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A Modified Technique for Fixation of Chronic Instability of the Distal Tibiofibular Syndesmosis Using a Wire and Button

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ABSTRACT

Distal tibiofibular syndesmosis injury accounts for 1% to 11% of soft tissue injuries of the ankle. Some acute syndesmotic injuries will fail to heal effectively owing to inadequate treatment or misdiagnosis, eventually resulting in chronic instability, which can destroy the stability of the ankle joint. Various surgical techniques have been described for fixation of the syndesmosis. Among the existing methods, the suture button has the advantage of allowing for physiologic micromotion at the syndesmosis by maintaining the reduction and preventing the risk of screw breakage. However, the "relatively" long suture between buttons can gradually relax under continuous loading, resulting in fixation failure, which we have termed *electric wire phenomenon*. In the present report, we have described a modified technique for flexible fixation using the Endobutton CL ULTRA fixation device by tricortical fixation, instead of quadricortical fixation, to allow for robust and reliable fixation of the distal tibiofibular syndesmosis. The modified technique is devoid of the concern regarding the use of screw fixation and can reduce the risk of displacement or elongation and skin irritation associated with the suture button.

The distal tibiofibular joint is a fibrous articulation in which the opposing surfaces are connected by ligaments (1). Since the first description by Quenu (2) in 1912, the recognition and treatment of syndesmotic injuries have remained controversial (3,4). These injuries are often caused by pronation–external rotation, pronation–abduction, and, infrequently, supination–external rotation mechanisms (5). Syndesmotic injury has mostly been associated with ankle fracture, with an incidence of 1% to 11% (6). Evidence based on management of syndesmotic injury is essential, because inadequate treatment or misdiagnosis of an acute syndesmotic injury can result in chronic instability, with persistent ankle pain, disability, and, eventually, arthritic changes in the ankle joint (7). Anatomic reconstruction of the distal tibiofibular syndesmosis is often required, and screw fixation has been the standard management in clinical practice. More recently, flexible fixation using the suture button device has been applied to stabilize the distal tibiofibular joint (8). In the present report, we have described a modified technique for flexible fixation of chronic instability of the distal tibiofibular syndesmosis using the Endobutton CL ULTRA fixation device (Smith & Nephew, York, United Kingdom).

Surgical Technique

The technical steps before insertion of the wire and button fixation device were similar to suture button fixation described by DeGroot et al (9). After reduction of the fracture, repair of the syndesmosis was initiated. For chronic instability of the distal tibiofibular syndesmosis, the fibrous scar and soft tissue in the distal syndesmosis can interfere with the reduction procedure and, therefore, should be trimmed thoroughly. The syndesmosis can then be reduced and maintained in position using a C-shaped clamp with the ankle in neutral flexion. Intraoperative fluoroscopy was applied to evaluate the fibular position and the accuracy of the syndesmotic reduction before final fixation. Anteroposterior, lateral, and mortise radiographs were taken to determine whether the tibiofibular relationship was correct. If a fibular plate was used, the button was placed through 1 vacant hole in the plate at an appropriate level. If not, or if the hole was not appropriately located or even unavailable in the plate, the button was placed directly against the fibula in a slightly posterolateral position. Under fluoroscopic guidance, a 3.5-mm drill hole was made through the fibula and tibia, angled approximately 30° anterior and located approximately 10 mm proximal to the distal tibiofibular syndesmosis level. The button was pulled through the tibia using the attached suture loop.

We modified the technique by tricortical fixation. The distance between the medial aspect of the lateral cortex of the tibia to the lateral aspect of the fibula through the hole was measured, and the button with an appropriate suture loop was chosen accordingly. Two separate

