Modified Evans technique for treatment of chronic lateral ankle instability

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Background

Chronic ankle ligamentous instability is not uncommonly encountered condition after severe ankle sprains. A number of operative procedures have been developed and described in the literature, including variations on the original Evans tenodesis. The aim of this study was to propose a modification to the original Evans procedure that includes surgical tips and rigid fixation of the rerouted peroneus brevis tendon.

Patients and methods

Ten patients with chronic lateral ankle ligamentous instability were operated upon with a new technique that represents a modified Evans tenodesis. In this technique, rigid fixation of the rerouted peroneus brevis tendon was achieved by securing the tendon through transverse tunnel 1 cm proximal to the tendon outlet.

Results

All patients in this study reported good to excellent functional outcome. The mean Karlsson score at 1-year follow-up showed a statistically significant increase from a preoperative mean of 61 ± 3.94 SD to a mean of 88.2 ± 3.97 SD. Tegner activity level showed a significant increase from a preoperative mean of 3.3 ± 0.82 SD to a mean of 6.1 ± 0.57 SD.

Conclusion

The proposed modification on the Evans procedure has shown clinical efficacy in patients with chronic lateral ankle instability. Secure tendon fixation allowed for early cast removal and faster rehabilitation, with subsequent early return to functional activities.

Keywords:

lateral ankle instability; modified Evans technique

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Introduction

Ankle ligamentous sprain injury is the most common single type of acute sport trauma [1]. Each day about one inversion injury of the ankle occurs for every 10 000 people [2]. A majority of patients improve following a treatment protocol involving a period of rest and physical therapy. However, it has been noted in previous studies that as many as 20% of patients with ankle ligamentous sprain injury have chronic symptomatic ankle instability [3,4].

The lateral ligament complex includes three capsular ligaments, namely the anterior talofibular ligament (ATFL), the calcaneofibular ligament (CFL), and the posterior talofibular ligament. Among the lateral ligaments, the ATFL is the weakest, as it has the lowest ultimate load [1,5]. Burks and Morgan [6] described considerable anatomic variation in the anatomy of the ATFL and CFL. This anatomic variation in the ligament position has been hypothesized as one factor predisposing individuals to chronic ankle instability.

Injuries typically occur during plantar flexion and inversion; the ATFL is most commonly torn. The CFL and the posterior talofibular ligament can also be injured, and, after severe inversion, subtalar joint ligaments are also affected. Commonly, an athlete with a lateral ankle ligament sprain reports having 'rolled over' the outside of their ankle [7]. Patients with chronic ankle instability usually complain of persistent pain, recurrent sprains, and recurrent episodes of the ankle giving way [8]. Examination may show tenderness, swelling, and reduced range of motion, especially in dorsiflexion. Severe cases exhibit discoloration, glossy skin, and temperature changes suggestive of reflex sympathetic dystrophy [9].

There are numerous operative procedures designed to correct mechanical instability of the lateral ankle ligaments [10]. Most of these operations have favorable clinical results, but there are contradictory results from different investigators. Consequently, it is difficult to arrive at a consensus as to the optimal surgical treatment for chronic lateral ankle instability [11].

Surgical procedures advocated to tackle ankle instability are broadly classified into anatomic ligament repairs versus reconstructive tenodesis [12,13]. Anatomic (primary, nonaugmented) repairs such as those by Broström [14] or Karlsson and Lansinger [15] address directly the damaged ligaments of the ankle to stabilize the joint. Nonanatomic (secondary, augmented) repairs by Evans [16], Watson-Jones [17], Anderson [18], Saltrick [19], Elmslie [20], and Chrisman and Snook [21] utilize tendon (e.g. peroneus brevis, plantaris) or fascia (fascia lata) grafts to reinforce the lateral ankle [10].

One of the most commonly performed procedures is the Evans procedure during which the entire peroneus brevis tendon is rerouted from anterior to posterior through a bony tunnel through the fibula. Inversion of the ankle is limited by restricting the excursion between the fibula and the fifth metatarsal [1,12]. In the original Evans procedure, the proximal free arm of the rerouted peroneus brevis tendon is sutured to the periosteum and adjacent soft tissue [16,22].

