Treatment of Distal Tibiofibular Syndesmosis Injury Associated with Ankle Fractures with Suture Button

Tratamento da lesão da sindesmose tibiofibular distal associada às fraturas do tornozelo com suture button

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Abstract

Objective To evaluate the results obtained from the surgical treatment of malleolar ankle fractures associated with distal tibiofibular syndesmosis (DTFS) injury submitted to conventional surgical procedure for fracture fixation and DTFS fixation by suture button (SB).

Methods Forty-nine patients were retrospectively evaluated, with a mean age of 45 years old and a mean follow-up of 34.1 months. Clinical and functional evaluation was based on the visual analogue scale (VAS) and on the American Foot and Ankle Society Score (AOFAS) for ankle and hindfoot, return to routine activities, and return to sport.

Results The postoperative mean AOFAS and VAS were, respectively, 97.06 (confidence interval [CI 95%: 95.31–98.81] and 0.16 [CI 95% 0,04 – 0,29]. All patients returned to previous daily activities, and only 12 showed some residual symptom. There was no postoperative instability in any patient. Forty-six patients returned to sports activities and, of these, only 1 did not return to the level prior to the injury. Only two patients presented SB-related alterations. There was no report of dissatisfaction.

Conclusion In malleolar fractures of the ankle with DTFS injury, the fixation of syndesmosis with SB demonstrated excellent postoperative results.

Level of Evidence IV, retrospective case series.

Keywords
- ankle joint
- ankle fractures
- suture techniques
- fracture fixation, internal

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Resumo

Objetivo Avaliar os resultados obtidos do tratamento cirúrgico das fraturas maleolares do tornozelo associadas a lesão da sindesmose tibiofibular distal (STFD) submetidas a procedimento cirúrgico convencional de fixação da fratura e fixação da STFD pelo suture button (SB).

Métodos Avaliou-se retrospectivamente 49 pacientes com uma média de idade de 45 anos e seguimento médio de 34,1 meses. A avaliação clínica e funcional foi baseada na escala visual analógica (EVA) e na escala American Foot and Ankle Society Score (AOFAS, na sigla em inglês) para tornozelo e retropé, retorno às atividades da rotina e retorno ao esporte.

Resultados As médias pós-operatórias das escalas AOFAS e EVA foram, respectivamente, 97,06 (índice de confiança [IC 95%: 95, 31 – 98, 81] e 0,16 [IC 95% 0,04 – 0,29]. Todos os pacientes retornaram às atividades prévias do cotidiano, sendo que apenas 12 apresentaram algum sintoma residual. Não se verificou instabilidade pós-operatória em nenhum paciente. Ao todo, 46 pacientes retornaram às atividades desportivas e, destes, apenas 1 não retornou ao nível prévio à lesão. Apenas dois pacientes apresentaram alterações relacionadas ao SB. Não houve relato de insatisfação.

Conclusão Em fraturas maleolares do tornozelo com lesão da STFD, a fixação da sindesmose com o SB demonstrou excelentes resultados pós-operatórios.

Nível de Evidência IV, série de casos retrospectiva.

Palavras-chave

- articulação do tornozelo
- fraturas do tornozelo
- técnicas de sutura
- fixação interna de fraturas

Introduction

The distal tibiofibular syndesmosis (DTFS) has, as main stabilizer, its ligament complex, composed of the lower anterior tibiofibular ligaments, the inferior posterior tibiofibular ligaments, the interosseous, and transverse ligaments.[1–3] Although it is one of the most stable joints of the human body, the DTFS presents a certain degree of mobility, such as external rotation, relative shortening of the fibula and small opening during load, and physiological movements.[3,4] Approximately 80% of the DTFS ligament injuries are associated with ankle fractures, so that the correct diagnosis and proper treatment of these lesions are extremely important to prevent complications such as chronic edema and pain related to synovitis, joint cartilage injuries, and degenerative disease secondary to chronic instability of this joint.[5,6]

