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Clinical Outcomes of the Open Modified Brostrom Procedure with Internal Brace Augmentation for Lateral Ankle Instability

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Abstract

Background: Lateral ankle instability is a common problem in professional athletes. Treatment preferred by most surgeons is to perform an open modified Brostrom procedure with internal brace augmentation. Literature shows good to excellent results.

Aim: To evaluate the clinical outcomes of the open modified Brostrom procedure with an internal brace augmentation in patients with Lateral ankle instability.

Methods: We studied the patients operated for lateral ankle instability between August 2015 and August 2017, 62 feet of 62 patients were treated with modified Brostrom procedure with internal brace. All outcomes were examined using NOFA Score (NOFAS).

Conclusion: In conclusion, these results suggest that the Modified Brostrom Procedure with Internal Brace augmentation for Lateral Ankle Instability is very effective. It helped to relieve pain, regaining ankle stability, quality of life, and ability to perform daily activities including sports.

Keywords: Neuromuscular; Lateral ankle instability; Surgery; Brostrom repair

Introduction

Sprains in the ankle joint are very common in recreational and professional athletes, comprising 14 to 23% of all sports related injuries [1,2]. The majority of these (almost 80%) are caused by an inversion mechanism [1]. Due to this, the lateral ankle ligaments are commonly injured. Injury to the anterior talofibular ligament (ATFL) being the most common [3]. In more severe sprains, injury to ATFL may be associated with injury to the calcaneofibular ligament (CFL) [4,5].

Non-operative treatment, that includes icing, limb elevation, rest and early weight-bearing with protective bracing, results in good clinical outcomes in many patients with acute ankle sprain [6-8]. However, up to 40% [2,9-11] of patients suffering from lateral ankle sprain report that they continue to have symptoms including pain, instability, recurrent sprains, minor swelling and proprioceptive deficits despite appropriate conservative treatment [6]. In addition to the above symptoms, chances of developing early-onset osteoarthritis are more in patients with lateral ankle instability [12].

There are various foot and ankle outcome scoring systems that have been used to evaluate the post-operative results. Good to excellent clinical results have been reported in 85 to 100% of patients undergoing anatomic lateral ligament reconstruction [13-15]. Broström described one of these repair procedures in the year 1966 which involved the direct repair of the lateral ankle ligaments [16]. Gould et al. [17] suggested and reported a modification of this anatomic reconstruction consisting of mobilization and reattachment of the extensor retinaculum to augment the repair. An internal brace is used to augment ligament repair. It comes from a ligament repair bridging concept, using braided ultra-high-molecular-weight polyethylene/polyester suture tape and knotless bone anchors to reinforce ligament strength as a secondary stabilizer after repair and return to sports. This additional reinforcement may help resist injury recurrence [18].

The purpose of this study was to evaluate the clinical outcomes of the modified Brostrom operation with an internal brace augmentation for ankle reconstruction in patients with lateral ankle instability.

Methods

We evaluated the 62 feet of 62 patients operated for lateral ankle instability using modified brostrom procedure with internal brace augmentation between August 2015 and August 2017. All patients were informed about the non-operative and operative options for lateral ankle instability and they preferred to undergo surgical procedure to stabilize their ankle. Informed and written consent was obtained from all patients.

Inclusion criteria included more than grade II mechanical laxity on the clinical examination and positive anterior drawer test and more than 2 episodes of functional instability (giving way) of the ankle. All patients included in our study were not improving after the trial of conservative therapy such as rest, bracing, anti-inflammatory drugs, proprioceptive training, ankle ROM exercises, and physical therapy for at least 6 months.

Exclusion of those patients from the study that had systemic diseases, neuromuscular disorders, obesity and anatomic deformities combined osteochondral lesion of the talus and previous surgery on the affected ankle.

All statistical analyses were performed using responses to the NOFA Questionnaire [19] post-surgery and scores were calculated. Microsoft excel was used to compile responses and pivot table was used to tabulate data. Descriptive statistics was used in the form of mean, SD or range.

