture anchor group. Walking distance improved to 6 blocks in the polyester group and 6.5 blocks in the suture anchor group with no statistically significant difference (*P*=0.067). Foot alignment was good in 25 patients in the polyester group and 27 patients in the suture anchor group with no statistically significant difference (*P*=0.448). Hindfoot motion was normal or mildly restricted in 18 patients of the polyester group and 20 patients of the suture anchor group with no statistically significant difference (*P*=0.582). Twelve patients of the polyester group had no difficulty walking

Table 3 Outcomes

	Polyester tape	Suture anchor	*P*
AOFAS	91 (86.75–95)	94 (91.5–95.25)	0.084
Walking distance (Blocks)	6 (5–7.5)	6.5 (5–8)	0.067
Foot alignment			
Fair (nonplantigrade foot, midfoot malalignment)	5 (16.7)	3 (10)	0.448
Good (plantigrade foot, midfoot well aligned)	25 (83.3)	27 (90)	
Hindfoot motion			
Moderate restriction	12 (40)	10 (33.3)	0.582
Normal or mild restriction	18 (60)	20 (66.7)	
Walking on uneven surface			
No difficulty	12 (40)	14 (46.7)	0.602
Some difficulty	18 (60)	16 (53.3)	
Activity limitation and support requirement post			
No limitation or support requirement	14 (46.7)	16 (53.3)	0.606
No limitations of daily activity, limitation of recreational activity, no support	16 (53.3)	14 (46.7)	
Pain			
Mild	14 (46.7)	12 (40)	0.602
None	16 (53.3)	18 (60)	

on uneven surface if compared with 14 patients of the suture anchor group with no statistically significant difference (*P*=0.602). Fourteen patients of the polyester group had no activity limitation or support requirement if compared with16 patients of the suture anchor group with no statistically significant difference (*P*=0.606). Fourteen patients had mild pain and 16 patients had no pain in the polyester group if compared with 12 patients with mild pain and 18 patients without pain of the suture anchor group with no statistically significant difference (*P*=0.602) (Table 3).

Delayed wound healing occurred within 3 weeks in 1 case of those with suture anchors. One case had superficial peroneal neuritis due to the anterolateral arthroscopic portal in each group of cases that resolved after 6 weeks with medical treatment.

Discussion

CAI is the perception of an abnormal ankle by a patient with symptoms including recurrent sprains, pain, swelling, and avoidance of activities. It is generally classified into two components: mechanical instability and functional instability [9].

MRI is more useful in the setting of CAI than in the acute setting. Ligament injury can be seen on MRI as swelling, discontinuity of fibers, a lax or wavy ligament, or non-visualization [10].

Management for CAI includes both functional strategies and surgical reconstructions. In the functional strategy group, a graded exercise regimen is recommended to reduce risks of recurrent ankle sprains using proprioceptive, stretching, and strengthening exercises [11].

Indications for lateral ligamentous reconstruction include persistent symptomatic mechanical instability and failed functional rehabilitation [12].

Trials have been studied to compare surgical and non-operative treatment. It showed statistically significant differences in favor of the surgical treatment for return to pre-injury level of sports; ankle sprain recurrence; long-term pain; and subjective or functional instability [13].

Over 80 surgical procedures have been described for chronic lateral ankle instability and these can be divided into three categories: anatomic repair, nonanatomic or checkrein reconstruction, and anatomic reconstruction. Anatomic techniques consist of direct repair of injured ligaments with the use of local tissue, or ligaments reconstruction using a free tendon graft [14].

The most common and time-tested anatomical repair is the Broström technique. The original procedure involved mid-substance imbrication and suture of the ruptured ends of the ligament. Gould and Seligson augmented the Broström repair with the mobilized lateral portion of the extensor retinaculum, attached to the fibula after imbrication of the ATFL and the CFL [15].

Our results in the polyester tape reinforcement group were comparable to the study held by Cho *et al.* which was conducted on 34 young female patients in which 31 (91.2%) cases achieved satisfactory functional results, but 1 case had chronic inflammation [16]. In our study, 1 case had superficial peroneal neuritis.

Polyester tape reinforcement has the advantage of avoiding the associated morbidity of using tendon autografts and the cost and risk associated with using tendon allografts. Also, the outcome is like the reported outcome of using the Internal Brace Ligament Augmentation Repair in the review study by Coetzee *et al.* [17].

Our results in the suture anchor group were comparable to the study held by Nuno *et al.* which was conducted on 31 patients but only 28 patients showed in follow-up in which their average AOFAS score was 85.3 but in their study, three patients had delayed wound healing of the anterolateral portal with some discharge which was successfully treated with conservative measures. Two of these patients complained of some tenderness on the scar. Three patients had some numbness of the superficial peroneal nerve. One patient had deep venous thrombosis which was treated with low molecular weight heparin and rest [18]. In our study, 1 case had delayed wound healing, and another had superficial peroneal neuritis.

Cho *et al.* [19] compared the transosseous fixation of ligaments with suture anchors. There were no significant differences in the clinical and functional outcomes between the two techniques for ligament reattachment.

Cho *et al.* [19] with respect to the surgical technique using the transosseous suture, the fibular periosteum should be dissected to a greater extent. When making multiple drill holes in the fibula for the bone tunnels, fractures of the cortical bone were commonly experienced; thus, the ligament tissue could not be reattached to the anatomically accurate position in three of the 20 cases in the trans osseous suture group.

The good functional outcome in this study, which was evaluated according to the AOFAS, is attributed to the correct diagnosis of the patients and the restoration of the ligament's anatomy and biomechanics. AOFAS score is improved postoperatively in both techniques without statistically significant difference (P=0.084).

In this research, there were no complications faced with patients regarding wound healing, infection, pain, and residual instability and nerve injury. All the studied cases returned to their original activity level. The minimum period for follow-up was 6 months.

The results of the two techniques were comparable without statistically significant differences regarding pain, walking distance, hindfoot motion, foot alignment, activity limitation, and support requirement (P= 0.602, 0.067, 0.582, 0.448, 0.606, respectively).

Being a comparative study between two famous techniques adds to the strength of this study. On the other hand, the small number of cases included, and the short follow-up period are the main limitations of this study.

The future of research in this topic will be on more advances in all arthroscopic techniques of ankle surgeries as well as the use of absorbable materials.

Conclusion

Failure of conservative treatment for ankle sprains is the only indication for operative treatment. The results of using polyester tape in form of a figure of O augmentation to the anatomic reconstructed ligaments or the use of suture anchor are comparable with good functional outcome. Early postoperative rehabilitation has a sound effect on the results.

Ethical approval

Ethical approval has been granted from the Ethical Committee of Alexandria University

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Nil.

Conflicts of interest

There are no conflicts of interest.

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