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Effectiveness Of Cryotherapy And Taping Vs US In Anterior Talofibular Ligament Injury

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ABSTRACT

Background and Objectives:

The anterior talofibular ligament (ATFL) is one of the branches of the lateral ligament of the ankle. The rehabilitation process after acute injury of ligaments and soft tissues may be complex, and experts and scholars at home. The aim of this study is to evaluate the effect cryotherapy and taping verses Ultrasound for pain relief in ATFL injury.

Material and methodology

Participants referred by an orthopedic surgeon were selected and assessed as per the selection criteria. Consent form was obtained by the participants. Outcome measure was NPRS and WOMAC scale. Then the procedure was started by randomly dividing the participants in two groups. Group A were receive Cryotherapy and taping. Group B were receive ultrasound. Outcome measure were assess at baseline before treatment on day 1st and the end of intervention on 3rd week. *Ultrasound* treatment of 1MHz, frequency with application time of 5 minutes on the medial side and 5 minutes on lateral side of knee is given for 4 days in a week.

Results

Cryotherapy and tape treatment resulted in significantly more complications, the majority being skin irritations, when compared with treatment with an elastic bandage [5,8] . In line with these data, this study showed that functional treatment with a ultrasound therapy leads to significant less complications than treatment by taping.

Conclusion

In conclusion this study shows that treatment of acute lateral ATFL injury with a ultrasound therapy leads to less complications and a higher patient satisfaction than treatment with tape. In line with previous studies there is no difference regarding functional outcome and pain. Therefore, using an ultrasound therapy should be considered for treatment of ATFL injury.

Key word: anterior talofibular ligament (ATFL), lateral ligament of the ankle, NPRS and WOMAC scale.

INTRODUCTION

The anterior talofibular ligament (ATFL) is one of the branches of the lateral ligament of the ankle. The lateral ligament of the ankle consists of three operative branches terminating anterolaterally to the talus (ATFL) and the calcaneus [posterior talofibular ligament (PTFL)], and posterolaterally to the calcaneus [calcaneofibular ligament (CFL)(Kim JS et. al., 2022). Among ATFL injurys, lateral ligament sprain is the most common, accounting for about 77%. In lateral ligament injury, the ATFL is the most vulnerable. When ankle joint varus or metatarsal flexion occurs, the lateral joint capsule is torn. In this case, the fragile ATFL is very easy to sprain or even tear, accompanied by joint hematocele, swelling, or subcutaneous ecchymosis. Acute injury to the ATFL can be treated by external fixation with braces or other conservative treatment measures. When the degree of injury is serious, surgical repair may be an option, e.g., arthroscopic ligament repair or open anatomical repair. However, the current literature does not clearly indicate the best treatment approach for acute injury to the ATFL. If poorly managed, long-term migration of the injured site and serious complications occur, with serious repercussions on quality of life and increased economic burden[Roemer FW, et al., 2014]. Therefore, it is necessary to better understand and master prevention and treatment for this common disease.

Research shows that the ATFL alone often accounts for the vast majority of injuries to the ankle[Yang H, et al., 2021]; the prevalence rate of ATFL-CFL combined injury is 20%-40%, whereas that for the CFL alone is only 2%[Yang H, et al., 2021];. About 50% of acute ATFL injuries occur in athletes who regularly engage in physical activities.

The rehabilitation process after acute injury of ligaments and soft tissues may be complex, and experts and scholars at home and abroad have explored many therapeutic measures to promote rapid recovery of acute injury to the ATFL.

