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Novel Abu Dhabi Subpectoral Biceps Tenodesis (ADSBT) Technique: Onlay Double Docking System Using Cortical Button

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Abstract

With more widespread use of biceps tenodesis, fairly high rate of mechanical failure and complications have been reported. This has led to a significant number of revision subpectoral tenodesis cases. To address this complication, the senior author, proposed a novel open subpectoral biceps tenodesis technique: Onlay double docking system using cortical button. The technique can be used for primary biceps tenodesis as well as revision indication that requires more reliable and rigid fixation strength and thus improving healing potential.

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Introduction

To manage superior labrum-biceps complex lesions like partial tears of the Long Head Biceps (LHB), SLAP lesions, biceps pulley lesion, subluxation or dislocation of LHB, biceps tenodesis is good option considering supination strength, tension length relationship, cosmesis especially in young and active patients [1-3]. Biceps tenodesis can be performed arthroscopic or open, suprapectoral or subpectoral with many kinds of techniques and implants. The implant(s) that provides the best fixation and outcome is debatable, and also which technique is optimal [4]. Although, clinical outcomes of biceps tenodesis have been satisfactory, fairly high rates of mechanical failure and complications have been reported in greater frequency due to increase in use [5]. To improve possible outcome, and decrease failure, the senior author, proposed an alternative method of fixation, the novel open, onlay, subpectoral biceps tenodesis technique, double docking system using cortical buttons. This technique can be used in primary as well as revision biceps tenodesis cases that require more reliable fixation strength and higher healing potential.

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Technique

The patient is placed in a beach chair position with 30° of shoulder abduction.

Longitudinal skin incision is made on the medial side of the axilla along the biceps and centered the inferior margin of pectoralis major tendon. Dissection proceeds by retracting the conjoined tendon medially and the pectoralis major superiorly. Finally, the long head of biceps tendon is identified and retrieved.

The tendon is whipstitched with two separate sutures (FiberLoop No. 2; Arthrex, Naples, Florida, USA), one is started at the musculotendinous (MT) junction of biceps and the two limbs terminates 2cm proximal to MT junction. The second suture begins from 1.5cm proximal to MT junction and overlaps the previously placed suture and ends 4cm proximal to MT junction. Four suture limbs are now available for dual cortical button fixation. Excessive tendon is trimmed (Figure 1A).

The lower sutures limbs, 2cm proximal to MT junction, are threaded limb by limb through the proximal and then distal holes of the cortical button (Cortical button; Arthrex, Naples, Florida, USA) respectively, and alternatively exit back through the opposite hole. The same procedures are carried out for the proximal suture limbs, 4cm proximal to MT junction (Figure 1B).

Two 3.2mm uni-cortical holes are made at 10mm distal and 10mm proximal to superior margin of pectoralis major tendon. The resultant construct is matched with cortical buttons located at the 2cm and 4cm proximal to the MT junction of biceps tendon. This is for better tension length relationship according to the anatomic study of Lafrance et al. resulting with the MT junction being located 3cm distal to the superior border of the pectoralis major tendon whose humeral insertion measure 76.8mm [6]. Bone bed preparation is done with round burr on the bicipital groove between the 2 holes to enhance tendon-bone healing process.

The cortical buttons are sequentially placed, distal to proximal in the respective unicortical hole and flipped in the medullary canal. The four free suture limbs are pulled, to reduce the biceps tendon on the bicipital groove using a sliding technique with the elbow in the extended and supinated position. Tightening of each cortical button is applied gradually and in an alternating fashion to prevent tension mismatch at the tendon between the two holes (Figure 1 C,D).

Once the tendon was fully seated on the bicipital groove, free sutures were passed through the tendon and tied to complete the repair (Figure 2 A,B).

Discussion

The ADSBT (Abu Dhabi subpectoral biceps tenodesis) technique, a novel onlay double docking subpectoral biceps tenodesis has several advantages compared with previously reported subpectoral biceps tenodesis techniques.

Firstly, our technique can allow more surface for the tendon bone healing between the two unicortical holes (2cm distance on bicipital groove). Recent animal model study demonstrated that tendon to bone healing in the biceps tenodesis occurred at the cortical surface rather than bone tunnel [7]. Because our technique has two-points of fixation, biceps tendon can have more contact surface area to the bicipital groove where the decortication procedure has been completed. Theoretically, this will result in better healing.

