JSES Open Access 1 (2017) 63–71

Contents lists available at ScienceDirect

JSES Open Access

journal homepage: www.elsevier.com/locate/jses

Effect on muscle strength of the upper extremities after open elbow arthrolysis

Wei Chen, MD [a,1], Wei Wang, MD [b,c,1], Zhiwei Li, MD [a], Yun Qian, MD [a], Jialin Song, MD [a], Jiazhi Liu, MBBS [b], Yuan Cheng, MD [a], Cun-yi Fan, MD, PhD [a,b,*]

[a] Department of Orthopaedics, Shanghai Jiao Tong University, Affiliated Sixth People's Hospital, Shanghai, China
[b] Department of Orthopaedics, Shanghai Sixth People's Hospital East Branch, Shanghai, China
[c] Shanghai University of Medicine and Health Science, Shanghai, China

ARTICLE INFO

Keywords:
Elbow stiffness
Arthrolysis
Isometric strength
Handgrip
Dominance
Range of motion
Prognosis

Level of evidence: Level IV, Case Series, Treatment Study

Background: Open elbow arthrolysis manipulates tendons and soft tissues surrounding the elbow and may lead to strength decline after the operation. We hypothesized that strength of elbow and wrist motions and handgrip could be compromised after the procedure and that the strength recovery pattern may differ between men and women and between the dominant and nondominant side.

Methods: This was a prospective cohort study. We monitored 32 patients with post-traumatic elbow stiffness who underwent open arthrolysis between June 2014 and December 2014. All patients underwent standardized postoperative physical therapy. Preoperative and postoperative isometric strength were measured by a handheld dynamometer. Mayo Elbow Performance Score (MEPS) and arc of motion (AOM) were also analyzed.

Results: Mean follow-up was 26.13 months. Significant improvement was noticed in mean AOM (from 46° to 127°) and MEPS (from 67.97 to 96.86). No significant decline was noted in isometric strength at the last follow-up day. The strength ratios between men and women showed no significant difference from postoperative day 7 to the last follow-up day. At all follow-up assessments, isometric strength showed no significant difference between the dominant and nondominant side.

Conclusions: AOM and MEPS achieved significant enhancement after open elbow arthrolysis. The procedure did not lead to isometric strength decline. Postoperative gain of strength was proportional to the baseline strength level of each muscle group, and men had a more prominent gain of strength than women during the entire follow-up. Dominance had no effect on postoperative strength recovery.

© 2017 The Authors. Published by Elsevier Inc. on behalf of American Shoulder and Elbow Surgeons. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

Elbow stiffness is a common post-traumatic complication that extensively reduces elbow activities, compromises quality of life, and decreases occupational function.[14,34,37,51] Surgical intervention, including open or arthroscopic elbow arthrolysis and elbow arthroplasty, are indicated for those who do not respond to conservative approaches[7,8,35,45,49] to restore the arc of motion (AOM) and elbow functions.

Complications of the procedure, such as elbow instability, wound infection, pin-related infections, and recurrence of elbow stiffness, have been studied.[6,22] Only a few studies,[2,9,51,53] however, have reported muscular strength compromise after the procedure, and they mainly focused on elbow flexors and extensors. We have observed clinically that all patients experience an abrupt strength decline for all elbow, wrist, and grip movements shortly after the operation and gradually recover afterward. We conducted a more systemic research to study strength recovery to the end point.

Ligaments and muscles surrounding the elbow contribute to its stability, motions, and strength. Besides regular capsulotomy, heterotopic ossification removal, or remodeling of the olecranon,[27,28,44] many authors[6,12,23,39,55] reported excision of the posterior and transverse bundle of the medial collateral ligament and partial excision of lateral collateral ligament complex for better release of elbow stiffness. If release is unsatisfactory, lengthening[38] or pie-crusting of the triceps,[51] or detachment of common tendons of flexors would be applied. We hypothesized that open elbow arthrolysis and manipulation of surrounding soft tissues may permanently compromise the muscular strength of elbow flexors and extensors, wrist flexors and extensors, and handgrip.

For studying the postoperative strength recovery of each individual, isometric strength needs to be measured, and the widely used

All procedures performed in studies involving human participants were in accordance with the ethical standards of the Institutional and National Research Committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The study was approved by Institutional Review Board of Shanghai Sixth People's Hospital East Branch (No. 2014-003).

[1]These authors contributed equally to this work and are co-first authors.

* Corresponding author: Cun-yi Fan, MD, PhD, Department of Orthopedics, Shanghai Jiao Tong University Affiliated Sixth People's Hospital, 600 Yishan Rd, Shanghai 200233, China.
E-mail address: cyfan@sjtu.edu.cn (C.-y. Fan).

http://dx.doi.org/10.1016/j.jses.2017.06.006
2468-6026/© 2017 The Authors. Published by Elsevier Inc. on behalf of American Shoulder and Elbow Surgeons. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

descriptive Oxford Scale of Muscle Strength (grade 0-5) was replaced by a handheld dynamometer (HHD; ReHabKit1 System, NCC Medical Co. Ltd, Shanghai, China). This HHD is a portable and cost-friendly device for measuring isometric strength and is regarded as being as a reliable and viable instrument as an isokinetic dynamometer[26,47] for strength assessment. We also studied the recovery pattern between the sexes and between the dominant and nondominant sides because these helped to guide intraoperative skills and create an individualized rehabilitation regimen.

