One-year minimum follow-up results following distal biceps tendon repair using tension slide technique

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Background
Tears of the distal biceps tendon are unusual and most often result from an injury or lifting a heavy object. These tears are usually complete and the muscle is separated from the bone and retracted back, causing weakness in supination and mid-prone elbow flexion. We present our results of patients undergoing repairs of these tears using the tension slide technique through a single longitudinal anterior incision who were followed up for a minimum of 1 year.
Patients and methods
A total of 17 patients with acute distal biceps tendon rupture were treated surgically by two surgeons, at two independent centers, using the tension slide technique (Arthrex) between 2017 and 2019. Patients were evaluated retrospectively at a minimum of 1-year follow-up using the patient-reported outcomes Quick Disabilities of the Arm, Shoulder, and Hand (DASH), Oxford elbow score (OES) and EQ-5D-5L.
Results
The average age at the time of injury was 49 years. All patients were right-hand dominant. Eleven injuries were on the right and remaining on the left side. All patients were males, and there was no documented history of anabolic steroid use. The average time to surgery, following injury, was 6 weeks. The mean postoperative DASH score was 4.4, the average OES was 49.17, and mean European quality of life five dimension (EQ5D) Vas was 84. The elbow range of motion (ROM) was comparable to the healthy contralateral side. There were no reported major complications, although we did have two (11%) minor complications: one case with delayed wound healing and the second patient with a delayed infection, treated with oral antibiotics for 14 days.
Conclusions
The utilization of the tension slide technique for repair of acute distal tendon biceps rupture using Endobutton and interference screw is safe. The complications were minor, and the function was excellent as reflected with OES and DASH scores.

Keywords:
biceps reinsertion, distal biceps lesion, single incision, tendon rupture

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Introduction

Acute distal biceps tendon rupture occurs commonly in middle-aged active men [1]. The most common mechanism of injury is an eccentric muscle contraction against a heavy load, occurring during a sudden or unexpected extension of an elbow, which is usually flexed to 90° [2].

Typically, patients present with significant weakness, especially during lifting heavy objects and doing manual jobs. Clinically, patients mostly present with swelling, bruising, and palpable tendon gap on the antecubital fossa of the elbow evidenced with positive Hook and Popeye signs. Reduced strength in forearm supination and elbow flexion is usually observed [3,4].

Repair is considered the gold standard treatment of acute rupture, as nonoperative treatment is associated with weakened forearm flexion and supination [5–8]. However, nonoperative treatment can be considered in older and inactive patients or patients with multiple medical comorbidities [9].

Boyd and Aderson described the original 2-incision technique [10]. Nevertheless, complications have been reported as heterotopic ossification (HO), postoperative stiffness, and weakness compared with the uninjured extremity [11]. Hence, the single-incision techniques became more popular with the evolution of different fixation techniques, including the use of a tenodesis screw, the tension slide technique with a cortical EndoButton, suture anchors, and a double-incision bone tunnel [12].

In this study, we adopted the tension slide technique using an Endobutton and cortical screw for acute distal biceps tendon rupture.

Patients and methods

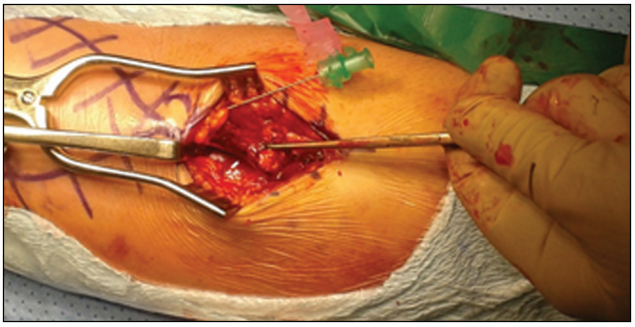
This was a retrospective double-center study conducted from April 2017 to June 2019 for patients with an acute distal biceps tendon rupture. Inclusion criteria were patients 18 years or older who had been diagnosed with acute complete distal biceps tendon rupture evidenced by U/S or MRI, and patients who had the procedure within a minimum of 12 months previously. Exclusion criteria were partial tendon ruptures, previous ipsilateral elbow surgery, injuries or surgical procedures involving the contralateral elbow, stiffness of the elbow, evidence of elbow joint osteoarthritis or inflammatory arthropathy, inability to return for postoperative follow-up, and chronic distal biceps tendon rupture requiring allograft tendon reconstruction. This study had the approval of the hospitals local ethical committee board. All patients whose data have been collected and presented, have consented to participate in this research project.