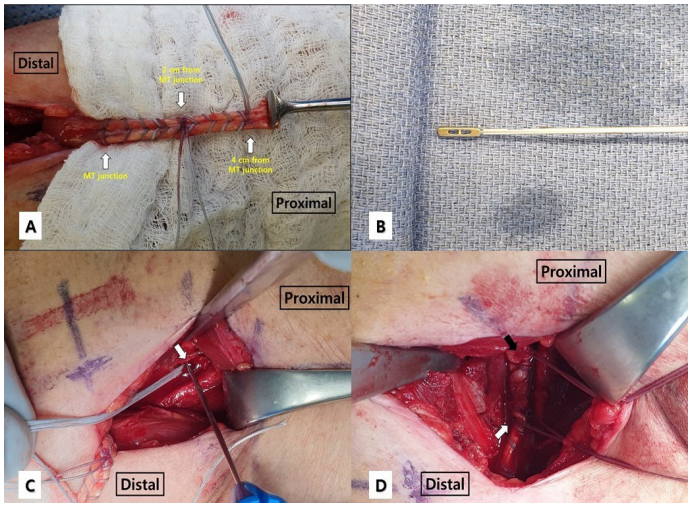

Figure 1: Perioperative images of onlay double docking subpectoral tenodesis using cortical button. **(A)** Two separate whipstitch sutures (FiberLoop No. 2; Arthrex, Naples, Florida, USA) were made, one started from the MT junction of biceps long head which leave 2 limbs at 2 cm proximal to MT junction, the other started from 1.5 cm proximal to MT junction and overlaps the previously placed suture which ends 4 cm proximal to MT junction for the endo button fixation. MT: musculotendinous **(B)** Cortical button with two holes for suture thread (Cortical button; Arthrex, Naples, Florida, USA) **(C)** Place the suture threaded cortical button in the proximal unicortical hole and flipped in the medullary canal (arrow) **(D)** The our free suture limbs are pulled from proximal hole (black arrow) and distal hole (white arrow) to reduce the biceps tendon on the bicipital groove.

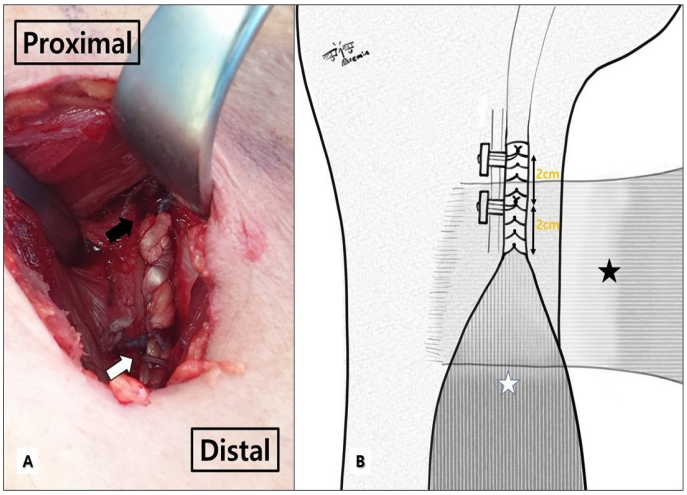

Figure 2: Perioperative image **(A)** and schematic illustration **(B)** of final construct of onlay double docking subpectoral tenodesis using cortical button. Once the tendon was fully seated on the bicipital groove, free sutures were passed through the tendon and tied over the proximal hole (black arrow) and distal hole (white arrow) to complete the repair. Black asterisk: pectoralis major tendon, White asterisk: Long head of biceps.

Secondly, only small unicortical holes (3.2mm) are required for fixation that can minimize the risk of humeral neck fracture. The cortical bone hole is a stress riser for humeral fracture and the size of cortical hole is known to have direct relationship with torsional load to failure [8]. The interference screw technique requires 7-9 mm bone tunnel, thus requiring lower energy to create fracture as compared to the currently described technique, thus, our technique can likely minimize the risk of humeral fracture.

Thirdly, onlay techniques have demonstrated improved soft-tissue fixation than inlay techniques in terms of mechanical failure. In a prospective randomized study comparing the onlay technique using suture anchor and inlay technique using interference screw, the inlay technique showed higher risk for anatomical failure, that results from tendon damage can be caused by acute angle between tendon and hard cortical bone surface. Additionally, the tendon length mismatch can be caused by a "double-loop" phenomenon [2]. Several cadaveric time zero studies reported no difference in biomechanical strength between inlay technique and onlay technique, some reported higher construct failure rate with cyclic loading test in inlay technique [9,10]. Furthermore, the current technique has two points of onlay fixation, resulting in likely higher pull-out strength, and construct stability.

Lastly, the length of whipstitches and location of uni-cortical holes in the current technique is based on the anatomic study which demonstrated the relationship of MT junction of LHB and the superior and inferior border of pectoralis major tendon [6]. Tension length mismatch issue can be minimized even in revision cases where the normal anatomy is already altered.

Lack of biomechanical data and long term follow up result can be limitations of this study, which expected to be filled up with following studies.

In conclusion, our novel onlay double docking subpectoral tenodesis technique using cortical button can be a good option for the primary biceps tenodesis case as well as the revision case which need more reliable fixation strength and higher healing potential.

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