The diagnosis of acute syndesmosis injury in patients with ankle fracture is made through clinical evaluation, imaging, and intraoperative evaluation.[7] The clinical finding suggesting injury to the syndesmosis is the presence of pain on palpation of the topography of the DTFS ligaments or of the proximal third of the fibula, when it is an injury associated with high fractures of the fibula.[8,9] Regarding imaging, the most used methods are plain radiography, computed axial tomography (CT) and magnetic resonance imaging (MRI).[3,8,10,11] Anteroposterior (AP), profile, and mortise (AP with 15° of internal rotation) radiographs are necessary to confirm the diagnosis of ankle fracture and to evaluate the occurrence of syndesmosis injury by identifying alterations such as syndesmosis fracture-avulsion, high fracture of the fibula (Weber type C or Maisonneuve), opening of the medial clear space > 4 mm, alterations of the overlap and tibiofibular light space, and the integrity of the posterior malleolus.[7,12] Computed tomography scan helps to assess the relative position between the tibia and the fibula, in the better understanding of possibly associated posterior malleolus fractures, and in the diagnosis of occult fractures. In up to 40% of cases, the treatment plan may change after CT images.[13] Magnetic resonance imaging is the test that presents greater specificity and sensitivity, besides providing a more detailed evaluation of DTFS ligament involvement, as well as associated intra-articular lesions.[3,8,9] Clinical examination, plain radiography and CT are sufficient for the indication and programming of surgical treatment of ankle fractures. In addition, the evaluation of fracture reduction and DTFS are also performed during surgery through direct visualization and stress tests, which confirm joint congruence and stability, respectively.[14]

The conventional treatment of ligament injury includes, in addition to fracture treatment, the fixation of the DTFS with stabilizing screws. There are discussions about the number of screws required, their thickness, the number of corticals fixed, and the height of the screws in relation to the joint line. However, since the distal tibiofibular joint allows micromovements as described above, this type of stabilization occasionally causes problems due to its inherent stiffness, such as: chronic residual pain, loosening of the screw, breakage of the synthesis material, stiffness, prolonged time without load, distal tibiofibular syostosis, need for a new surgical procedure for screw removal, late diastasis after failure or removal of the material, and even degeneration of the ankle joint.[3,11,15,16]

Due to the aforementioned factors, there is an increase in the popularity of flexible devices for the fixation of the DTFS, which allow some movement while conferring sufficient stability to maintain joint congruence and prevent implant

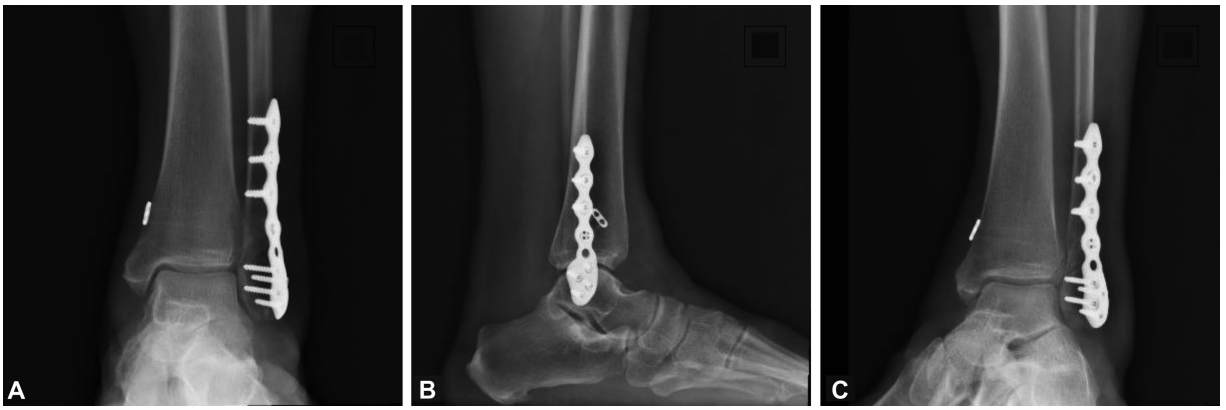

Fig. 1 Ankle radiography after surgical treatment with malleolus fixation with plate and screws and DTFS with SB in AP (**A**), profile (**B**)and mortise (**C**) incidences.

failure.[11] With this, it is possible to restore the biomechanics of the DTFS so they become similar to the physiological biomechanics.[2,17,18] In view of this situation, despite cases of local irritation and of syndesmosis heterotopic ossification, the use of these fixation methods aims to reduce the incidence of residual symptoms and the need for secondary surgical procedures to remove the synthesis material, as well as to enable early support.[2,16,17,19,20]

The objective of the present work is to evaluate the results obtained in the surgical treatment of malleolar fractures of the ankle with associated DTFS injury by fixing the malleolus with plates and screws, and the DTFS with the suture button (SB) (►**Figure 1**).

Materials and Methods

The present study was developed in the institution after approval by the Research Project Manager System (SGPP, in the Portuguese acronym). The present study was administered according to the requirements of CNS Resolution 466/2012 and obtained approval from the Research Ethics Committee of the institution, with registration in Plataforma Brasil, under CAEE number 99556918.7.0000.0071.