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Surgical Technique

The patient was placed in a supine position on the operating table. Spinal anesthesia was administered (Figure 1). To elevate the foot a few inches off the operating table, a well-padded thigh tourniquet was applied, and a thigh holder was positioned. Before initiating the procedure, the distal fibula, the course of the peroneal tendons, the superficial peroneal nerve, the anterior talofibular ligament and the inferior retinaculum were outlined with a surgical marker.

Standard approach was used to a Brostrom repair to help augment the repair of the native ATFL ligament. Landmarks on the distal fibula were found along with the non-articulating ridge of the talus, while the foot was in neutral position with slight eversion. The talar attachment to the ATFL was distal and anterior to the articular surface of the talus in line with the tip of the fibula. 3.4 mm drill was drilled into the non-articulating surface of the talus in line with the superior ATFL directed 45 degrees posteromedially with respect to the lateral border of the foot. The talar tunnel was tapped down using the 4.75 mm SwiveLock Tap (Figure 1a). The 4.75 mm SwiveLock loaded with FiberTape was placed into the talar hole (Figure 1b). The driver was turned clockwise while the black paddle on the screwdriver was held stationary. The black line on the driver was to be buried into the bone with caution since incomplete tapping of the talar hole may compromise anchor fixation.

Next, a hole with the 3.4 mm drill was drilled in the fibula, angled slightly proximally, in line with the lateral border of the foot (Figure 1c). The hole was tapped with a 4.7 mm tap for at least two turns to breach the fibular cortex (Figure 1d). Both limbs of the FiberTape which are anchored to talus were passed through the eyelet of the 4.75 mm SwiveLock and the anchor was inserted (Figure 1e). The SwiveLock was then inserted into fibular tunnel with care since this occasionally requires a gentle tap with a mallet and to avoid over-tensioning, a small curved hemostat should be placed between FiberTape and fibula while inserting SwiveLock. The remnant FiberTape tails are cut with FiberWire Scissors, after final anchor placement is correctly inserted. Suturing of the inferior extensor retinaculum to fibula or capsule was then completed (Figure 1f).

Postoperative Rehabilitation Protocol

Postoperatively, a compression bandage was applied and progressive weight-bearing in a cam boot along with walker was allowed. During first postoperative visit at 2 weeks, physical therapy including proprioceptive training and ankle range of motion exercises are started, avoiding inversion movement. At week 6, the cam boot is removed and straight inline running allowed. Return to high-contact sports (soccer and basketball) were allowed after 6 to 8 week mark depending on patient recovery.

Results

62 feet of 62 patients were evaluated for their post-operative clinical outcome. There were 22 male and 40 female patients with a mean age of 41.94 years (Range, 16-66 years). 21 patients were affected on the Left side and 41 patients were affected on the Right side. The surgical time ranged from 45 to 60 minutes, with the mean operating time of 50 minutes from skin to skin. There were no intra-operative complications or difficulties encountered for any patient by the operating surgeon.

We analysed post-operative progress of patients using NOFA Score and found the average score of all patients to be 73.81 which falls under the good category of NOFA Score (Table 1). 53 out of a total of 62 Patients stated that undergoing this ankle reconstruction procedure

Figure 1(a): The talar tunnel was tapped down using the 4.75 mm SwiveLock Tap.

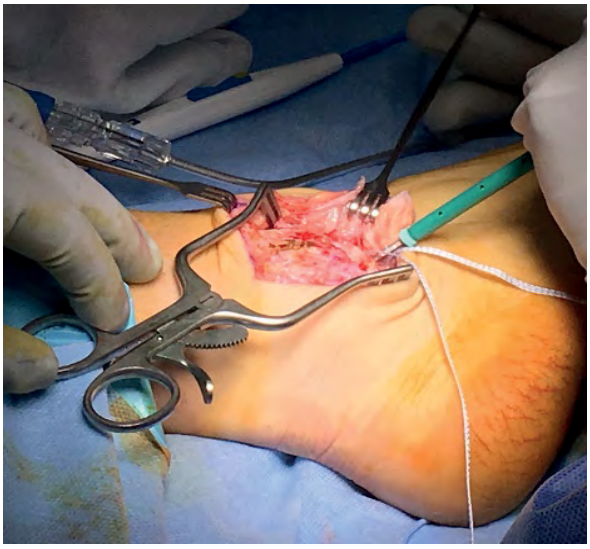

Figure 1(b): The 4.75 mm SwiveLock loaded with FiberTape was placed into the talar hole.

