Analysis of Return to Play After Modified Broström Lateral Ankle Ligament Reconstruction

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Background: Despite marked improvements in stability after lateral ankle ligament repair, many patients do not return to their preinjury activity level. There are few studies addressing athletes' assessment of their ability to return to play after lateral ankle ligament reconstruction for recurrent instability.

Purpose: To determine the rate of return to the preinjury activity level among physically active patients after the modified Broström procedure (MBP) for recurrent lateral ankle instability.

Study Design: Case series; Level of evidence, 4.

Methods: Included were patients who had undergone a primary MBP by a single surgeon over a 6-year period and had a minimum 24 months of follow-up. A telephone questionnaire was conducted to ascertain the patient's ability to return to sport and/or work activity at final follow-up. Activity levels were evaluated utilizing the Tegner activity score. Outcome scores and other measured variables were compared between patients who returned to their preinjury level and those who did not. The reasons for failing to return were also documented.

Results: Of the 59 patients who met the inclusion criteria, 41 (69%; 20 men and 21 women) participated in the telephone interview. Results indicated that 22 (54%) returned to their prior level of activity (returners). The mean age of returners was 27.2 years; for nonreturners, the mean age was 27.1 years. Most patients (36/41; 88%) were satisfied with surgery and the overall outcome. Of the 19 nonreturners, 7 (37%) noted ankle-related reasons for not returning (pain: 57%; residual instability: 29%; decreased range of motion: 14%), and 12 (63%) cited non–ankle-related reasons. The mean preinjury and postoperative Tegner score for returners was 6.8. Moreover, 7 of 14 (50%) high-level athletes with preinjury Tegner scores $\geq$8 returned to their preinjury activity level. For high-level athletes who did not return to their previous level, the mean postoperative Tegner score was 6.6, and only 1 (7%) cited an ankle-related reason for not returning.

Conclusion: A high patient satisfaction rate was reported after the MBP for recurrent lateral ankle instability. The majority of patients who did not return to their preinjury level cited a non–ankle-related factor as the reason for not returning to sport. This was especially true for the higher level athletes.

Keywords: return to play; lateral ankle instability; modified Broström procedure

Ankle sprains are among the most common musculoskeletal injuries treated by physicians. An estimated 2 million acute ankle sprains, accounting for nearly 30% of all sport injuries, occur each year in the United States.[5,14,16,20,34,40] Previous studies[7,19,36,37] have calculated the incidence of ankle sprains to be between 2.15 and 58.4 per 1000 person-years. Although nonsurgical treatment is successful in the majority of cases, approximately 20% to 30% of inversion ankle injuries will experience recurrent sprains, which often occur during sporting activities.[9,24,25,28] If a structured rehabilitation program involving rest and physical therapy does not yield near-normal functional stability, surgical intervention is indicated.[28]

The short-term goal for the surgical treatment of lateral ankle instability is to improve ankle function and stability to allow patients to return to full unrestricted activity. Despite the marked improvement in stability, which is often observed after anatomic lateral ankle ligament repair, a large percentage of patients do not return to their preinjury level of activity.[31] The topic of return to play after ligament reconstruction has been an area of substantial interest in recent years, primarily with regard to anterior cruciate ligament (ACL) reconstruction.[1,2,13] Several investigators[1,2,13] have documented alarmingly low rates of return to play after ACL reconstruction, often in spite of excellent scores on standardized functional outcome scales.

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However, less is known about return to play after the surgical treatment of lateral ankle instability.

More than 50 operative procedures for the correction of lateral ankle instability have been described.[6,8,10,11,17,24,38] Anatomic repair with direct suturing of the torn ligaments, imbrication, and reinsertion to bone have become increasingly popular.[12] Broström[6] described the direct repair of the anterior talofibular and calcaneofibular ligaments in 1966, which was modified by Gould et al[17] in 1980 to include reattachment of the lateral portion of the extensor retinaculum to the distal fibula. While restoring the original anatomy, this procedure also has the advantage of being rather simple and does not sacrifice healthy tendons around the ankle.[12] This surgery has historically produced good outcomes, as measured by standard scoring tools such as the American Orthopaedic Foot & Ankle Society (AOFAS) and Tegner activity scores.[12,28,30] The Tegner score, which was first described in 1985 for knee ligament injuries, has been used for other joint evaluations as well.[15,26,28,35] However, similar to other ACL reconstruction outcome tools, these measures are imperfect in evaluating return to play after ankle reconstruction in an athletic population.