In the current study, a modification of the original Evans procedure is proposed that aims at obtaining more rigid proximal fixation of the proximal arm of peroneus brevis tendon. It is thought that maintaining the tension of the rerouted tendon with simple suturing to the periosteum represents a matter of nonrigid fixation with subsequent prolonged cast immobilization and risk for loss of the desired tension. A more rigid fixation through a proximal transverse tunnel in the fibula can maintain the desired tension and courage for early rehabilitation program.

Patients and methods

Between August 2008 and July 2010, 10 consecutive patients were operated upon for chronic ankle instability with a modified Evans procedure and presented in this study. Seven men and three women were included, with a mean age of 26.6 years (range 23–33 years) at the time of surgery. The right ankle was involved in six patients and the left in four patients.

All patients had a history of either recurrent ankle sprains or a chronic post-traumatic ankle instability combined with pain. None of the patients responded to initial conservative therapy that included immobilization and aggressive rehabilitation when the chronic instability occurred. Each patient presented with symptoms of at least 12 months' duration.

Standard stress radiographs were obtained in the anteroposterior and lateral projections when inversion stresses were applied. The results of stress radiography were considered to be positive for instability according to the standard criteria when the tibiotalar angle was more than 10° on the anteroposterior view (Fig. 1) or when the tibiotalar distance was more than 6 mm on the lateral radiographs. MRI was performed for all patients to confirm the diagnosis and to exclude associated chondral lesions.

Figure 1

Stress radiograph showing increased tibiotalar angle.

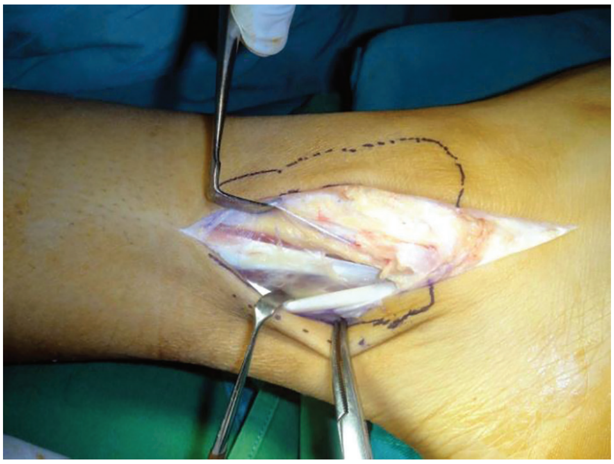
Surgical technique

The procedure proposed in this study represented a modification on the method of tendon fixation originally described by Evans. In the original Evans procedure, the rerouted tendon of peroneus brevis is passed through tunnel in the fibula, and then sutured to the adjacent soft tissue and periosteum [16]. It was thought that this method of fixation is not rigid enough to maintain the adjusted tension and that early mobilization and rehabilitation could not be performed with the original Evans technique.

In the proposed technique, the proximal end of peroneus brevis is firmly looped in a proximal transverse tunnel in the fibula, where this type of fixation will ensure maintaining the adjusted ligament tension.

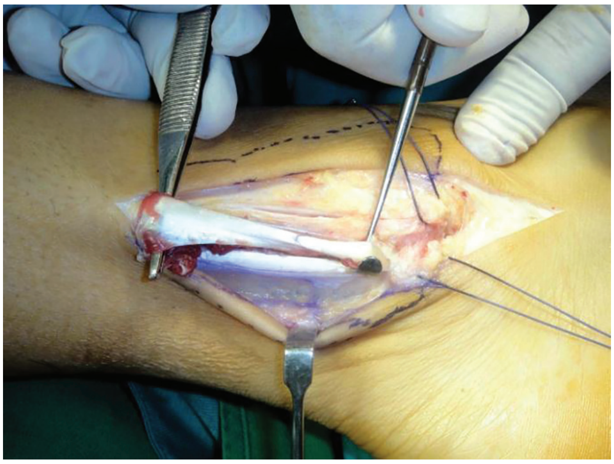
The patient lies supine on the operating table and a curvilinear incision is made along the course of the peroneal tendons. The peroneus longus tendon is identified and retracted posteriorly (Fig. 2). The peroneus brevis tendon is identified proximal and distal to the retinaculum (Figs 3 and 4), and the proximal end of the tendon is sectioned (Fig. 5) and passed distally beneath the retinaculum (Fig. 6). A guide wire is passed from the tip of the lateral malleolus proximally and posteriorly (Fig. 7), and a cannulated drill bit 3.5 mm is used to drill a tunnel for rerouting the peroneus brevis tendon (Fig. 8). The proximal end is passed by the help of anterior cruciate guide wire (Fig. 9) through the fibular tunnel to emerge superiorly and posteriorly (Fig. 10).