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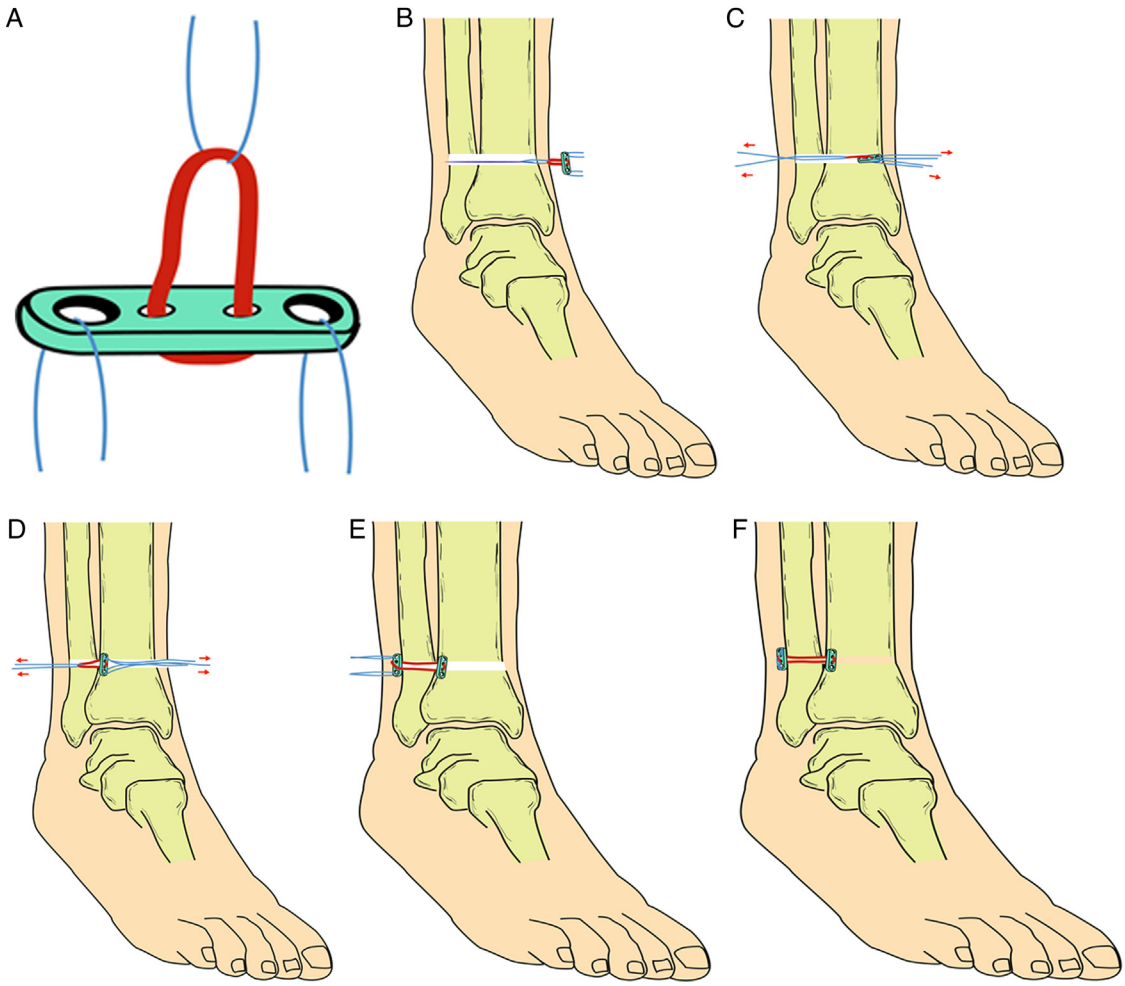

Fig. 1. Schematic diagrams showing the modified technique for fixation of chronic instability of the distal tibiofibular syndesmosis using the wire and button. (*A*) Three separate 2-0 Ethibond Excel™ polyester suture strands were passed through the bilateral apertures and the suture loop of the button. (*B*) Both free ends of the pull-through suture strand were attached through the eye of the pull-through needle and manually pulled through from the medial aspect to the lateral aspect of the bone channel. (*C*) The pull-through suture was pulled out and the button was inserted into the medullary space of the tibia from the medial hole at the same time. (*D*) The suture strands were adjusted at the bilateral apertures of the button during insertion, ensuring that the button was parallel to the axis of the tibia and nestled closely against the medial aspect of the lateral cortex of the tibia. (*E*) The second button was inserted just under the suture loop that had been pulled out from the lateral aspect of the fibula. (*F*) The suture strands of the second button were tied crosswise against the suture loop to prevent the loop from sliding off the button.

2-0 Ethibond Excel® polyester suture strands (Johnson & Johnson, Somerville, NJ) were passed through the bilateral apertures of the button, leaving the free ends of the suture stands for adjusting the button during insertion. Another 2-0 Ethibond Excel® polyester suture strand was passed through the suture loop. Next, both free ends of the pull-through suture strand were attached through the eye of the pull-through needle and manually pulled through from the medial aspect to the lateral aspect of the bone channel using a hemostat or needle holder, ensuring that the button was parallel to the axis of the tibia and nestled closely against the medial aspect of the lateral cortex of the tibia. Two separate 2-0 Ethibond Excel® polyester suture strands were also passed through the bilateral apertures of the second button. The second button was inserted just under the suture loop, which was pulled out from the lateral aspect of the fibula. Finally, the suture strands of the second button were tied crosswise against the suture loop to prevent the loop from sliding off the button (Fig. 1).

Discussion

Distal tibiofibular syndesmosis injury can be classified as acute, subacute, and chronic (10). A chronic syndesmosis injury has been defined as persistent syndesmotic widening 3 months after the injury. At that point, the ruptured anterior tibiofibular ligament, posterior tibiofibular ligament, and interosseous tibiofibular ligament have either healed in an elongated position or formed fibrous scar tissue. The latter has been more commonly confirmed at surgery. Each of these ligaments contributes 9% to 35% of the stability (11,12). Rupture of 2 or more of these ligaments can lead to instability. Although most published works on the management strategies for chronic syndesmotic instability have consisted of case reports that have detailed a wide variety of approaches, repair or reconstruction has often been unable to achieve a satisfactory outcome comparable to that for acute syndesmotic injury (13).

For distal tibiofibular syndesmosis injury, especially for an acute injury, a variety of approaches have been used, including syndesmotic screw fixation (currently considered the reference standard), bioabsorbable screw fixation, syndesmotic hook fixation, integrated syndesmotic fixation with a nail (ANK nail), direct repair, staples, and the use of suture loops, with or without buttons (3,14–16). However, not all these strategies for an acute injury will be effective for chronic syndesmotic instability. Although syndesmotic screw fixation of the distal tibiofibular syndesmosis has remained the preferable option for