Currently, there are only a few studies that have evaluated return to play after the modified Broström procedure (MBP) or Broström-Gould procedure for recurrent lateral ankle instability. Hunt et al[21] performed a systematic review and found that both the frequency and quality of return-to-play criteria in reporting were very low in patients after lateral ligament repair. Furthermore, among the population of patients who do not return to play, reasons for failure to return have also been poorly defined.

The purpose of this study was to determine the rate of return to preinjury activity levels among patients after the MBP for recurrent lateral ankle instability. We hypothesized that a high percentage of athletes would be able to return to sport after the MBP. Our secondary hypothesis was that for those athletes who do not return to their preinjury level of sport, the reasons would not be related to ankle function after the MBP.

METHODS

Study Population

After obtaining approval through our institutional review board, we searched patients' surgical records for the Current Procedural Terminology code for the MBP (27698 [repair, secondary, disrupted ligament, ankle collateral]) over a consecutive 6-year period (2011-2017). Patient charts were reviewed for data including age, sex, coexisting preoperative diagnosis, coexisting surgical procedures, and surgical findings. Return-to-play data were collected by means of a telephone interview conducted by independent investigators, who were blinded to the patient's chart to minimize response-interpretation bias.

Patients were included in the study who (1) underwent a primary MBP by the senior author (R.D.F.), with a minimum of 24 months' postoperative recovery before participating in the telephone questionnaire; (2) participated in sport activities a minimum of 2 times per week before the injury that required ankle reconstruction surgery; and (3) were able to complete a telephone survey in English. Patients were excluded for (1) age older than 45 years; (2) prior ankle surgery on the unstable ankle; or (3) additional physical injuries, conditions, or surgery not related to the treated ankle that may contribute to limited sport participation.

In all patients, nonoperative treatment, consisting of bracing, proprioceptive training, strengthening, and nonsteroidal anti-inflammatory medications, failed to provide symptomatic relief after a minimum of 6 months. Patients underwent arthroscopic ankle surgery and, if needed (based on physical examination findings and preoperative imaging), an arthroscopic subtalar examination to identify concurrent intra-articular abnormalities. All intra-articular abnormalities were addressed arthroscopically at the same time as the stabilization procedure if possible; otherwise, the remainder were treated during the open portion of the case. Contraindications to the MBP were (1) weight greater than 250 lb (113.4 kg), (2) prior failed anatomic ankle ligament repair, (3) an incompetent or nonexistent anterior talofibular ligament as visualized during arthroscopic ankle surgery, and/or (4) a fixed-heel varus deformity. The 250-lb weight limit was chosen to maintain consistency with our original Broström study in which we used the same contraindications.[12] We were initially concerned that patients weighing more than 250 lb might not have as good a result from the Broström procedure as patients who weigh less. The operative technique and postoperative rehabilitation were performed using the methods previously described.[12,25]

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Ethical approval for this study was obtained from the Southern California Orthopedic Institute (protocol No. 010814MD1).

