Early Results of Anterior Elbow Release With and Without Biceps Lengthening in Patients With Cerebral Palsy

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Purpose To investigate the effect of partial biceps lengthening on elbow flexion posture and active elbow flexion and extension in patients with cerebral palsy.

Methods We retrospectively reviewed 29 patients with cerebral palsy who underwent anterior elbow release as part of multilevel upper extremity surgery. The early series of the patients (N = 14; group 1) had lacertus fibrosus division, brachialis fractional lengthening, and denuding of the pretendinous adventitia off the biceps tendon. The later series of patients (N = 15; group 2) had partial biceps tendon lengthening in addition to the procedures in group 1. We compared the 2 sets of patients for elbow flexion posture, active elbow flexion and extension, forearm rotation, and House scores, with mean follow-ups of 72 months for group 1 and 31 months for group 2.

Results The 2 groups were comparable in terms of mean age, number of procedures, and preoperative House scores. Group 2 patients had more improvement in flexion posture (53° vs 44°) and active extension (23° vs 15°) than group 1 postoperatively. However, group 2 had a mean decrease of 7° in active elbow flexion, whereas group 1 had no changes. There was no difference in forearm supination or in the improvement of House scores between groups.

Conclusions Early results of partial lengthening of the biceps tendon showed that it may improve elbow flexion posture and active elbow extension in patients with flexion deformity in cerebral palsy. *(J Hand Surg Am. 2014;39(5):902–909. Copyright © 2014 by the American Society for Surgery of the Hand. All rights reserved.)*

Type of study/level of evidence Therapeutic III.

Key words Cerebral palsy, flexion deformity, anterior elbow release, biceps lengthening.

Elbow flexion posture or flexion deformity is caused by spasticity of the biceps, brachialis, and brachioradialis in patients with cerebral palsy (CP).[1–4] Elbow flexion deformity can interfere with hand positioning for functional activities and is of aesthetic concern as the deformity becomes more pronounced during ambulation.[3–5] To improve elbow flexion deformity or spasticity, several surgical treatments have been performed, such as neurectomy of the musculocutaneous nerve, release of the flexor-pronator muscle from the medial epicondyle, and lengthening of the anterior elbow muscles.[6] Because the musculocutaneous nerve has been cut only for mild contractures and because flexor–pronator muscle release has been shown to have less of an effect at the elbow than at the hand, lengthening of the anterior elbow muscles is considered the standard surgical treatment of elbow flexion deformity.[1,3,4,7]

For anterior elbow release, Mital[1] performed a division of the lacertus fibrosus, z-plasty of the biceps,

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and fractional lengthening of the brachialis, and reported improvement in flexion contracture from 48° to 10°. Although Mital reported no loss of elbow flexion, he noticed weakness of supination in 1 patient, which may have resulted from lengthening of the biceps, a principal supinator of the forearm. Manske et al[3] pointed out that this potential risk of supination loss is a major concern in patients with CP, who usually have a pronation deformity of the forearm. They modified the procedure of Mital: Instead of lengthening the biceps, they denuded the pretendinous adventitia off the biceps, potentially removing afferent nerve fibers and receptors. However, Carlson et al[4] performed partial lengthening of the biceps (sliding without z-plasty lengthening) in patients with fixed elbow contractures less than 45° and reported greater reduction in elbow flexion posture compared with the results of Manske et al (57° improvement vs 49°), which they attributed to partial lengthening of the biceps tendon. However, their study was a case series without an internal control group.

For patients with fixed flexion contracture less than 45°, we used the procedure of Manske et al[3] for anterior elbow release in our earlier patients; later, we added partial lengthening of the biceps tendon. The purpose of this study was to compare the outcomes of the 2 sets of procedures done by a single surgeon, to determine the effect of partial lengthening of the biceps tendon on elbow flexion posture and active elbow flexion and extension.

MATERIALS AND METHODS

Subjects

We reviewed patients with CP who underwent single-event, multilevel upper extremity surgery between May 2004 and March 2012. All procedures were done by the same hand surgeon (H.G.). Our institutional review board approved this study. A total of 31 patients underwent anterior elbow release, and 29 of them with follow-up of more than 1 year and complete data were included in this study. The indication for surgery was a preoperative flexion posture of greater than 50° with activities.[3] Earlier patients (May 2004 to March 2008) had anterior elbow release procedure for elbow flexion posture, described by Manske et al[3]: division of the lacertus fibrosus, fractional lengthening of the brachialis, and denuding of the pretendinous adventitia of the biceps tendon. The later patients (April 2008 to March 2012) had the same procedures and added fractional lengthening of the biceps tendon.[6] The earlier patients (group 1) included 14 with a mean age of 21 years (SD, 12 y; range, 6−54 y) and the later patients (group 2) included 15 patients with a mean age of 20 years (SD, 5 y; range, 10−34 y). Group 1 patients were reviewed with a mean follow-up of 72 months (range, 48−96 mo) and group 2 patients were reviewed with a mean follow-up of 31 months (range, 12−54 mo). Group 1 included 9 males and 5 females, and group 2 had 11 males and 4 females. All patients had spastic hemiplegia or tetraplegia, and no patients were ataxic or dyskinetic.

Surgical procedures

For anterior elbow release in group 1, we made a transverse incision over the antecubital fossa, divided the lacertus fibrosus (Fig. 1), and fractionally lengthened the brachialis muscle by making 2 transverse incisions spanning the entire width of the aponeurosis over the muscle and extending the elbow (Fig. 2). We did not cut the brachialis muscle fibers. Then, we stripped the adventitia off the length of the biceps tendon to disrupt afferent nerve fibers, as described by Manske et al.[3] For group 2 patients, we added partial lengthening of the biceps tendon to the procedure. We made 2 transverse incisions 3 cm apart (1 on the medial half of the tendon and the other on the lateral half), and extended the elbow to separate these 2 partial tenotomy sites (Fig. 3). We placed 2 nonabsorbable sutures between the 2 tenotomy sites to prevent further splitting of the fibers (Fig. 4).[6] We did not perform z-plasty lengthening of the biceps tendon, brachioradialis release, or capsular or ligamentous release of the elbow.

In addition to anterior elbow release, patients received other upper extremity procedures as single-event multilevel upper extremity surgery. There was no change in principles and techniques throughout the study period. Tables 1 and 2 present the additional surgical procedures patients received. For forearm deformity, we performed pronator rerouting for absent or weak active supination, pronator tenotomy for active supination short of neutral, and rotational osteotomy for a fixed pronation deformity.[8,9] For wrist deformity, we transferred the flexor carpi ulnaris to the extensor carpi radialis brevis for patients with wrist flexion deformity and transferred the extensor carpi ulnaris to the extensor carpi radialis brevis with fractional lengthening of the wrist flexors for patients with primarily wrist ulnar deviation deformity.[10] We performed wrist arthrodesis in patients with fixed flexion contracture of the wrist.[11] For the fingers, we fractionally lengthened the digital flexor tendons for tight flexors and sometimes