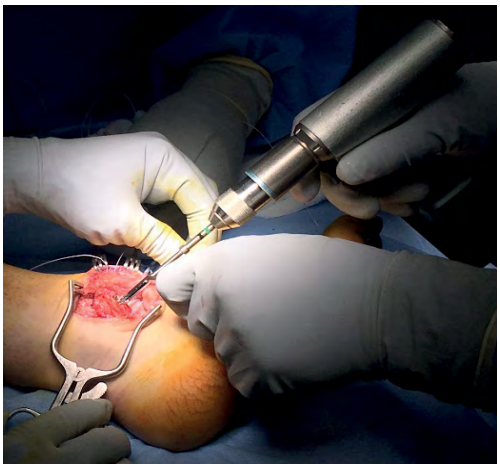

Figure 1(c): Hole with the 3.4 mm drill was drilled in the fibula.

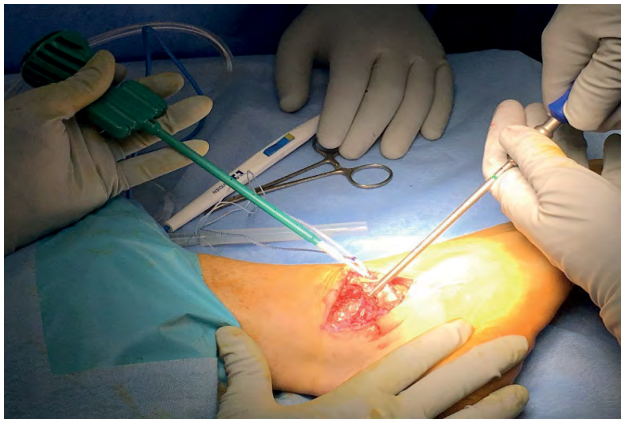

Figure 1(d): The hole was tapped with a 4.7 mm tap for at least two turns to breach the fibular cortex.

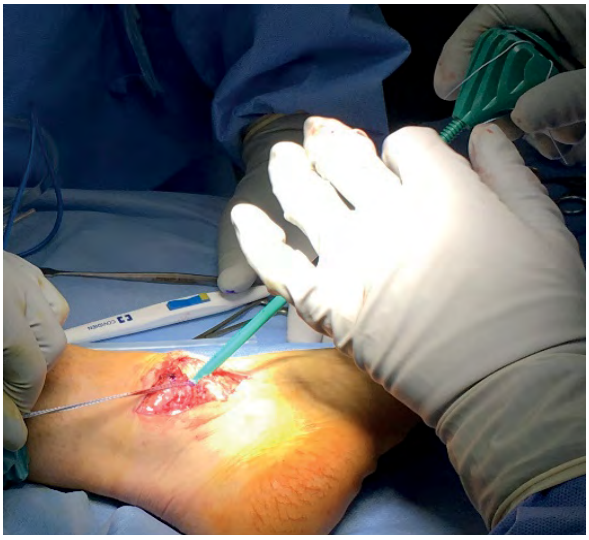

Figure 1(e): FiberTape which are anchored to talus were passed through the eyelet of the 4.75 mm SwiveLock and the anchor was inserted.

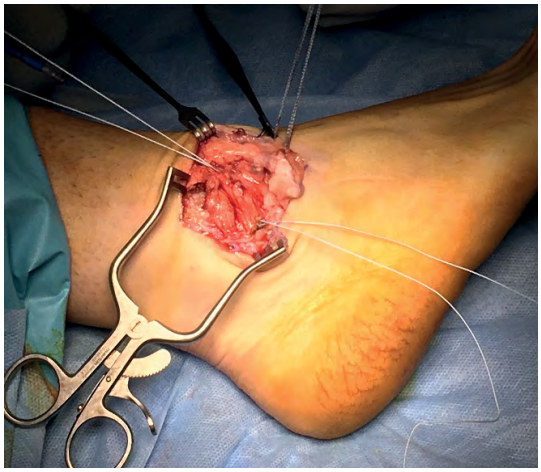

Figure 1(f): Suturing of the inferior extensor retinaculum to fibula or capsule.

had helped them in improving stability, quality of life, ability to perform sporting activities and relieved most of their symptoms. The main reason for fair result in 12 patients was only due to some remaining apprehension, especially on rough ground. However, there was no giving way or pain which distracted them from any activities. Detailed analysis of the 9 out of 62 patients falling under poor category reflected that the main reason for their discomfort being intermittent pain and swelling. None of our patients developed any infection or required any revision procedure.