TABLE 1
Telephone Survey

1. Did you participate in sports or athletic activities at least twice per week on average before your ankle injury? (*Patients who answered "no" were excluded.*)
2. Did you have prior surgery on the affected ankle, or do you have any additional physical injury(ies), condition(s), or surgery not related to the treated ankle that could limit your ability to participate in sports/activities? (*Patients who answered "yes" were excluded.*)
3. Patients participating in sports/activities at least twice per week before an ankle injury, without prior surgery or conditions that could limit activity participation, were then asked to complete the remainder of the telephone questionnaire.[a]
   a. Are you satisfied with the outcome of your ankle surgery? (*yes/no*)
   b. After your surgery, do you feel you have returned to your preinjury level of activity? (*yes/no*)
   c. What were your most vigorous activities before you injured your ankle?
   d. At what level did you participate in these activities?
   e. What is your most vigorous activity after ankle ligament reconstruction surgery?
   f. At what level were you able to participate after surgery?
4. Those patients who did not return to their same preinjury activity or level were then asked the following: If you have not completely returned to your preinjury activity level, why?
   a. Was it ankle related? (*ie, instability, lack of motion, pain, weakness, swelling*)
   b. Was it because of a life-related event? (*job/school requirements, graduation, children, pregnancy, marriage*)
   c. Was it a choice? (*lack of interest, lack of time, desire to try something new, fear of a reinjury*)
   d. Was it because of another health condition? (*We did not allow patients to elaborate on this further.*)

[a]Tegner activity scores were calculated based on patient responses to questions 3c and 3d (preinjury score) as well as 3e and 3f (postoperative score).

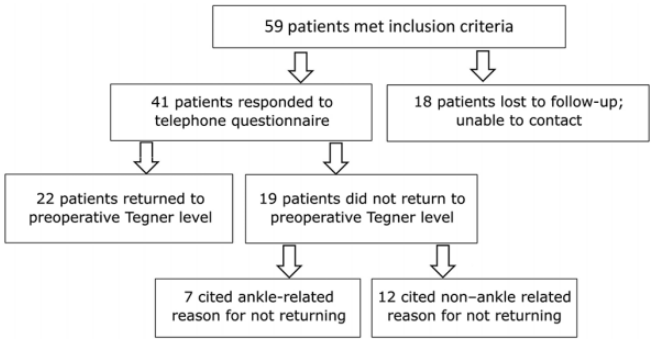

Figure 1. Patient selection flowchart.

Rating Systems

A telephone questionnaire was developed to ascertain the patient's ability to return to sport and/or work activity at a minimum of 24 months postoperatively (Table 1). Tegner activity scores were calculated based on patient responses to survey questions 3c and 3d (preinjury score) as well as 3e and 3f (postoperative score).[35]

Statistical Analysis

Categorical variables were compared utilizing analysis of variance or the nonparametric Mann-Whitney U test or Kruskal-Wallis test if either the normality or homogeneity of various assumptions was violated. The relationship between outcome scores and continuous variables was evaluated with the Spearman (rho) correlation coefficient. Alpha was set at $P < .05$ to declare significance. In addition, correlations were evaluated according to the Cohen effect size in which 0.10 indicates a small effect, 0.30 indicates a medium effect, and 0.50 indicates a large effect. SPSS (Version 25.0; IBM) was utilized for analyses.

RESULTS

Figure 1 demonstrates the patient-selection process. A total of 59 patients met the inclusion criteria, and 41 patients were able to participate in the telephone interview (69% response rate). The study population consisted of 20 male and 21 female patients. Among all participants, 22 (54%) returned to their preinjury level of activity (returners) and 19 (46%) did not return to their preinjury level (nonreturners).

The mean age of those who returned was 27.2 years, while the mean age of the nonreturners was 27.1 years ($P = .98$). The levels of competition and activity for all study participants are outlined in Table 2. Of all responders, 36 (88%) were satisfied with surgery compared to 5 (12%) who were not satisfied with their overall outcome ($P = .64$) (Table 3). The mean age of patients who were satisfied with their outcome was 26.7 years versus 30.3 years for patients who were not satisfied with their outcome ($P = .307$) (Table 3).

Only 1 of the 5 patients who were not satisfied with surgery did not return to the preinjury level of play. Overall, 7 nonreturners (37%) noted ankle-related reasons for not being able to return to sport (4 had pain, 2 had residual instability, and 1 had decreased range of motion) (Figure 2). Further, 12 of the nonreturners (63%) cited non–ankle-related reasons for not returning to their preinjury level, as shown in Figure 3. A total of 5 had a change in their level of play after a graduation event, 2 cited family reasons/children, 2 noted that the demands of education prevented them from returning, 2 were no longer interested in competing at the same level, and 1 stopped because of nonankle joint pain.