This is a longitudinal, retrospective study of a series of patients diagnosed with malleolar ankle fractures associated with DTFS ligament injuries submitted to surgical treatment between 2000 and 2017. The clinical and radiographic data necessary for the study were collected from the electronic medical records (HiDoctor) of the patients. All procedures were performed by two foot and ankle surgeons.

A total of 49 medical records were evaluated. There were 22 male patients (44.9%) and 27 (55.1%) female patients. The mean age of the study participants was 45 years old, with the maximum age of 79 years old and the minimum age of 16 years old. The right and left sides were affected in a similar proportion, with a total of 25 right ankles (51%) and 24 left ankles (49%).

Inclusion and Exclusion Criteria

Patients of both genders, with mature skeleton, who suffered ankle fractures associated with DTFS lesions diagnosed by radiography and confirmed by intraoperative tests and underwent a surgical procedure with anatomical reduction and conventional fracture fixation added to the stabilization of syndesmosis with SB (TightRope - Arthrex) were included in the study. The exclusion criteria were patients with a history of previous ankle fractures, neurological pathologies, congenital deformities, collagen diseases, inflammatory pathologies, diabetes, and renal failure.

Outcomes Evaluated

The results of questionnaires related to clinical and functional evaluation, such as the visual analog scale (VAS) for pain and the American Foot and Ankle Society Score (AOFAS) for ankle and hindfoot, were analyzed.[21] Residual symptoms, return to routine activities and necessary time, return to daily physical activities and level of return to physical activities in relation to performance prior to the injury, surgical complications, need for secondary procedures, and patient satisfaction index were also evaluated.

Statistical Analysis and Sample Planning

Numerical variables with normal distribution were described by means and standard deviations (SDs), and variables with non-normal distribution were described by medians and interquartile intervals (IQRs), in addition to the minimum and maximum values. The distributions of numerical variables were verified by histograms, boxplots and, when necessary, Shapiro-Wilk normality tests. Categorical variables were described by absolute and relative frequencies. The results are presented followed by 95% confidence intervals (CIs) for proportions and means so that they can be discussed with the literature.

Results

Only one SB was used for 44 patients (89.8%), and 2 for 5 (10.2%). The follow-up time ranged from 2 to 144 months, with a mean of 34.1 months (95%CI: 25.4–42.8).

The mean AOFAS and VAS postoperative ranges were, respectively, 97.06 and 0.16 (►**Table 1**). The 95%CIs for the means of these measurements were, respectively, 95.31–98.81 and 0.04–0.29.

Table 1 Postoperative outcomes ($n = 49$)

Postoperative AOFAS	
Mean (standard deviation)	97.06 (6.08)
Minimum - Maximum (*n*)	68.00–100.00 (49)
Postoperative VAS	
Mean (standard deviation)	0.16 (0.43)
Minimum - Maximum (*n*)	0.00–2.00 (49)
Postoperative VAS (by category)	
0	42 (85.7%)
1	6 (12.2%)
2	1 (2.1%)
3	0 (0%)

Abbreviations: AOFAS, American Foot and Ankle Society Score; VAS, visual analogue scale.

Only 12 patients (24.5%) showed any residual symptoms. The symptoms presented by these patients were: pain and movement limitation in 2 (4.1%); possible discomfort in 2 (4.1%); mild discomfort in fibular tendons in 1 (2%); discomfort with efforts in 4 (8.2%); and occasional pain in 3 (6.1%). All patients (100%) returned to their previous daily activities and the mean time to return was of ~ 3.7 months, with a minimum time of 0.5 months and a maximum time of 8 months. Regarding physical activities, 3 (6.1%) did not return to sports practice and 46 (93.9%) returned to their practice, and only 1 (2%) stated that they did not return to the same level (►**Table 2**).

From the 49 operated patients, only 2 (4.1%) presented alterations directly or indirectly related to the SB, 1 of them with failure to fix the SB (and subsequent distal tibiofibular arthrodesis), and another with complaint of discomfort in the SB Fiberwire (wire granuloma). Regarding the satisfaction index, 48 (98%) patients said they were fully satisfied, 1 (2%) indicated partial satisfaction, and there was no report of dissatisfaction (►**Table 3**).