While analysing the reasons for the poor NOFA Score of the 9 out of 62 patients we found, four of them were having discomfort and poor outcome because they had rolled their ankle again after surgery, leading to a re-injury. 1 male patient aged 59 years was having signs of ankle arthritis which may be secondary to the neglected lateral ankle instability. Rest four patients complained of swelling and pain most times which most probably can be due to complex regional pain syndrome post-surgery. It is also noticeable that all of these 9 patients were under the age bracket of 51 to 61 years, with an average age of 55.6 ± 4.16 years which may point towards the associated changes of age related degeneration of ankle/subtalar joint or atrophied ligaments/tendons as the cause for poor outcome.

Discussion

Literature has recognized the presence of altered mechanics in ankles with lateral ankle instability as compared to normal ankles [20,21]. While some of these injuries can resolve with non-operative care, numerous surgical procedures have been proposed in an effort to restore normal ankle function after lateral ankle instability [22]. Majority surgeons prefer to perform an open modified Brostrom procedure for the treatment of lateral ankle instability since good-to-excellent results have been reported in the literature [23].

A study done by Konradsen et al. [24] showed that 80% of their patients with lateral ankle ligament injuries improved when treated with a course of supervised rehabilitation specifically aimed at proprioceptive and strength training with a 7-year follow-up. Plenty of literature that backs this, hence, for our study we considered only those patients for surgery that had no improvement after the trial of conservative treatment for 6 months or more. Further, to support our decision for surgery, even a recent meta-analysis of 12 clinical trials and 2562 patients with lateral ankle ligament complex injuries comparing surgical versus conservative management showed statistically significant differences in favour of surgical treatment in 4 areas: return to preinjury level of sports, recurrence, chronic pain, and subjective or functional instability [25]. This same meta-analysis also showed good to excellent results in 90% to 95% of patients with lateral ankle reconstruction for chronic instability; however, there was also a 5% to 15% failure rate regardless of the technique used [25]. Our study "Clinical outcomes of the open modified Brostrom procedure with internal brace augmentation for lateral ankle instability" has investigated the outcome of a procedure which has been established to give good results in more than 80% patients in literature. After looking at our results, 41 (66.1%) patients had good, very good or excellent NOFA score while 21 (33.9%) patients had fair to poor outcomes. The main reason for fair result in 12 patients was only due to some remaining apprehension, especially on rough ground. However, there was no giving way or pain which distracted them from any activities. Also, these patients are otherwise satisfied with this procedure and they will improve with time.

Many outcomes criteria have been assessed in the literature,

NOFA score range	Clinical outcome	No. of patients	Average NOFA score	Age; Mean ± Standard deviation (Range)	Number of months passed since surgery Mean ± Standard deviation (Range)
90-100	Excellent	9	96.83	46.8 ± 15.9 (17-66 Yrs)	33.6 ± 17.2 (9 – 60 Months)
80-89.5	Very good	13	85.08	36.9 ± 12.0 (16-56 Yrs)	30.8 ± 18.2 (8 – 68 Months)
70-79.5	Good	19	74.55	37.2 ± 11.3 (23-56 Yrs)	42.6 ± 17.9 (14 – 70 Months)
60-69.5	Fair	12	64.00	39.7 ± 14.1 (25-53 Yrs)	18.5 ± 11.6 (10 – 27 Months)
Below 60	Poor	9	46.06	55.6 ± 4.2 (51-61 Yrs)	32.4 ± 14.0 (14 – 44 Months)
Grand total		**62**	**73.81**	**41.4 ± 13.4 (16-66 Yrs)**	**33.38 ± 17.23 (8 – 70 Months)**

Table 1: Post-operative outcome analysis using NOFA Score[18].