The technique was performed through a single incision (Fig. 1) and using Biceps-Button and Bio-interference screw (Smith and nephew).

Anteroposterior and lateral radiographs were recorded in the affected elbow in a neutral position both intraoperatively and postoperatively. The radiographs were used to confirm the appropriate placement of a cortical button against the far cortex of the radial tuberosity and to assess for radioulnar synostosis.

A total of 20 patients who underwent EndoButton cortical screw fixation were eligible for the study. Patients were followed up in the clinic at 3, 6, and 12 months to undergo physical examination and completion of functional outcome scores. Overall, 17 patients were successfully recorded. The Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire was conducted on all patients. Oxford elbow score (OES) and EQ-5D-5L scores were recorded for all patients (Table 1).

Figure 1



Intraoperative photograph showing delivery of biceps brachii tendon.

Follow-protocol

All patients underwent a similar physiotherapy protocol at both institutions. Patients were placed into a crepe bandage after surgery, which was removed to begin active range of motion (ROM) at day 1 postoperatively. After 6 weeks of restricted heavy weight lifting, patients were advanced to a 10-lb lifting restriction, and at 12 weeks, they returned to normal sport activates (Figs 2 and 3).

Results

A total of 20 patients had been enrolled in this study, but 17 patients met the inclusion criteria based on our chart review. Demographic information is summarized in Table 1. The mean age at the time of follow-up was 48.88 years, and the time from injury to time of surgery was less than 6 weeks. All participants who consented coincidentally were male, which is consistent with the literature.

All patients were satisfied with their outcome and were able to return to their normal daily activities and their jobs. No neurovascular complications occurred. There was no clinical or radiological evidence of heterotrophic ossification in any patient. All patients had an intact biceps tendon and had normal biceps muscle power. None of the patients experienced failure of fixation with immediate active motion. Patients achieved near-full ROM and near-complete return of strength and endurance without any complications.

The mean follow-up was 14.5 months (12–18). The mean DASH score was 4.4, the average OES was 49.17, and the mean European quality of life five dimension (EQ5D) Vas was 84.

Discussion

Distal biceps tendon rupture is an uncommon musculoskeletal injury that predominantly affects middle-aged men employed as manual workers [13]. Rupture of the distal biceps brachii tendon is an injury that may result in significant weakness and limitation of function in those affected, particularly in patients whose occupations require frequent heavy lifting or are laborer. Many authors compared nonoperative and operative management of distal biceps ruptures. The results were superior in terms of function and return to work in the surgical group [5,14,15].

Boyd and Anderson [9] reported the first two-incision technique, which was afterward modified by Morrey *et al*. [4]. However, the drawback of this technique

Table 1 Demography of patients and results

DoB	Date of surgery	Occupation	EQ. 5D mobility	Self-care	Usual activities	Pain/ discomfort	Anxiety/ depression	EQ. 5D VAS	UEFI (/80)	OES (/48)	QuickDASH	QuickDASH work	QuickDASH sports/arts	Complications (patient reported)
27/9/86	06/19	Double glazing fitter	1	1	2	2	2	80	N/A	60	13.63	25	31.25	
1312/90	09/18	Steel worker	1	1	1	1	2	90	75	55	4.54	0	18.75	Superficial infection
1312/90	06/19	Steel worker	1	1	1	2	2	90	80	60	2.27	0	0	
10/12/79	10/17	Electrician	1	1	1	1	1	100	N/A	54	0	0	0	
14/8/73	06/17	Electrician	1	1	1	1	1	95	80	56	4.54	6.25	N/A	
23/11/77	01/17	Police Surgeant	1	1	1	1	1	90	80	60	0	0	0	Superficial infection
28/12/61	3/09	Transport manager	1	1	2	2	3	45	80	47	0	0	NA	
29/11/61	5/09	IT consultant	3	3	4	3	2	40	55	35	31.8	6.25	NA	
27/6/59	2016	Telephone engineer	1	1	1	1	1	98	77	37	11.36	18.75	NA	
4/2/53	4/12	IT manager	1	1	1	1	1	90	80	47	0	0	0	Corner of wound took a week longer to heal than the rest
27/7/69	9/12	Railway signal technician	1	1	1	1	1	93	80	48	0	0	0	
8/12/66	9/12	Lorry driver	1	1	1	1	1	90	80	48	0	0	NA	
6/3/70	5/12	Telecoms engineer	1	1	1	1	1	80	80	48	0	0	NA	
1/5/70	9/13	Double glazing fitter	1	1	1	1	2	87	78	44	4.55	12.5	NA	
27/6/67	6/14	Painter	1	1	1	1	1	75	39 (this does not correlate with DASH answers)	48	0	0	0	
23/6/63	2/12	Shared service director	1	1	1	1	1	95	80	48	0	0	0	
5/4/75	5/13	Fireman	1	1	1	2	1	90	78	41	2.27	12.5	18.75	