Figure 2



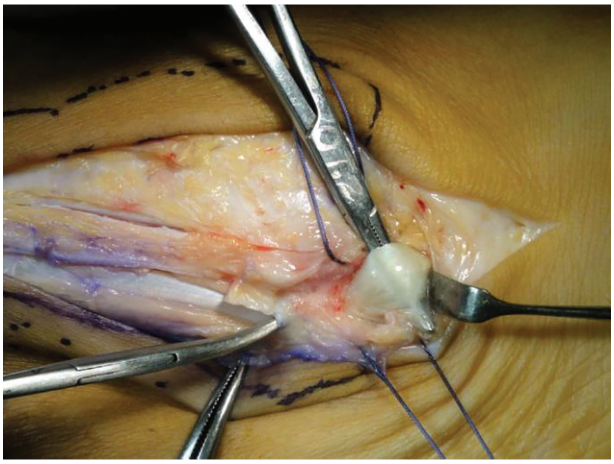
Peroneus longus tendon is identified and retracted posteriorly.

Figure 3



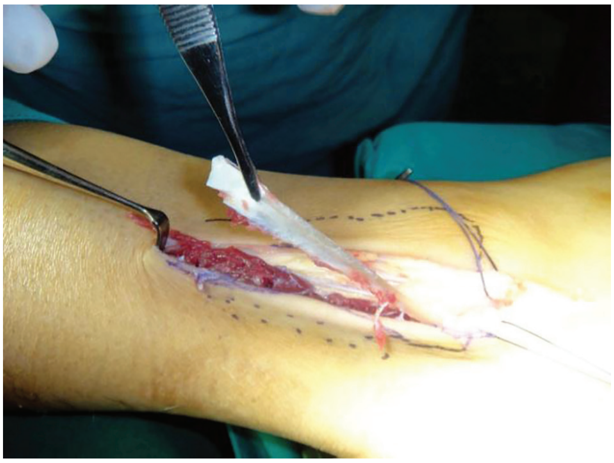
Peroneus brevis tendon is identified proximal to the retinaculum.

Figure 4



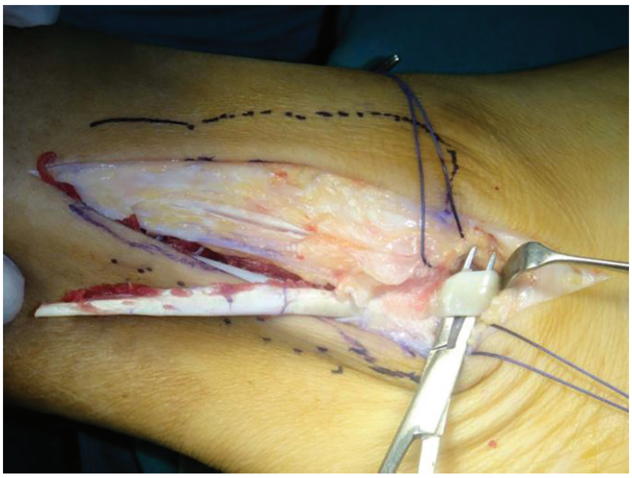
Peroneus brevis tendon is identified distal to the retinaculum.

Figure 5



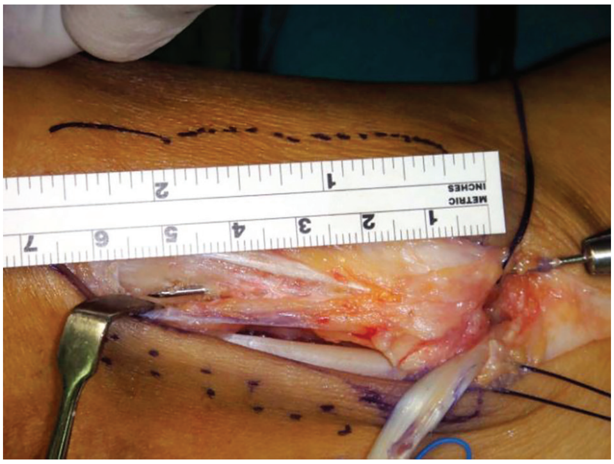
Proximal end of the tendon is sectioned.