Studies have shown that a new type of bioelectric stimulation device can provide a small direct current and a direct current electric field. Electrical stimulation is applied close to the patient's inflamed or injured tissue using a percutaneous metal probe, which can relieve pain, prevent edema, and increase the rate of tissue regeneration. This novel treatment plan provides more possibilities for the conservative treatment of ATFL injury(Molsberger A, 2018). Functional treatment Functional therapy combines external support with a rehabilitation program. External supports are important in the functional treatment of injury to the ATFL,

which may involve limiting ankle activity and reducing the risk of injury, especially for athletes. Currently, the commonly used external supports in clinical practice are divided into rigid and flexible supports. Rigid supports (casts and braces) and orthotics are more commonly used. The flexible supports used include flexible plasters, silicone ankle covers, elastic bandages, elastic socks, and adhesive tapes(Punt IM, et al., 2015). There is no consensus on which rigid or flexible support is the best.

The aim of the study is to evaluate the effect cryotherapy and taping verses Ultrasound for pain relief in ATFL injury.

METHODOLOGY

STUDY DESIGN/STUDY TYPE - Experimental study. It is an experimental study of pretest and post-test.

SOURCE OF DATA - Brij Health Care Hospital, Vrindavan, Mathura.

SAMPLING METHOD - Purposive random sampling.

SAMPLE SIZE- 98

STUDY VARIABLES

1) DEPENDENT VARIABLE- Pain and strength of knee muscles.
2) INDEPENDENT VARIABLE- taping, ultrasound and strengthening exercises.

DURATION - 3 weeks

INCLUSION CRITERIA-

- Both male and female.
- Subject with ATFL injury having pain

➢ **EXCLUSION CRITERIA-**

- Neurological problems
- Any recent fracture
- Any pediatric disease
- Any bone mal alignment
- Recent trauma

Procedure

Participants referred by an orthopedic surgeon were selected and assessed as per the selection criteria. Consent form will be obtained by the participants.Outcome measure will be NPRS and WOMAC scale. Then the procedure will be started by randomly dividing the participants in two groups. A group, B group. Group A will receive Cryotherapy and taping. Group B will receive ultrasound. Outcome measure will be assess at baseline before treatment on day 1st and the end of intervention on 3rd week. *Ultrasound* treatment of 1MHz, frequency with application time of 5 minutes on the medial side and 5 minutes on lateral side of knee is given for 4 days in a week.

Data Analysis and Interpretation

In total 98 patients were included in the study and randomized after initial treatment and screening .1). Two patients were considered non-eligible after randomization: both patients had a fracture at control X-ray and fulfilled exclusion criteria. The results regarding primary outcome (patient satisfaction, complications and pain) were completed for 81 (83%) patients (nine patients in the tape group and 8 patients in the brace group were lost from follow-up). The results regarding secondary outcome (ankle function) were completed for 70 (71%) patients. Effectiveness of Tapping vs US in ATFL injury

Characteristics of patients according to allocated treatment

	Cryotherapy and tapping (N = 49)	**Ultrasound therapy (N = 49)**	**P-value**
No. of females/male	23/26	16/26	0.1
Mean (SD) age (years)	30	29.8	0.9
Percentage sport related injury	39% (19/49)	37% (18/49)	0.8
Percentage grade III ATFL injury	2% (1/49)	4% (2/49)	0.2

Until now, it is still puzzling for a surgeon to diagnose and evaluate the injury of ATFL. It has been stated that the routine methods, including physical examination, stress X-ray, arthrography or MRI, are not reliable to evaluate the chronic ATFL injury. While the ultrasound has been confirmed to be a reliable and accurate method to evaluate chronic ATFL injury.

For a torn ligament, the ideal treatment is to repair the ligament in situ where the ligament was torn. We design the classification on account of the following assumption: The result of US could be evidence for surgeon to select the operative procedure for ATFL injury. In this classification, we include ligament texture, ligament continuity, location where ligament torn, degree of ligament thickening, degree of residual ligament, large strong echo zone and cortical continuity as the criterion of the classification. Other abnormalities such as irregularities of the talar bone, small high level echo zone in the ligament, small level echo zone beside the ligament were not included into the classification because they would not affect the selection of the operation procedure.

