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Original Research Article

Pull out suture using the plunger flange of the syringe, a better alternative to the button

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ABSTRACT

Background: Tendon avulsions within zone 1 of the hand presents challenges for repair. The traditional technique involves using a button to secure the tendon sutured to the bone. This study explores an alternative method utilizing the plunger flange of a syringe.
Materials and Methods: The study involved patients with zone 1a and 1b injuries. The plunger flange technique was employed by drilling two holes in the plunger, passing a polypropylene suture through them, and securing it with a sterile knot. The technique was compared with the traditional button approach.
Results: The plunger flange technique demonstrated feasibility and effectiveness in tendon avulsion repair. Plunger flanges, which eliminated the need for separate sterilization, were more readily available. Patients could initiate therapy sooner post-surgery. Complications, although limited, resembled those of the traditional button method.
Conclusion: The plunger flange technique presents a viable alternative to the button in repairing tendon avulsions. This method is easily accessible, doesn't require separate sterilization, and allows for early therapy initiation. The study suggests that the plunger flange technique could be recommended as a replacement for the button.

1. Introduction

Tendon avulsions within zone 1 of the hand represent a complex and challenging subset of injuries that require careful consideration and innovative surgical approaches. Traditionally, the button technique, first introduced by Bunnell[1] in 1944, has been a cornerstone for repairing tendon avulsions by anchoring the sutured tendon to the bone using a button secured over the finger nail. This method, though pioneering, has undergone modifications to enhance its applicability. For instance, Mantero et al[2] further adapted the technique by situating the button over the fingertip, eliminating the need to pass it through the distal phalanx. The intricate nature of zone injuries necessitates a systematic classification for effective management. Moimen and Elliot's[3] classification divides laceration injuries within zone 1 into three distinct subgroups (Figure 1). Group 1a encompasses lacerations distal to the A5 pulley, presenting a challenge in placing core sutures due to the anatomical complexity. Zone 1b injuries reside between the distal edge of the A4 pulley and zone 1a, while zone 1c encompasses injuries beneath the A4 pulley. Consequently, zones 1b and 1c often lend themselves to conventional tendon repair techniques, while zone 1a avulsions pose a unique dilemma.[4]

The management of avulsions or complete disruptions of the flexor digitorum profundus tendon within zone 1a commonly involves the application of a pullout suture technique tied over a button, as advocated by Bunnell.[1]

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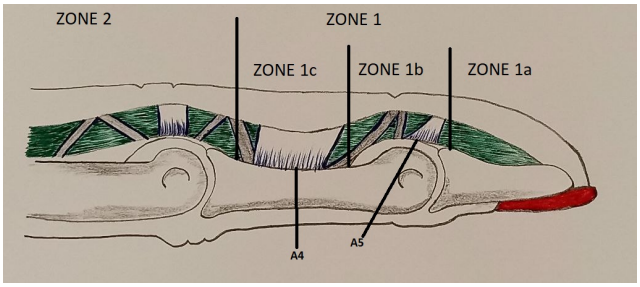

Fig. 1: Sub-classification of zone 1 FDP injury

This technique, while established, has been scrutinized for its limitations, prompting the exploration of innovative alternatives to optimize tendon repair outcomes.[5]

The current study investigates a unique alternative to the traditional button technique by utilizing the plunger flange of a syringe. This novel approach presents the potential to address the challenges associated with the button technique, particularly in terms of procedural efficiency, availability, and early postoperative rehabilitation.

While the button technique has demonstrated its utility, it is not without limitations. Challenges in locating appropriately sized buttons in the fast-paced environment of an operating theater have raised concerns regarding procedural delays and the potential impact on patient outcomes. In contrast, the plunger flange technique offers the advantage of simplicity, immediate availability within operation theaters, and a potentially smoother surgical workflow.

To explore the feasibility and effectiveness of the plunger flange technique, this study compares its outcomes with those of the traditional button approach in patients with zone 1a and 1b injuries. By systematically evaluating aspects such as surgical feasibility, postoperative complications, and the timeline for initiating therapy, this study aims to contribute valuable insights to the field of tendon avulsion repair within zone 1 of the hand.

The overarching goal of this study is to introduce and validate the plunger flange technique as a potentially superior alternative to the traditional button method, thereby expanding the armamentarium of surgical options available for managing tendon avulsions within zone 1 of the hand.