Table 2 Postsurgical results ($n = 49$)

Residual symptom –*n* (%)	
Showed no residual symptom	37 (75.5)
Pain and movement limitation	2 (4.1)
Eventual discomfort	2 (4.1)
Mild discomfort in fibular tendons	1 (2)
Discomfort during efforts	4 (8.2)
Occasional pain	3 (6.1)
Return to routine activities –*n* (%)	
No	0 (0)
Yes	49 (100)
Return to routine activities; how long after surgery (months)	
Mean (standard deviation)	3.7 (1.6)
Median (IQR)	4.0 (2,5 – 4,5)
Minimum - Maximum	0.5–8
Return to physical activities –*n* (%)	
No	3 (6.1)
Yes	46 (93.9)
Physical activities level in relation to the level before the injury –*n* (%)	
Lower level	1 (2.0)
Same level	45 (91.9)
Did not return	3 (6.1)

Table 3 Complications and satisfaction ($n = 49$)

Complications related to suture button –*n* (%)	
No	47 (95.9)
Yes	2 (4.1)
Type of suture button complication ($n = 2$)	
Fixation failure – distal tibiofibular arthrodesis performed	1
Granuloma on suture button Fiberwire wire	1
Reoperation due to suture button complications –*n* (%)	
No	47 (95.9)
Yes	2 (4.1)
Satisfaction Index –*n* (%) ($n = 49$)	
Fully satisfied	48 (98.0)
Partially satisfied	1 (2.0)
Unsatisfied	0 (0.0)

Discussion

In view of the wide discussions about the advantages and disadvantages of the use of SB compared with the conventional method, we describe, through a retrospective analysis, the results obtained in the surgical treatment of ankle fractures associated with DTFS lesion fixed with this device.

Kim et al.[4] followed, for > 1 year, 44 patients who underwent ankle fracture surgery associated with syndesmosis injury, of which 20 were treated with the use of SB and 24 with the use of screws, and found postoperative AOFAS/VAS of 88.1/1.4 and 86.6/1.5, respectively. In our results, we found a mean postoperative AOFAS of 97.06 and an average postoperative VAS of 0.16.

Thornes et al.[22] retrospectively compared fixation with SB and screws in 32 patients, divided into 2 groups of 16. Patients in the fixation group with SB showed earlier return to work (2.8 months) when compared with the screw fixation group (4.6 months). The mean time of return to previous daily activities in our study was 3.7 months, which is slightly longer than that described by Thornes et al.,[22] but shorter than the conventional method indicated, corroborating the hypothesis of faster rehabilitation.

There are few studies that investigated the residual symptoms presented by patients. In our study, of the residual symptoms observed, the most limiting consisted of pain and limitation of movement. The other residual symptoms were framed as occasional or physical exertion.

It is noteworthy that the works of both Zhang et al.[23] and Unal et al.[3] showed a better cost-benefit ratio in fixation with SB, because when it is not necessary to perform a second surgery to remove the implant, the medical-hospital cost is reduced, in addition to reducing the possible complications and the time of return to work. Additionally, by avoiding a second intervention, the technique does not incur the loss of DTFS reduction as observed by Endo et al.[13] in their study with 20 patients who underwent syndesmosis fixation with screws for the correction of ankle fractures. It was found that, 1 year after the removal of the screws in the second procedure, there was an increase in the anterior tibiofibular distance.

Zhang et al.,[23] in their systematic review compared the use of SB and screws in the treatment of DTFS lesions, observed inadequate reduction in 4 studies, 1.0% of which occurred with the use of SB and 12.6% with the screw. In addition, implant failure was found in 7 studies, with no failures in the SB group and 30.9% failures in the screw group. Other complications such as infection, irritation, discomfort, and syndesmosis ossification (except inadequate reduction and implant failure), were reported in 5 studies, 12% in patients with SB and 16.4% in patients with screw. In our study, complications resulting from the use of SB occurred in 2 patients (4.1%); in 1 of the cases, implant failure occurred in the postoperative follow-up with a new procedure (distal tibiofibular arthrodesis). In the other patient, there was the formation of a granuloma around the Fiberwire SB wire, a complication directly related to the device that is positioned in the subcutaneous part of the medial part of the tibia; therefore, the removal of the SB after ligament healing was performed. Both patients had good evolution. Similarly, Zhang et al.[23] also reported 7 studies that demonstrated the need for implant removal, 3.7% in the SB group and 40.2% in the screw group.

Despite the complications, there was a high total satisfaction index (98.0%) and a small partial satisfaction index (2.0%) with the treatment, as well as a high rate (91.9%) of return to physical activities at the preinjury level.

The limitations of the present study are concentrated in the fact that it is a retrospective analysis of data, including a small number of patients, and with absence of a control group.

Conclusion

The present study, in line with the literature, demonstrates excellent results of the fixation of syndesmosis with SB. Compared with the conventional method, SB may present similar or superior results, with the advantage of allowing early loading, maintenance of reduction, physiological mobility, and dispensing with the need for a new procedure for implant removal.

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Conflict of Interests
Marcelo Pires Prado declares that he is an educational consultant for Arthrex.

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