DASH, Disabilities of the Arm, Shoulder, and Hand.

Figure 2

Clinical photograph 3 months postoperatively showing full right forearm supination.

Figure 3

Clinical photograph 3 months postoperatively showing good right biceps contour.

included radioulnar synostosis and heterotopic ossification [16]. With the evolution in fixation devices, including the development of the suture anchor, single-incision repair popularity has risen again, and there are now many single-incision surgical options available [16–19].

Bain *et al*. [20] reported the first series of distal biceps tendon rupture treated with the EndoButton fixation technique. Biomechanical tests for several methods of distal biceps tendon repair were reported. EndoButton fixation was significantly better than suture anchor, bone tunnel, and interference screws [17,21]. EndoButton and TST have been shown to have the highest ultimate tensile load [22]. Clinical studies with the EndoButton have also demonstrated good results with few complications [20]. Another advantage is the ability to start early active ROM exercises compared to other fixation methods. In our present study, we adopted both fixation methods EndoButton and interference screws with no reported implant failure or loosening. All our patients regained their elbow function in less than 6 weeks with a return to their occupations in 3 months.

Our present study shows that clinical outcomes are comparable to those reported previously in the literature. Gasparella *et al*. [23] reported a DASH score of 4.7 (0–10.8), Grewal *et al*. [18] reported a DASH score of 7.8, and Citak *et al*. [24] reported a DASH score of 10.5, which are comparable to our results, with a DASH score of 4.4.

The complications in our study are also comparable to those reported by Dunphy *et al*. [25], with a 20.7% rate of lateral antebrachial cutaneous nerve paresthesia overall, and Cain *et al*. [26], who observed a 26.2% rate in association with all techniques and a 27.1% rate in association with the single-incision techniques [12]. In this article, no major complications are reported including paresthesia or re-rupture. The explanation might be based on our technique, by limiting the amount of tissue present between the bone and retractor and ensuring proper retractor placement. Moreover, ensuring that the repaired biceps tendon is in its anatomical tunnel behind the bicipital aponeurosis decreases the risk of compressing the brachial artery and improves the tendon glide and excursion.

This study is not without weakness. The retrospective nature of the study design may have introduced selection bias and variations in treatment over time. More importantly, shorter duration of clinical follow-up compared with QuickDASH follow-up, which although adequate to determine results regarding pain relief, function, and activity, may not be enough to jump to conclusions regarding long-term outcomes. It was difficult to have all patients return to the clinic for a clinical examination for study purposes, especially with the COVID situation. The low number of patients is another drawback of this study.

On the contrary, the strengths of the study include it being a double-center study series. The benefit of multiple surgeons is that the results and conclusions of the present study are more generalizable. Another strength is that all clinical measurements were performed by the same individual, that is, the principal author. As such, there was minimal variation in data collection that may have affected results.

Conclusion

In our experience with this technique, we have demonstrated good patient satisfaction as all patients returned to their occupations with no major complications. However, further studies need to be conducted. Single-incision repair of distal biceps rupture using the tension slide technique is a safe and effective technique allowing the surgeon to perform an anatomic distal biceps repair with a single-incision approach.

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Conflicts of interest

There are no conflicts of interest.

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