Figure 6



Peroneus brevis tendon passed distally beneath the retinaculum.

Figure 7



A guide wire is passed from the tip of the lateral malleolus proximally and posteriorly.

A horizontal drill hole is made in the fibula 1 cm above the proximal exit of the rerouted tendon (Fig. 11), through which the peroneus brevis tendon is pulled and securely tensioned and tightened over itself in slight ankle eversion (Fig. 12).

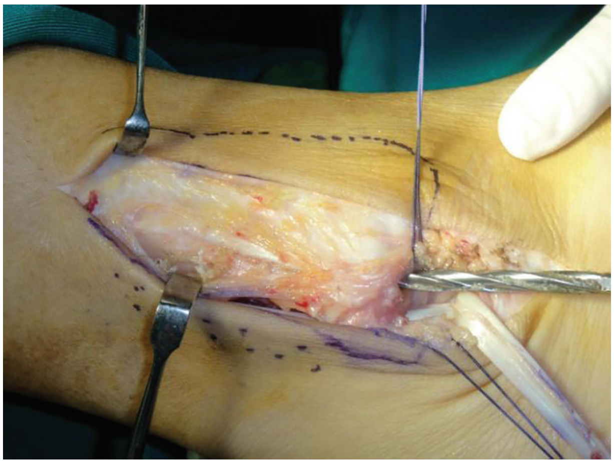
After surgery, all patients were placed in a short-leg cast with the ankle at 90° and in slight eversion, and they were kept non-weight-bearing for 3 weeks after surgery. Gradual weight bearing through full plaster for another 3 weeks was initiated in the fourth postoperative week. A structured rehabilitation program was initiated after cast removal 6 weeks postoperatively. Rehabilitation initiated with extension–flexion training, avoiding inversion movements for the first 4 weeks after plaster removal. Full range of motion and progressive sports activity is allowed 3 months after the operation.

Patients were followed up for a mean of 18.7 months (range 15–24 months, SD 2.87). All patients were evaluated for the functional outcome 1 year postoperatively with Tegner activity level [23] and scored according to the Karlsson scoring system [15,24]. Return to all activities desired by the patient, ligamentous laxity, pain, and any subsequent sprains were all monitored, and patient satisfaction scale was conducted at the 1-year follow-up.

Results

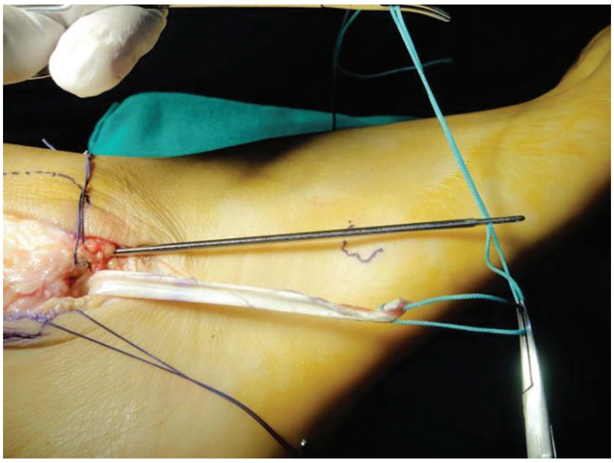
The resultant functional outcome of the patients was assessed with the Karlsson scoring system that assesses patients for pain, swelling, instability, stiffness, stair climbing ability, running, work activities, and need for support.

Figure 8



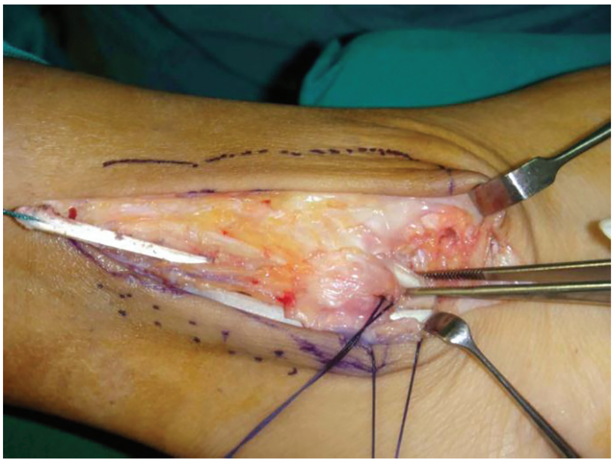
Cannulated drill bit 3.5 mm is used to drill the planned tunnel.