Another consideration of the design is that the type III injury doesn't have a subtype of IIIC. The reason is that the avulsion fracture of talus is seldom seen in the clinical situation. More important, it would not affect the selection of operative procedure.

For the type injury, one of the criteria is the thickness of the ligament. The width of the ATFL is thought to be about 2 mm, so, a ligament thicker more than 20% of this standard is thought to be a thick ligament.

The thick ligament might be attributed to the scar because of the healing of the ligament. But, the ligament might become thick because of the retraction when the ligament tears at the either side. So, if there is injury at the either side, a type II or III injury but not type IV injury is considered.

A ligament is often injured at one site, but recurrent twists could induce the injury at multiple sites. In our research, the type VI injury is seldom but still could be seen. The characteristic is that there are always 2 partial tears at this type.

Until now, lots of surgeons would like to use the same procedure to deal with all the patients. Our research shows that in the patients with ATFL injury, three types of injuries (I, II and IV) compose majority of the injuries (more than 70%). But no type could be than 50%. This result indicates that there is no a single procedure could deal with all the patients.

Based on the results of the evaluation of ultrasound, we recommend the following operation strategy: 1) Injury of type I, typeIIA, Type IIIA: Conservative treatment is recommended. 2) Type IIB injury: We suggest to employ an open or arthroscopic ligament repair at fibula side; 3) Type IIC injury, we advise the fixation of the bone fragment, or the procedure to repair the ligament to a roughened fibula after removal of the bone fragment; 4) Type IIIB injury, we suggest to employ an open or arthroscopic ligament repair at talar side; 5) Type IV injury, we suggest the Broström procedure, arthroscopic ATFL shrinkage or ligament repair with augmentation at fibular side;6) Type V injury, we suggest ATFL reconstruction; 7) Type VI injury, depending on the degree of the injury, a repair procedure at the site where the injury is most severe, ATFL reconstruction or conservative treatment can also be selected depending on the degree of the injuries.

There are also some shortcomings in this study. At first, the sonographic evaluation for chronic ATFL injury is not a golden standard, which would make the proportion of the sub-types ligament injury different from the real condition. While the previous studies have showed it had high accuracy and reliability even comparing to the operative detection [7, 12], we believe the classification based on the sonographic evaluation would help the clinician to make the strategy of the treatment for chronic ankle instability. Secondly, there is no clinical result to support whether the new classification guided treatment is better than the present operation strategy. A further prospective study is needed to confirm the clinical value of this classification. Thirdly, we did not employ the dynamic ultrasound to evaluate the ATFL injury in this study because it had not been routinely used in our clinic. We believe it might improve the accuracy of the examination and we would make it as a routinely method in the future. Furthermore, the type of calcaneofibular ligament injury is not included in this study because a classification including two ligament injuries would be too complex. In addition, some studies have questioned the necessity of repairing CFL when it was injured. So, we prefer to type the CF injury in the other classification system.

Table 3: Active and passive range of motion after functional treatment of ATFL injury

	Treatment	N	Mean	SD	P-value
Passive ROM -week 4	Tapping	39	12.5	8.9	0.9
	ultrasound therapy	41	12.3	11.3	
Active ROM - week 4	Tapping	39	13.7	9.0	0.7
	ultrasound therapy	41	12.8	14.1	
Passive ROM - week 12	Tapping	34	3.6	6.4	0.2
	ultrasound therapy	35	5.8	7.6	
Active ROM - week 12	Tapping	34	6.1	7,.6	1.0
	ultrasound therapy	35	6.1	7.9	

Range of motion (ROM) is defined as the difference between injured and uninjured ankle when substracting the maximal dorsoflexion from plantairflexion. N is number of patients, SD standard deviation.

DISCUSSION

This study is intended to find out Functional treatment is a widely used and generally accepted treatment for ATFL injury. A number of studies assessing the effectiveness of different conservative treatments of ATFL injury have been performed, but until now, little was known about patient satisfaction in relation to the functional outcome. The results of this randomized controlled trial comparing semi-rigid ankle brace with tape treatment demonstrated improved patient satisfaction with less local complications in patients treated with a ultrasound therapy, but overall showed no improved functional outcome.