including postoperative range of motion and radiographic improvement as seen with decreased talar translation and tilt on stress radiographic view [26]. It has been shown, however, that radiographic stability does not necessarily equate to good clinical outcome or resolution of functional instability [27,28]. Therefore, using radiographs or physical examination alone as a measure of outcome can be misleading, especially in high-demand athletes. However, several ankle function questionnaires have been validated in the literature as an excellent way to evaluate patients' outcomes after surgery [26]. A comprehensive literature search revealed us that there is only one study which documented the ability of athletes to return to their previous level of activity, measured by using the Tegner scoring system, after anatomical reconstruction of lateral ankle ligaments [29,30]. Long-term follow-up of the Gould-modified Broström procedure also showed good to excellent results in all patients by Ferkel and Chams [31] at the 60-month follow-up.

There are several strengths to our study. We had strong inclusion criteria which were grade >2 mechanical laxity on the clinical examination and positive anterior drawer test and >2 episodes of functional instability (giving way) of the ankle. Our patient selection was very strict as all of these patients were not responding to nonsurgical measures such as rest, bracing, anti-inflammatory drugs, proprioceptive training, ankle strengthening, and physical therapy for at least 6 months. We also had excellent follow-up of 100% patient retention rate and more than 3 years. Overall, over 85.4% patients reported that they felt improvement post-surgery as per the NOFA questionnaire [19] which was a better result than most reported studies using other questionnaires. Patients experienced improved stability, better quality of life, and higher ability to perform activities and felt a significant relief in pain symptoms. Few of the reasons for poor score in nine of our patients was re-injury to ankle, associated ankle or subtalar arthritis, atrophied ligaments and tendons and complex regional pain syndrome post-surgery. There are limitations to this study, as there were no controlled groups for comparisons. Further, we did only functional outcome analysis and not performed any radiographic evaluation post-operatively.

Conclusion

In conclusion, our results suggest that the modified brostrom procedure with internal brace for lateral ankle instability is very effective and have well to excellent clinical outcomes. It helped in improving stability, quality of life, ability to perform activities and relieve pain symptoms of majority number of patients. I suggest prospective and comparative studies will help for further research of this subject.

Conflict of Interest

The author (s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

References

1. Fong DT, Chan YY, Mok KM, Yung P, Chan KM (2009) Understanding acute ankle ligamentous sprain injury in sports. Sports Med Arthrosc Rehabil Ther Technol 1:14.
2. Gerber JP, Williams GN, Scoville CR, Arciero RA, Taylor DC (1998) Persistent disability associated with ankle sprains: A prospective examination of an athletic population. Foot Ankle Int 19: 653-660.
3. Ferran NA, Maffulli N (2006) Epidemiology of sprains of the lateral ankle ligament complex. Foot Ankle Clin 11: 659-662.
4. DiGiovanni BF, Partal G, Baumhauer JF (2004) Acute ankle injury and chronic lateral instability in the athlete. Clin Sports Med 23: 1-19.
5. Maffulli N, Ferran NA (2008) Management of acute and chronic ankle instability. J Am Acad Orthop Surg 16: 608-615.
6. Ardevol J, Bolibar I, Belda V, Argilaga S (2002) Treatment of complete rupture of the lateral ligaments of the ankle: A randomized clinical trial comparing cast immobilization with functional treatment. Knee Surg Sports Traumatol Arthrosc 10: 371-377.
7. Munk B, Holm-Christensen K, Lind T (1995) Long-term outcome after ruptured lateral ankle ligaments. A prospective study of three different treatments in 79 patients with 11-year follow-up. Acta Orthop Scand 66: 452-454.
8. Povacz P, Unger SF, Miller WK, Tockner R, Resch H (1998) A randomized, prospective study of operative and non-operative treatment of injuries of the fibular collateral ligaments of the ankle. J Bone Joint Surg Am 80: 345-351.
9. Hintermann B, Boss A, Schafer D (2002) Arthroscopic findings in patients with chronic ankle instability. Am J Sports Med 30: 402-409.
10. Schmidt R, Cordier E, Bertsch C, Eils E, Neller S, et al. (2004) Reconstruction of the lateral ligaments: Do the anatomical procedures restore physiologic ankle kinematics. Foot Ankle Int 25: 31-36.
11. Verhagen RA, de Keizer G, van Dijk CN (1995) Long-term follow-up of inversion trauma of the ankle. Arch Orthop Trauma Surg 114: 92-96.
12. Gribble PA, Bleakley CM, Caulfield BM, Docherty CL, Fourchet F, et al. (2016) Evidence review for the 2016 International Ankle Consortium consensus statement on the prevalence, impact and long-term consequences of lateral ankle sprains. Br J Sports Med 50: 1496-1505.
13. Bell SJ, Mologne TS, Sitler DF, Cox JS (2006) Twenty-six-year results after Brostrom procedure for chronic lateral ankle instability. Am J Sports Med 34: 975-978.
14. Messer TM, Cummins CA, Ahn J, Kelikian AS (2000) Outcome of the modified Brostrom procedure for chronic lateral ankle instability using suture anchors. Foot Ankle Int 21: 996-1003.
15. Ng ZD, Das De S (2007) Modified Brostrom-Evans-Gould technique for recurrent lateral ankle ligament instability. J Orthop Surg (Hong Kong) 15: 306-310.
16. Brostrom L (1966) Sprained ankles. VI. Surgical treatment of "chronic" ligament ruptures. Acta Chir Scand 132: 551-565.
17. Gould N, Seligson D, Gassman J (1980) Early and late repair of lateral ligament of the ankle. Foot Ankle 1: 84-89.
18. Lubowitz JH, MacKay G, Gilmer B (2014) Knee medial collateral ligament and posteromedial corner anatomic repair with internal bracing. Arthrosc Tech 3: e505-e508.
19. Batra AV, O'Sullivan J, Nicholson D, Rao P (2018) Post-operative outcome of achilles tendon injury treated with knotless percutaneous achilles repair system. Clin Res Foot Ankle 6: 1-7.