Figure 9



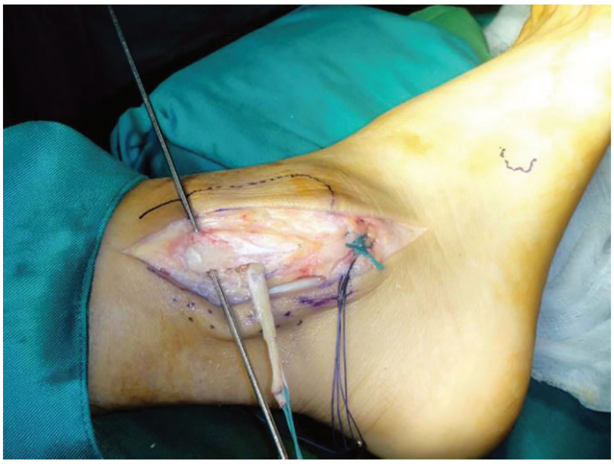
Proximal end of peroneus brevis tendon is passed by the help of anterior cruciate guide wire.

Figure 10



Peroneus brevis tendon emerging superiorly and posteriorly.

Figure 11



Horizontal drill hole 1 cm above the proximal exit of the rerouted tendon.

Two patients showed excellent results (scoring 91–100 on a Karlsson scale), whereas eight patients showed good results (scoring 81–90). The mean Karlsson score at 1-year follow-up showed a statistically significant increase from a preoperative mean of 61 ± 3.94 SD (through a range of 55–65) to a mean of 88.2 ± 3.97 SD (through a range of 82–95) (Chart 1).

Tegner activity level showed a significant increase from a preoperative mean of 3.3 ± 0.82 SD (through a range of 2–4) to a mean of 6.1 ± 0.57 SD (through a range of 5–7). All patients reported satisfaction for the overall outcome with a mean satisfaction score of 4.5 on a 0–5 satisfaction scale.

All ankles were either totally pain free (seven patients) or experienced only transient discomfort in the form of pain and swelling (three patients) with prolonged running or standing. Two patients reported minor sprains during the follow-up period, with no deleterious effects to the repair. They were treated routinely as minor ankle sprains.

One patient developed superficial wound infection, which was overcome with prolonged course of antibiotic therapy and regular dressing without affecting the postoperative program. One patient developed hypoesthesia upon removal of the plaster, which was spontaneously resolved in the fourth postoperative month.

Discussion

Although 80–85% of acute ankle sprains are successfully treated with a functional ankle-rehabilitation program, the remaining 15–20% have recurrent ankle instability and reinjury, necessitating surgical intervention [4,12,25]. The fundamentals of the surgical approach to lateral ankle instability are based on the anatomy of the lateral ankle ligaments, the ATFL, and the CFL [26].

Many clinical comparisons have been performed between anatomic repairs and reconstructive tenodesis [12]. Most authors reported better clinical outcome for the anatomical reconstruction group [27,28].

Other authors agree with the study by Rosenbaum *et al.* [29], who compared the outcome after anatomical reconstruction and the Evans tenodesis in a randomized controlled trial and showed that both methods produced comparable clinical and functional outcome within 1 year of surgery.

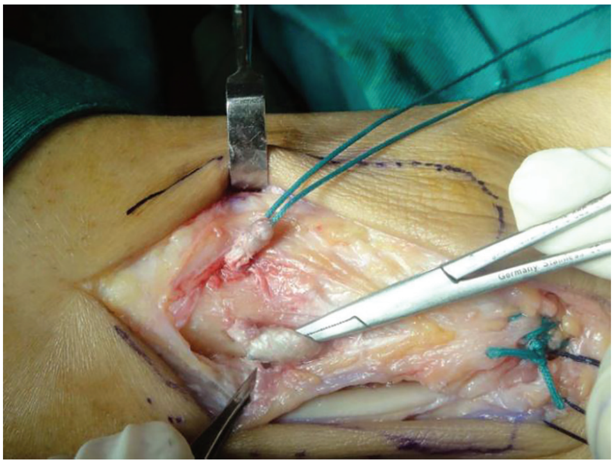
In contrast, Prisk *et al.* [30] stated that no lateral ankle ligament reconstruction completely restored native contact mechanics of the ankle joint and hindfoot motion patterns.