2. Materials and Methods

2.1. Technique

In case of zone 1a and 1b injuries the routine method is reinsertion of tendon onto distal phalanx using a modification of the technique as described by Bunnell. Here a two-strand 3-0 or 4-0 Polypropylene core tendon suture is passed through the bone and nail complex and tied over a button. However, in this study we have used plunger flange instead of button.

Numerous techniques have been developed to repair flexor digitorum profundus tendon after avulsion or laceration.[5] Commonly internal or external fixation using bone anchor or buttons are preferred.

In our study we have used plunger flange instead of button.

To substitute the button; firstly, we have removed the plunger flange from the syringe and then drilled 2 small holes on the plunger flange with a 1.5 mm k-wire (Figure 2). A 3-0 polypropylene suture is then passed through these holes, after that we have placed a piece of sterile gauze between the 2 threads and tied with a simple knot (Figure 3) resembling button system.

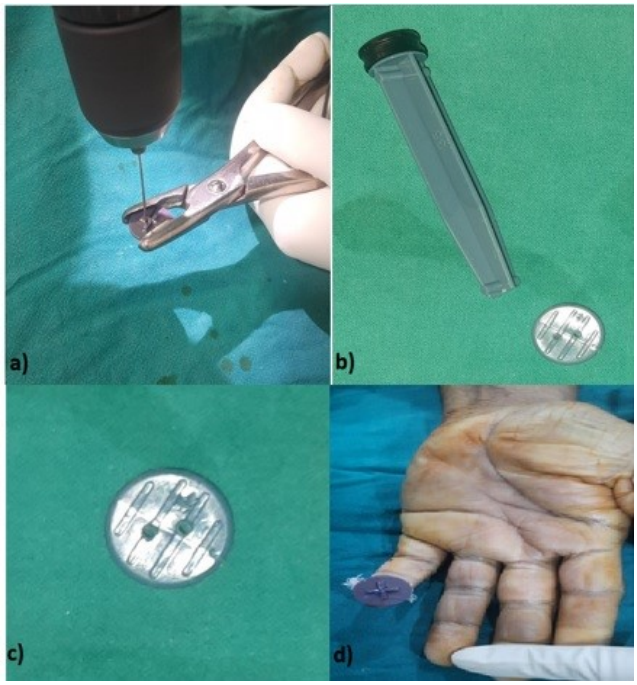

Fig. 2: a): Holes are being made into separated plunger end via K-wire and drill machine; **b**): Separated plunger end is shown with 2 holes made in it; **c)**: Enlarged view of plunger end with holes, for passage of suture; **d**): Sutures passed via modified plunger end after extensor tendon repair

We also diverge the holes towards pulp in mallet fracture and try to avoid nail if applying from volar side.

Or larger syringe can be used depending on the size necessary (Figures 4 and 5)

This technique allows patients to start therapy soon after surgery. The first dressing is done after 10 days; however, proximal joints can be mobilized during that time. At 6 weeks we remove plunger flange in office or OPD after which involved joint can be mobilized.

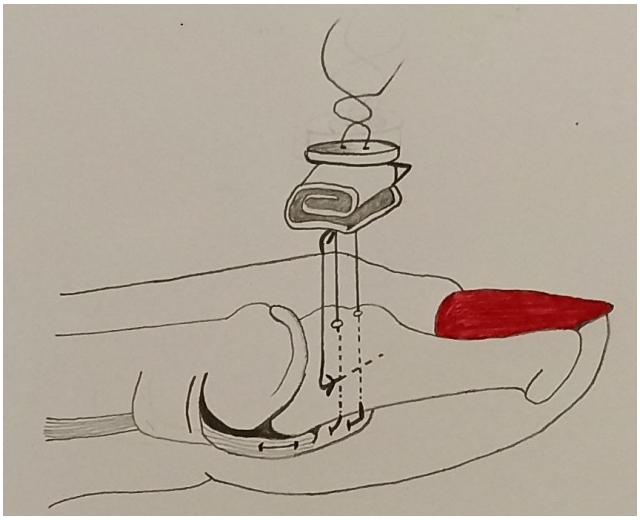

Fig. 3: A sterile gauze between 2 threads and tied with a simple knot over the plunger flange