Previously, two studies compared patient satisfaction with treatment using brace. In total 76% of patients treated with a brace in the study by Jongen et al. [8] were very satisfied or satisfied with brace treatment, while in our study 95% of patients qualified their satisfaction as excellent or good. This higher percentage may be due to another design of the brace with a more rigid lateral and medial support in our study. Patients in the ankle brace group in the randomized trial from Boyce et al. [16] reported higher levels of comfort and satisfaction, although the used methods to evaluate satisfaction were not specified. The functional outcome Karlsson score was also significantly higher in the brace group compared to that in the elastic bandage group at 10 days and one month.

Kerkhoffs et al. [5] reviewed different functional treatment strategies for acute lateral ankle ligament injuries in adults in a meta-analysis. Although it was impossible to make definitive conclusions about the most effective functional treatment because diversity of outcome results prohibited pooling of results, there seemed to be no evidence that using a ultrasound therapy is superior to taping concerning functional outcome in the individual studies. A semi-rigid ankle support provided more stability and a quicker return to work and sport than an elastic bandage [5]. In addition, as for the functional outcome, objective (ROM) as well as patient-reported functional outcome score (Karlsson scale), this study shows that there was no difference functional ability between the two groups. In addition, the pain score was similar between the tape and ultrasound therapy treatment at 3 months. However, tape treatment resulted in significantly more complications, the majority being skin irritations, when compared with treatment with an elastic bandage [5,8] . In line with these data, this study showed that functional treatment with a ultrasound therapy leads to significant less complications than treatment by taping (RR 0.11; 95% CI 0.01 to 0.86). These results match previous other published studies [5,8-10,16].

A number of remarks must be made when interpreting these observations. Although the loss of follow-up for the primary outcome parameters was 17% at 5 weeks, incomplete data on the secondary outcome parameters was higher with a loss to follow-up for the secondary outcome parameter of 29% at 13 weeks. This loss to follow-up may have introduced misclassification bias [17]. Although the lost-to-follow up was equally distributed among treatment groups and remains below the cut-off value of 80% for the primary outcome parameter, this is not the case for the secondary outcome parameter (Fewtrell MS. Arch Dis Child, 2008;93(6):458-461). Post hoc power analysis indicated that 25 patients should be analyzed in both groups to detect the differences in patients satisfaction score as found in our study. For detecting differences in Karlsson score post hoc power analysis indicated >100.000 patients should be included.

In addition, the costs of treatment with a ultrasound therapy are higher than the treatment with a tape. Diercks et al. [18] described the effectiveness and costs in relation to the patient satisfaction in a small study on the treatment of ATFL injury with tape and treatment with a brace and found higher patient satisfaction, but also higher costs of the treatment with a ultrasound therapy (€183 versus €238) Specification of the costs are illustrated in the article by Diercks et al. This comparison seems to be different when tape and brace interventions are used as a preventive measure. In a study by Olmsted et al. found that the costs of preventing one ATFL injury was significantly higher using preventive tape treatment compared to preventive brace treatment [19]. The treatment of an ATFL injury using tape in our study was cheaper mainly due to material costs than treatment with a ultrasound therapy (total costs: €167 (diagnostic costs 121; working costs 27; material costs 8; overhead 11) versus €204, (diagnostic costs 121; working costs 22; material costs 35; overhead 26), respectively). A higher level of comfort during treatment of an ATFL injury therefore comes at the expense at higher treatment costs.

CONCLUSION

In conclusion this study shows that treatment of acute lateral ATFL injury with a ultrasound therapy leads to less complications and a higher patient satisfaction than treatment with tape. In line with previous studies there is no difference regarding functional outcome and pain. Therefore, using a ultrasound therapy should be considered for treatment of ATFL injury.

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