TABLE 2
Age and Activity Level of Participants[a]

	Returners (n = 22)	Nonreturners (n = 19)
Age, mean ± SD, y	27.2 ± 9.3	27.1 ± 7.7
Tegner score		
Before injury	6.8	7.4
After surgery/rehabilitation	6.8	5.8
Competition level		
Junior high	0 (0)	1 (5)
High school	2 (9)	2 (11)
Recreational	13 (59)	12 (63)
College	2 (9)	4 (21)
Work	2 (9)	0 (0)
Competitive	3 (14)	0 (0)

[a]Data are reported as n (%) unless otherwise stated.

TABLE 3
Age and Satisfaction of Survey Responders[a]

	Returners (n = 22)	Nonreturners (n = 19)	Age at Surgery, y
Satisfied (n = 36)	20 (91)	16 (84)	26.7 ± 8.7
Not satisfied (n = 5)	2 (9)	3 (16)	30.3 ± 7.9
P value			.307

[a]Data are reported as n (%) or mean ± SD.

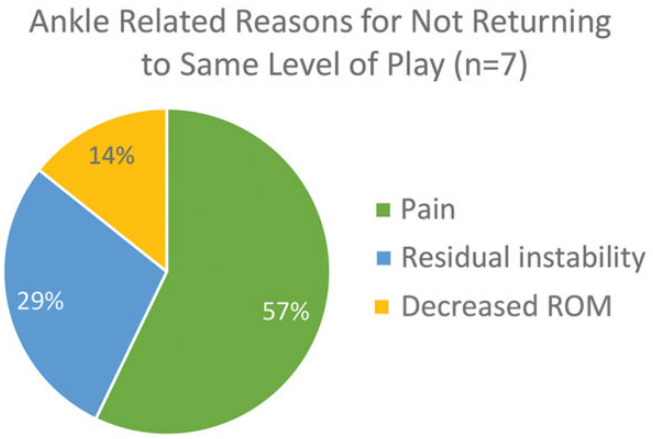

Figure 2. Ankle-related reasons for not returning to the same level of play. ROM, range of motion.

The mean preinjury and postoperative Tegner score for those who did return to their same level of activity was 6.8 ± 1.73. The mean Tegner score for those athletes who did not return to the preinjury level was 7.4 ± 1.30 before the injury and 5.8 ± 0.96 postoperatively. There was a statistically significant difference in age between patients with a preinjury Tegner score ≥8 versus <8 (P = .003) (Table 4). When analyzing the higher level athletes, that is, those with a preinjury Tegner score ≥8 (high-level sports, more than just recreational), 7 of these 14 athletes (50%) returned to their preinjury level of play. The mean postoperative Tegner score of those high-level athletes who did not return to the same level of play was 6.6. Of the higher level athletes with a Tegner score ≥8, overall, 100% were satisfied with surgery compared with 81% of those with a preinjury Tegner score <8 (P = .147) (Table 4). Of the high-level athletes who did not return, 1 cited an ankle-related reason for not returning (lack of motion in the joint), 1 noted pain in an adjacent ipsilateral joint (knee) as the reason, and the remaining 5 all noted non–ankle-related reasons for not returning (change in the level of play after graduation from high school or college).

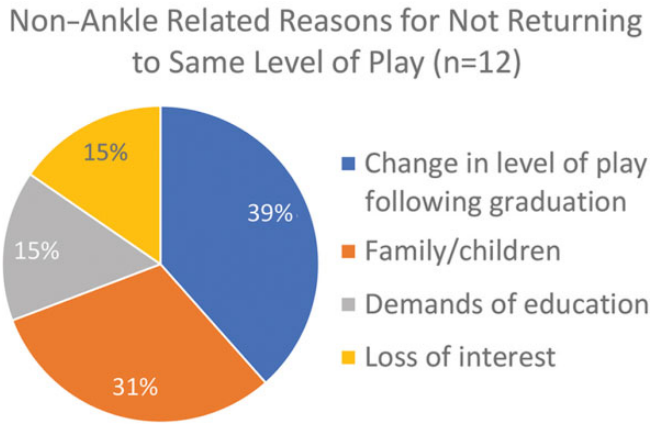

Figure 3. Non–ankle-related reasons for not returning to the same level of play.