The ultimate goals of surgery are to reestablish ankle stability and function without compromising motion and without complications [12].

The effect of partial or complete sectioning of peroneus brevis tendon remains controversial.

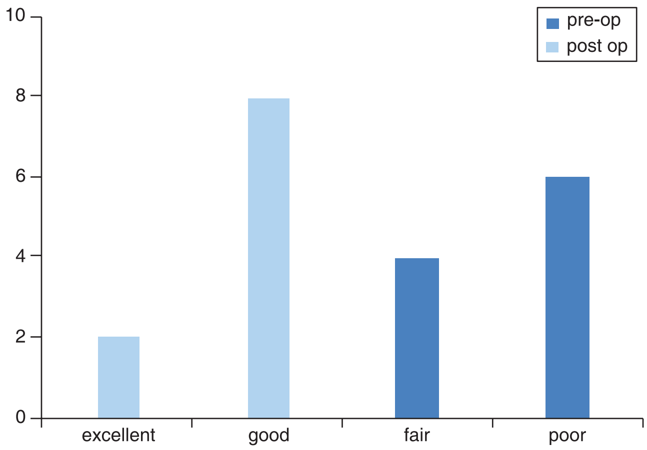
Baumhauer and Brien [12] stated that peroneus brevis is important in dynamic ankle stability and described procedures that sacrifice peroneus brevis tendon to weaken eversion strength of the ankle. In contrast, St Pierre and colleagues found through the Cybex II evaluation that surgical loss of the peroneus brevis muscle in the Evans lateral ligamentous reconstruction does not appear to result in a significant loss of

Figure 12



Peroneus brevis tendon is pulled and securely tensioned and tightened over itself.

Chart 1



Karlsson score before and after the operation.

eversion strength and power when compared with the contralateral normal ankle. Therefore, the authors contend that the loss of the peroneus brevis tendon should not be a factor in the selection of an operative procedure for lateral ankle instability [22].

The original Evans procedure is an operation that involves peroneus brevis tenodesis, sectioning the tendon proximally and transferring it through the lateral malleolus [16]. It has been used worldwide for decades and has the advantage of being a relatively simple procedure that improves lateral ankle stability. Clinical results were generally very favorable with success rates of 50–97% [11,29].

In this study, a modification on the original Evans procedure is proposed that entails rigid proximal fixation of the rerouted peroneus brevis tendon through an additional transverse tunnel proximal to the tendon aperture in the fibula. This rigid fixation is thought to courage earlier cast removal and involvement in rehabilitation program to avoid structural deterioration of the graft properties.

Karlsson and Lansinger [15] introduced a comprehensive scale that correlates well with the subjective and objective status of the ankle joint and concluded that it is a useful tool in the evaluation of the ankle joint function. The Tegner activity scale was considered as a good indicator of functional outcome after multiple orthopedic procedures and demonstrated acceptable psychometric parameters as patient-administered scores [31].

Li *et al.* [3], in a series of high-demand athletes with chronic lateral ankle instability, showed that 94% of patients were able to return to their previous sports activity level as demonstrated by the Tegner score. In addition, the average Karlsson ankle functional score was 92 ± 5.2 and 95 ± 3.1 at the 1- and 2-year postoperative time frame, respectively.

In the current study, two patients showed excellent results and eight patients showed good results on the Karlsson scale. The mean Karlsson score at 1-year follow-up showed a statistically significant increase from a preoperative mean of 61 ± 3.94 SD to a mean of 88.2 ± 3.97 SD. Tegner activity level showed a significant increase from a preoperative mean of 3.3 ± 0.82 SD to a mean of 6.1 ± 0.57 SD. All patients reported satisfaction for the overall outcome of the described procedure.

The more rigid fixation allowed for early involvement in rehabilitation program. Patients were placed in a non-weight-bearing short-leg cast for 3 weeks after surgery, followed by gradual weight bearing through the plaster for another 3 weeks. A structured rehabilitation program was initiated after cast removal 6 weeks postoperatively. Despite limited number of patients included in this study, the good results achieved would invite more studies for evaluation of this technique.

Conclusion

The modification of the Evans procedure as described in this study has been used in 10 consecutive patients of chronic ankle instability with good to excellent overall results. Secure tendon fixation achieves early cast removal, physical rehabilitation, and return to functional activities.

Acknowledgements

Conflicts of interest

There are no conflicts of interest.

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