Materials and methods

Patients

This prospective cohort study evaluated all patients with elbow stiffness who underwent open arthrolysis at our institution between June 2014 and December 2014. Patients were considered eligible when the following inclusion criteria were met: (1) age 18 years or older, (2) post-traumatic elbow stiffness, and (3) elbow stability confirmed by physical examination in patients with history of dislocation. Exclusion criteria included (1) elbow stiffness due to severe burn, head injuries, spinal injuries, or nontraumatic arthritis; (2) preoperative or postoperative elbow instability; (3) a history of trauma or musculoskeletal diseases of the opposite upper limb; (4) decreased muscular strength caused by stroke or brain or spinal cord injuries; (5) recurrent elbow stiffness; or (6) elbow stiffness treated with total elbow arthroplasty, interposition arthroplasty, or arthroscopic arthrolysis.

Between June 2014 and December 2014, 52 patients with elbow stiffness underwent open elbow arthrolysis. Elbow instability was detected in 3 patients, including 2 before the procedure and 1 after the procedure. Excluded were 8 patients aged younger than 18 years, 2 with trauma history with the opposite upper extremity, 1 patient with elbow stiffness caused by brain trauma, 1 by burn, and 2 by rheumatoid arthritis, and 1 patient with recurrent elbow stiffness after arthrolysis in another hospital.

Among the 34 patients who met the criteria, 2 patients were lost during the follow-up. Finally, 32 patients (13 women and 19 men) were included in the study, with an average age of 35.5 ± 11.4 years (range, 22-62 years) at the time of the operation. Demographics, types of initial injuries, and other clinical characteristics of these patients are summarized in Table I. The average interval from injury to arthrolysis was 21.22 ± 12.24 months (range, 11-62 months). The mean follow-up period was 26.13 ± 2.59 months (range, 22-31 months).

Table I
Patient demographics and clinical characteristics

Characteristics	No. or mean ± SD (range) (n = 32)
Sex	
Male	19
Female	13
Affected side	
Right	15
Left	17
Age, y	35.5 ± 11.4 (22-62)
Follow-up time, mo	26.13 ± 2.59 (22-31)
Duration from injury to arthrolysis, mo	21.22 ± 12.24 (11-62)
Pathogenesis, No	
Radial head fracture	6
Ulnar fracture	1
Humeral fracture	
Distal	14
Distal (lateral epicondyle)	2
Distal with ulnar fracture	1
Medial (medial epicondyle)	2
Olecranon fracture	9
Elbow dislocation	1
Coronoid fracture	1
Initial treatment, No	
ORIF	28
Splint immobilization	4
Open arthrolysis approaches	
Medial and lateral (%)	20 (62.5)
Posterior (%)	12 (37.5)

ORIF, open reduction and internal fixation; *SD*, standard deviation.

Surgical technique

All operations were performed by the same senior surgeon (C.-y.F.). The procedure was conducted under brachial plexus block or general anesthesia, with the patient placed supine. A sterile tourniquet was used to avoid bleeding during the operation. A combination of the lateral and medial approaches was used in 28 operations and a posterior approach in the other 5. All implanted hardware, including plates, cannulated screws, Kirschner wires, and steel cables, were completely removed in all patients.

The techniques were applied as described previously.[27,44,51] At the medial side, the ulnar nerve was released and transposed. Then, posterior capsulotomy and incision of the posterior and transverse bundle of the medial collateral ligament were performed. The olecranon was remolded, posterior osteophytes were resected, and the olecranon fossa was cleared so that no resistance was left to restrict elbow extension. If elbow extension was still more than 10° to 15° (arc of extension <10° was considered to be adequate), the origin of common flexor tendons could be released after we confirmed that antecubital skin and subcutaneous tissues would not be too tightened to achieve another 5° to 10° of extension.

At the lateral side, the extended Kocher approach was performed to achieve further release. Reflection of brachioradialis and extensor carpi radialis longus was necessary to enter the joint. The anterior capsule was released, osteophytes were removed, and the humeroradial joint and contracted ligaments complex were routinely released. Elbow flexion of more than 130° was considered adequate.

The posterior approach was applied for those with posterior midline incision to achieve cosmetic benefits. Then, the soft tissue flats were reflected, and the same procedure was undertaken within joints as in the medial and lateral approach.[16,40,43,55] The anterior bundle of the medial collateral ligament and the lateral collateral ligament complex were repaired. The origin of the common flexor tendons was reattached 0.5 to 1 cm distal to the original site on the humeral condyle by nonabsorbable anchors (Fig. 1). We named this procedure the "flexor tendon advancement." A hinged external fixator (Orthofix, Verona, Italy) was applied for approximately 1.5 months to provide assistance of postoperative physical therapy and elbow stability.[7,46,55]

Measurement of muscle strength and AOM

Preoperative and postoperative muscle strength was detected in the same way. The HHD was used to measure isometric strength (kg) of elbow flexors and extensors and wrist flexors and extensors. A grip force meter (CAMRY, City of Industry, CA, USA) was used to measure handgrip strength (kg). Andrews et al[1] reported the measurement skill for different muscle groups of the upper extremities, detailing the position of joints and limbs, dynamometer placement, and stabilization of subjects. McGarvey et al[30] studied the timing of isometric strength measurement in 1 day and showed a significant difference among the measurements in the morning, noon, and late afternoon. Therefore, bilateral upper limbs were measured between 9 and 10 AM, which was approximately 1 to 2 hours after

Download English Version:

https://daneshyari.com/en/article/8926638

Download Persian Version:

https://daneshyari.com/article/8926638

Daneshyari.com