TABLE 4
Age and Satisfaction Based on Preinjury Tegner Score[a]

	Tegner Score <8 (n = 27)	Tegner Score ≥8 (n = 14)	*P* Value
Age, y	29.94 ± 8.56	21.94 ± 5.98	.003
Satisfied	22 (81)	14 (100)	.147
Not satisfied	5 (19)	0 (0)	

[a]Data are reported as mean ± SD or n (%).

A concomitant diagnosis of a foot and ankle injury was common. All patients (41/41; 100%) had at least 1 additional diagnosis. The most common diagnosis in addition to lateral ankle instability was soft tissue impingement. There were 13 patients who were noted on arthroscopic ankle surgery to have soft tissue impingement requiring arthroscopic debridement. Of these 13 patients, 8 (62%) returned to their preinjury level of activity. Of the 13 patients, 6 underwent arthroscopic subtalar surgery for sinus tarsi impingement, subtalar joint loose bodies, or subtalar edema based on preoperative magnetic resonance imaging. Of these 6 patients, 4 (67%) returned to their preinjury level of activity. Of the 4 patients diagnosed and arthroscopically treated for loose bodies within the ankle joint, 3 (75%) returned to their preoperative level of play.

Osteochondral lesions of the talus (OLTs) were also common in patients treated for lateral ankle instability. Overall, 13 of the 41 patients (32%) had a documented OLT noted on an arthroscopic examination. A total of 5 of the 13 (38%) returned to their prior level of activity (3 were treated with microfracture, and 2 were treated with reduction and pinning of the fragment). Thus, 62% of the survey responders who were diagnosed with an OLT did not return to their preinjury level. All of these were treated with microfracture. In all, 2 cited continued pain as a reason for not returning, 1 cited instability, and the other 5 nonreturners with OLTs cited non–ankle-related reasons for not returning.

DISCUSSION

Lateral ligament injuries to the ankle are extremely common among all levels of athletes. Our study demonstrated that the MBP yielded a high patient satisfaction rate, but some patients may not be able to return to their preinjury level of play. We had 22 athletes return to their level of sport and 19 not return to sport. We found that 37% of athletes who did not return were because of ankle complaints (pain: 57%; residual instability: 29%; decreased range of motion: 14%) and 63% were because of other reasons not related to ankle complaints.

Recurrent or chronic ankle instability is present in 10% to 20% of patients.[4,22,23,27,32] This chronic instability can often be disabling and require surgical treatment. Anatomic procedures, including the MBP, show loading-force patterns similar to those seen in intact ankles.[3,33] Peters et al[32] reviewed the literature to compare the success rates of the most common types of lateral ankle stabilizing procedures. A review of 460 ankles treated with the anatomic MBP resulted in 87% to 95% good to excellent outcomes.[32] A prior study by Krips et al[28] demonstrated higher Tegner activity levels after postsurgical rehabilitation for anatomic reconstruction compared to tenodesis. Although anatomic reconstruction via the MBP is highly effective at improving chronic lateral ankle instability, there is still a discrepancy between the preinjury and postrehabilitation activity levels of these patients.[6,17,28] In our study, 54% reported that they returned to their preinjury level of activity. Of the 19 athletes who did not return to their preinjury level of activity, 37% cited ankle-related reasons for not returning, while 63% cited non–ankle-related reasons for not returning. The most common non–ankle-related reason was a change in the level of play after a graduation event. The rate of return to the preinjury level of activity in our study (54%) was similar to the rate of return to prior activity for anatomic reconstruction reported by Krips et al[28] (42%), but it is important to note that they evaluated only patients with preinjury Tegner scores $\geq$7. When we looked at higher level athletes, that is, those with a preinjury Tegner score $\geq$8, there were 50% who returned to their preinjury level. Of these higher level athletes in our study, only 7% cited an ankle-related cause for not returning. Maffulli et al[31] also reported their results after Broström repair and looked at return to play. They found that 58% of the athletes were able to return to their preinjury level while the remaining 42% were still able to be physically active (16% were able to compete but at a lower level).[31]