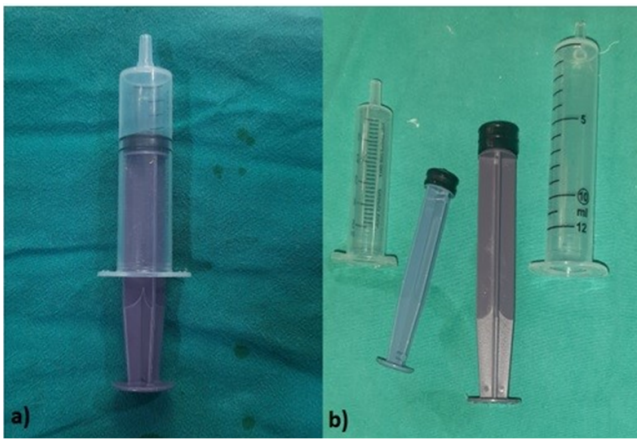

Fig. 4: a): A 10 ml syringe; **b)**: A 5 ml and 10 ml syringes with plunger pulled out and showed separately

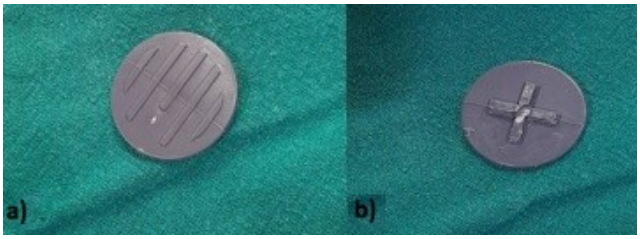

Fig. 5: a, **b**): Both sides of the pushing end of plunger shown separately

3. Results

The plunger flange technique demonstrated notable feasibility and efficacy in the repair of tendon avulsions within zone 1, thereby shedding light on its potential as a valuable alternative to the conventional button method.

The study underscores the value of the plunger flange technique as a viable alternative for repairing tendon avulsions within zone 1. While acknowledging the shared complications, the technique's enhanced availability, ease of preparation, and procedural efficiency present compelling attributes that warrant further exploration. The outcomes of this study contribute to the evolving discourse on innovative methods for improving the management of tendon injuries within this challenging anatomical region.

4. Discussion

In the realm of tendon repair techniques,[6,7] the plunger flange emerges as an intriguing alternative to the conventional button approach, offering a range of advantages that address longstanding challenges. One of the prominent advantages lies in the simplicity of procurement and preparation of the plunger flange, a departure from the logistical complexities of finding appropriately sized buttons. Particularly in bustling operation theaters where time-sensitive decisions are commonplace, the ease of access to plunger flanges could significantly streamline surgical procedures.

The enhanced availability of plunger flanges in every operation theater provides a noteworthy benefit. Unlike buttons, which might require specific sizing and planning, plunger flanges are ubiquitous due to their standard presence in various medical contexts. This inherent availability aligns well with the dynamic and unpredictable nature of clinical settings, offering surgeons a readily accessible tool to facilitate efficient and consistent repair procedures. The plunger flange's accessibility is in stark contrast to the scenario where button availability can lead to delays and compromises in patient care.

In comparing the usability of plunger flanges to the traditional button technique, it's important to consider the convenience factor. Plunger flanges can be swiftly prepared, and their use is straightforward, reducing the intricacies associated with the traditional button technique. This convenience might have a cascading effect, potentially expediting the overall surgery and allowing medical professionals to focus more on the surgical nuances rather than grappling with technicalities. Furthermore, the relative simplicity of the plunger flange technique might facilitate its adoption among surgeons, ultimately leading to a broader and more consistent application.

However, as with any medical procedure, a balanced consideration of potential complications is imperative. While the plunger flange technique exhibits advantages,

its associated complications must be acknowledged. Interestingly, the complications associated with the plunger flange technique closely resemble those of the traditional button method.[8–10] These complications encompass issues such as local wound irritation, nail deformities, skin necrosis, pain, infection, and the potential for snagging or rupture of the repair.[11–13] The overlap in complications between the two techniques underscores the importance of rigorous postoperative monitoring and care,[14,15] regardless of the method employed.

It is noteworthy that a comprehensive understanding of these complications can inform surgeons in anticipating and mitigating potential risks, ensuring that patients receive optimal care throughout their recovery journey. Further, studies may be warranted to elucidate any nuances or variations in complication rates between the plunger flange technique and the traditional button approach, enabling a more nuanced assessment of the risk-benefit profile.

5. Conclusion

Our technique using the planger flange is simple and easily reproducible in operation theatre. Contrary to button, the plunger flange doesn't need to be sterilized separately; it is also readily available across an array of sizes. Thus, the authors recommend the plunger flange as a better alternative to the button.

6. Source of Funding

None.

7. Conflict of Interest

None.

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