20. Omori G, Kawakami K, Sakamoto M, Hara T, Koga Y (2004) The effect of an ankle brace on the 3- dimensional kinematics and tibio-talar contact condition for lateral ankle sprains. Knee Surg Sports Traumatol Arthrosc 12: 457-462.

21. Stormont DM, Morrey BF, An KN, Cass JR (1985) Stability of the loaded ankle. Relation between articular restraint and primary and secondary static restraints. Am J Sports Med 13: 295-300.

22. Cottom JM, Rigby RB (2013) The "all inside" arthroscopic Brostrom procedure: A prospective study of 40 consecutive patients. J Foot Ankle Surg 52: 568-574.

23. Hamilton WG, Thompson FM, Snow SW (1993) The modified Brostrom procedure for lateral ankle instability. Foot Ankle 14: 1-7.

24. Konradsen L, Bech L, Ehrenbjerg M, Nickelsen T (2002) Seven years follow-up after ankle inversion trauma. Scand J Med Sci Sports 12: 129-135.

25. Kerkhoffs G, Handoll H, DeBie R, Rowe BH, Struijs PA (2007) Surgical versus conservative treatment for acute injuries of the lateral ligament complex of the ankle in adults. Cochrane Database Syst Rev: CD000380.

26. Karlsson J, Bergsten T, Lansinger O, Peterson L (1988) Reconstruction of the lateral ligaments of the ankle for chronic lateral instability. J Bone Joint Surg Am 70: 581-588.

27. Colville MR (1998) Surgical treatment of the unstable ankle. J Am Acad Orthop Surg 6: 368-377.

28. Sugimoto K, Takakura Y, Akiyama K, Kamei S, Kitada C, et al. (1998) Long-term results of Watson-Jones tenodesis of the ankle: Clinical and radiographic findings after ten to eighteen years of follow-up. J Bone Joint Surg Am 80: 1587-1596.

29. Tegner Y, Lysholm J (1985) Rating systems in the evaluation of knee ligament injuries. Clin Orthop 198: 43-49.

30. Krips R, Van Dijk C, Lethtonen H, Halasi T, Moyen B, et al. (2002) Sports activity level after surgical treatment of chronic anterolateral ankle instability. Am J Sports Med 30: 13-19.

31. Ferkel RD, Chams RN (2007) Chronic lateral instability: Arthroscopic findings and long-term results. Foot Ankle Int 28: 24-31.