There are only 2 other published articles that have specifically looked at return to play after the MBP. White et al[39] evaluated 42 professional athletes who underwent modified Broström repair. All patients reported that their ankles felt stable, and the median visual analog scale score improved from 4 preoperatively to 0 postoperatively. In addition, the median Foot and Ankle Outcome Score (FAOS) improved in all categories with statistical significance. All of the patients returned to their respective preinjury level of play with an average time of 77 days. A major difference of their cohort was that these patients underwent surgery acutely, with the average time being 7 days from the date of injury (range, 5-21 days). We were not able to look back at our data and come up with an accurate time frame from the date of injury to surgery. However, the majority, if not all, of our patients had a considerably longer time period because nonoperative treatment (rest, ice, bracing, functional rehabilitation, etc) was recommended for several months before undergoing surgery. Their cohort of professional athletes demonstrates the effectiveness of the surgical procedure to allow patients to return to their preoperative level. However, these patients have access to high-end physical therapists and rehabilitation equipment daily, not to mention the time devoted to returning to play, all of which our population did not have the luxury of having.

Lee et al[29] also published on return to play after modified Broström repair. Their study involved 18 elite athletes who underwent surgery. They defined these athletes as either high level or junior level; however, they did not further define what qualifies them for each level. The return-to-play rate was 83.3% at 4 months after modified Broström repair and 100% at 8 months. The study included a preoperative AOFAS ankle-hindfoot score; however, they did not record any postoperative functional outcome scores.

Our study revealed that 100% of ankles surgically treated for chronic instability had a concomitant diagnosis. This is similar to a prior study by Ferkel and Chams[12] that found that 95% of the patients treated for chronic lateral ankle instability had intra-articular abnormalities. In the present study, the most common intra-articular abnormalities were soft tissue impingement (32%) and OLTs (32%). The frequency of OLTs in our study is slightly higher than the 24% reported by Ferkel and Chams.[12] Patients with instability who had a concomitant OLT had poorer results than patients with concomitant soft tissue impingement or with isolated ankle instability. Gregush and Ferkel[18] also looked at patients with lateral ankle instability with or without an associated OLT. They found that patients who underwent an isolated MBP did better than those who also had a concomitant OLT treated at the same time.[18]

Despite the fact that 46% of our cohort did not return to their preinjury level of activity, the overall satisfaction rate with the surgical procedure, rehabilitation process, and ultimate outcome was 88%. This is likely because of the resolution of the patients' chronic ankle instability. This

is important information that the orthopaedic surgeon can share with this patient population.

Limitations

This study has a number of limitations that may have affected the results: (1) a relatively small study cohort; (2) none of the patients were seen in the office for clinical follow-ups and radiographs; (3) the Tegner score may not be the best way to assess return to sport for patients after the MBP; (4) the patients generally were not high-level athletes, and it is difficult to compare them with elite or professional athletes; (5) the study cohort was heterogeneous with a high rate of significant concomitant injuries; and (6) this is a retrospectively designed study that could cause bias, with a follow-up period of more than 2 years.

CONCLUSION

In this study, patient satisfaction after the MBP was very high (88%), even for those athletes who were unable to return to their preinjury level. However, a large percentage of athletes (46%) did not return to their preinjury activity level, but only 37% reported ankle-related reasons for not returning. Overall, in this study, patients were more likely to return to their preinjury level if they were younger, had a higher preinjury Tegner score, and had no associated abnormalities.

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