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Distal biceps tendon repair: comparison of clinical and radiological outcome between bioabsorbable and nonabsorbable screws

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Background: Distal biceps tendon repair to the radial tuberosity can be conducted by means of an interference screw in combination with a transosseous button. Bioabsorbable interference screws have been associated with complications such as severe osteolytic reactions. We questioned whether patients with a distal biceps tendon repair with bioabsorbable poly-L-lactide (PLLA) screws had different functional, clinical, and radiologic outcome than patients with nonabsorbable poly-ether ether ketone (PEEK) screws.

Methods: Between 2010 and 2014, 23 patients with an acute distal biceps tendon rupture were treated with reinsertion of the distal biceps tendon in a bone tunnel at the radial tuberosity through a single anterior incision using a transosseous button combined with an interference screw. A PLLA screw was used in 12 patients and a PEEK screw in 11 patients. All patients were retrospectively evaluated with a minimal follow-up of 1 year clinically and by means of the visual analog scale for pain, Mayo Elbow Performance Score, and Disabilities of Arm, Shoulder and Hand Outcome Measure score. Bone tunnel volume was measured with computed tomography segmentation.

Results: Elbow mobility and arm and forearm circumference were symmetric for all patients. The visual analog scale for pain was 0.2 in the PLLA group and 0.7 in the PEEK group. The Disabilities of Arm, Shoulder and Hand score and Mayo Elbow Performance Score were 5.4 and 98.7 in the PLLA group vs. 3.1 and 95.9 in the PEEK group. Bone tunnel enlargement of 43% in the PLLA and 38% in the PEEK group was noted.

Conclusions: Clinical and functional outcome at more than 1 year after distal biceps tendon repair was excellent in both groups. Bone tunnel widening occurred in all patients.

Level of evidence: Level III; Retrospective Cohort Design; Treatment Study

Keywords: Biceps tendon; osteolysis; PLLA; PEEK; interference; repair

Distal biceps tendon ruptures are relatively uncommon. Approximately 3% of all biceps tendon ruptures are at the distal insertion.[43] The most commonly described mechanism is an excessive eccentric contraction of the biceps brachii with the elbow held in a flexed and supinated position.[44]

Operative treatment improves flexion and supination strength and endurance compared with conservative treatment.[3,10] Surgery can be associated with complications such as nerve injuries, heterotopic ossification, and traumatic reruptures.[25,30,43] Anatomic repair of the distal biceps tendon

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can be performed using a 1- or 2-incision technique.[14,18] To date, no consensus has been reached regarding the preferred approach.

Multiple fixation methods have been proposed since the transosseous suture technique described by Morrey et al.[31,35,38,48] Biomechanical studies comparing the load to failure of suture anchors, button fixation, and interference screws show variable results.[2,12,23,33,41,45] An interference screw combined with a transosseous button can increase the fixation strength.[14,15,28,47] Initially, biodegradable poly-L-lactide (PLLA) screws were proposed because of the theoretic advantages such as biocompatibility, gradual degradation, and replacement by bone.[1,7] However, specific complications such as (severe) osteolysis, foreign body reactions, cyst formation, and screw breakage were reported.[5,8,29,49,52] Although no adverse correlation was found between radiologic osteolysis and functional outcome, concern has grown following reported fractures of the femoral and tibial tunnels.[15,29,40,47,49] Owing to the smaller size of the proximal radius, the risk of fracture through the surgically created bone tunnel for distal biceps tendon repair could be a potential problem.

The risk of osteolysis might be lower when a nonabsorbable poly-ether ether ketone (PEEK) screw is used. Good clinical results with these screws have been reported, but osteolysis has also been described.[22,50] To our knowledge, no data on the use of PEEK screws in distal biceps tendon repair have been presented yet.

The first goal of our study was to compare the clinical and functional results of bioabsorbable and nonabsorbable screws in distal biceps tendon repair. The second goal was to evaluate and compare tunnel widening and osteolytic reactions between both groups.

Materials and methods

This is a retrospective case-control study in which the first author (P.C.) evaluated all consecutive patients treated for acute distal biceps tendon rupture at our institution between October 2010 and May 2014.

The senior author (J.D.) performed all surgeries through a single anterior incision technique, as described previously.[12,23] Surgical exploration was performed through a 4-cm longitudinal incision starting centrally at the elbow crease and extending distally. In case of marked proximal retraction or adherence of the distal biceps tendon stump, the incision was extended proximally over the elbow crease in a lazy-S shape. After débridement of the biceps tendon to healthy tissue, a partially absorbable suture (FiberLoop 2; Arthrex, Naples, FL, USA) was passed in a whipstitch fashion in the distal 20 mm of the tendon so that its ends emerged at the distal tendon end.

With the forearm held in hypersupination, a guide pin (3.2 mm) was drilled through the radial tuberosity until it passed through the opposite cortex. Care was taken with the pin position to not damage the posterior interosseus nerve. The guidewire was then over reamed through 1 cortex with a 7-, 7.5-, 8-, or 8.5-mm cannulated drill bit. The depth of this bone tunnel was similar to the length of the interference screw (ie, 10 or 12 mm). An interference screw of 7×10 mm was chosen for drill holes of 7 or 7.5 mm, and an interference screw of 8×12 mm was used for drill holes of 8 or 8.5 mm.

Next, the tendon was inserted into the bone tunnel using a transosseous titanium Biceps Button (Arthrex) and the tension-slide technique.[46] Finally, the appropriate interference screw was placed over 1 end of the suture wire into the drill hole until flush with the cortex, and the wire was sutured over the screw for a strong fixation.

From October 2010 to October 2012, the PLLA bioabsorbable interference screw (Arthrex) was used in 12 patients. From October 2012 to May 2014, 11 patients were treated with a nonabsorbable screw made of PEEK (OPTIMA from Invibio, Arthrex).

The elbow was immobilized in 90° of flexion and neutral rotation for 10 days, after which active and passive range of motion exercises were started. Muscle strengthening commenced at 2 months postoperatively. Controlled, unlimited lifting was allowed at 3 months. Sport activities were allowed at 5 months.

Patients were invited for clinical, functional, and cone-beam computed tomography (CT) scan evaluation. Passive and active range of motion of the elbow and forearm were measured using a goniometer. Arm and forearm circumference was measured at the highest point of the biceps and 4 cm distal to the elbow crease, respectively.

Functional evaluation included the Mayo Elbow Performance Score (MEPS), the Dutch version of the Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire, and the visual analog scale for pain. The MEPS is a widely applied measure of function of the elbow. It is a clinician-completed score that includes 4 categories: pain, motion, stability, and the ability to perform 5 functional tasks. The DASH score is a validated patient-oriented rating scale that analyzes factors involved in activities of daily living, followed by optional questions. Complications were recorded. Patients with other ipsilateral upper limb disease were excluded.

Cone-beam CT images of the proximal radius (Fig. 1) were used to calculate tunnel volumes as described and validated by Robbrecht et al.[42] This technique uses MIMICS 14 image processing software (Materialise, Leuven, Belgium) to calculate tunnel diameters and volume by semiautomated segmentation. This measurement was performed independently by 2 observers (P.C. and J.D.) and was repeated with an interval of 2 weeks. The surgically created tunnel volume was calculated as the volume of a cylinder ($\pi \times \text{radius}^2 \times \text{height}$), based on the diameter of the cannulated drill, as mentioned in the operative notes, and the length of the screw that was used. Tunnel widening was calculated by measuring the proportional increase in tunnel volume between the initial volume and the volume measured with the cone-beam CT scan.