ISOKINETIC AND FUNCTIONAL EVALUATION OF DISTAL BICEPS RECONSTRUCTION USING THE MAYO MINI-DOUBLE ROUTE TECHNIQUE

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ABSTRACT

Objective: To evaluate the functional outcome among patients with distal biceps injuries who were operated using the Mayo mini-double route technique, with a minimum follow-up of six months after surgery, through digital isokinetic dynamometry, goniometry and subjective scores in order to establish objective and subjective improvement patterns and discuss the effectiveness of the procedure. Methods: Nine patients who underwent surgery to treat distal biceps injury were evaluated by means of Cybex digital dynamometry using an angular velocity of 30°/s with five repetitions and 120°/s with 15 repetitions, in comparison with the uninjured side. DASH (Disabilities of the arm, shoulder and hand), Mayo elbow score and conventional goniometry were also used. Results: Digital dynamometer showed that using the angular velocity of 30°/s with five repetitions, there was an average flexion deficit of 9.6% and an average supination deficit of -28.97%. Using an angular velocity of 120°/s with fifteen repetitions, the average flexion deficit was 4.43% and the average supination deficit was -24.1%. Conclusions: The loss of flexion followed the pattern already shown in the literature. However, in our series, there were supination strength gains, possibly due to the strict rehabilitation protocol. The technique used in this study was safe and low-cost, with few complications and good functional results.

Keywords - Tendon Injuries; Tendons/surgery; Treatment Outcome

INTRODUCTION

Avulsion of the distal tendon of the brachial biceps is an uncommon injury that accounts for around 3% of all injuries of the biceps tendon. It mainly affects the dominant arm, in active middle-aged men (in their fifth and sixth decades of life)[1].

The brachial biceps is a muscle with insertion in the radial tuberosity and, because of this anatomical position, its main biomechanical function is to perform supination of the forearm. It is also considered to be secondary flexor of the elbow. Elbow flexion is optimized through supination, and the maximum torque with the elbow is at flexion of between 90º and 110º[2-4].

The injury mechanism is usually traumatic, and injury occurs when an eccentric load of 400 newtons or more is applied to the forearm with the elbow at 90°[4-6]. Tendons with degenerative characteristics secondary to bursopathy and conditions that affect collagen metabolism may also be factors predisposing towards this type of lesion[2,7-11].

The clinical condition comprises sudden acute pain in the region of the cubital fossa that persists for a few hours, followed by a less intense pain that may

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continue for some days or even months. In the physical examination, edema may be observed in the same region, accompanied by ecchymosis[1-21].

The belly of the biceps retracts proximally to produce a distal defect, thus forming the inverted Popeye sign, which is enough to suggest that a lesion is present[1,5,12,14,16,17]. Loss of movement is not a significant characteristic, but loss of strength occurs, particularly for performing supination of the forearm, with a deficit of around 40%. Since the loss of flexion strength is around 30%, it may go unnoticed by the patient[2-4,8,12,13,18].

The diagnosis is clinical, and the hypothesis of the lesion can be confirmed by means of imaging examinations (ultrasonography and magnetic resonance)[1-21].

The treatment for ruptures of the distal tendon on the biceps can be conservative or surgical[1-21]. With conservative treatment, the loss of muscle strength for supination is maintained[1,2,8,18]. This suggests that surgical repair might be more indicated for athletes, patients with high functional demands and patients who do not accept loss of strength or esthetic deformity[1,4,7].

Surgical repair may attain a muscle strength level similar to that of the unaffected contralateral limb[2,3,6,8-12,20]. Studies on surgical treatment have demonstrated high levels of muscle strength and resistance for the elbow flexors and forearm supinators after surgical repair[2,3,6,8-17,20].

The first technique described was lesion repair by means of a single anterior incision. However, reports in the literature have demonstrated complications such as injury to the radial artery, median nerve and posterior interosseous nerve[6,8-17,19-21].

In 1961, Boyd and Anderson[3] introduced a double-incision technique in order to minimize these risks. However, their technique may have the complication of proximal radioulnar synostosis[3,4,8-18,20,21]. More recently, Morrey *et al*[22] modified the original technique using a mini-double route, thereby achieving lower complication rates[13-15,20].

Conservative treatment is advised in cases of sedentary individuals or elderly people who do not need to perform activities requiring forearm supination strength and elbow flexion in their daily activities and in cases in which the esthetic deformity is acceptable to the patient[8,16,17,20].

When proximal retraction occurs, use of grafts is indicated in order to perform tenodesis[6,8-17,19-21]. The grafts used generally come from the fascia lata, radial flexor of the carpus, semitendinosus or calcaneal tendon[8-17,19-21].

To assess muscle strength after the operation, measurements on the moment of force and torque at constant velocity can be made using the isokinetic test[8,16,17,20]. This assessment can be done using an isokinetic digital dynamometer, which can also assist in rehabilitation, as well as identifying muscle deficits, particularly during the postoperative rehabilitation activity phase[8,16,17,20].

Few studies objectively evaluating the functional results from the surgical procedures (using digital dynamometry) are available in the worldwide literature. The existing studies present small numbers of patients and a variety of surgical techniques[17].

The objective of the present study was to evaluate the functional results from using the original Mayo mini-double route technique for the biceps, with a minimum of six months of postoperative follow-up, using isokinetic digital dynamometry, DASH (Disabilities of the Arm, Shoulder and Hand), Mayo Elbow Score and goniometry, in order to establish objective improvement patterns and discuss the effectiveness of the procedure.

METHODS

This was a retrospective cross-sectional study. Between April 2006 and July 2011, 18 patients with lesions of the distal biceps underwent operations, of which 17 underwent the Mayo mini-double route technique with transosseous sutures (Figures 1, 2, 3 and 4). Of these patients, nine underwent a digital dynamometry examination using Cybex® and were analyzed in this study.

Eight patients who underwent operations by means of the Mayo mini-double route technique did not undergo this examination: three because less than six months had passed since their surgery; one because the same lesion was presented on the contralateral side; and four who were unable to come back for the examination.

The patient who was not operated using this technique was a professional bodybuilder and presented great retraction, with injury more than two years earlier. The surgery that was performed lowered the