

# Restoration of Elbow Flexion



Bryan J. Loeffler, MD<sup>\*</sup>, Daniel R. Lewis, MD

## KEYWORDS

- Elbow flexion • Tendon transfer • Latissimus dorsi • Pectoralis major • Triceps to biceps
- Steindler flexorplasty

## KEY POINTS

- The latissimus dorsi, pectoralis major, flexor-pronator mass, and triceps are all options when considering muscle transfer to restore elbow flexion, and a thorough preoperative assessment is required to determine the ideal transfer.
- The bipolar latissimus transfer produces the greatest strength and additionally can be performed as a myocutaneous flap to assist in soft tissue coverage.
- Pectoralis major transfer is reliable for restoring elbow flexion, but is the most cosmetically deforming option.
- Steindler flexorplasty produces weak elbow flexion, but reduces active supination and often requires concomitant wrist and digital flexion with elbow flexion, which can limit its functional advantage.
- Triceps to biceps transfer restores elbow flexion, but sacrifices active elbow extension and can produce significant elbow flexion contractures in the long term. Isolated long head of triceps transfer may allow for restoration of elbow flexion without sacrificing active elbow extension, but clinical results are limited.

## INTRODUCTION

The loss of active elbow flexion is disabling, particularly when the hand is functional. Several procedures have been described to restore elbow flexion, including unipolar or bipolar transfer of the pectoralis major, Steindler flexorplasty, unipolar or bipolar transfer of latissimus dorsi, triceps to biceps transfer, pectoralis minor transfer, and sternocleidomastoid transfer.

Loss of elbow flexion most commonly occurs following brachial plexus injury, proximal injury to the musculocutaneous nerve, or anterior elbow trauma, which results in irreparable damage to the biceps and brachialis. Arthrogryposis, particularly the amyoplasia form, is often associated with the inability to actively flex the elbow, but with preserved elbow extension. In addition, elbow flexion

paralysis was seen due to poliomyelitis infection historically. Patients with preserved hand and wrist function, but a lack of elbow flexion are limited by their inability to position the hand in space.

The principles of any tendon transfer must be followed when considering a transfer to restore elbow flexion. These include, but are not limited to, assessment of available muscle donors, including their work capacity and mechanical advantage, presence of passive elbow flexion, and potential disability created as a result of the transfer. In addition, matching the line of pull and excursion of the biceps is ideal for a transfer aimed at improving elbow flexion.

In the case of recent brachial plexus injury, patients may be candidates for nerve grafting or distal nerve transfers. If these procedures have been performed, it is recommended to wait 2 years

---

OrthoCarolina Hand Center, 1915 Randolph Road, Charlotte, NC 28207, USA

\* Corresponding author.

E-mail address: [Bryan.Loeffler@orthocarolina.com](mailto:Bryan.Loeffler@orthocarolina.com)

Hand Clin 32 (2016) 311–321

<http://dx.doi.org/10.1016/j.hcl.2016.03.002>

0749-0712/16/\$ – see front matter © 2016 Elsevier Inc. All rights reserved.

postoperatively before determining that muscle transfer is required.

## TRANSFER OPTIONS

### *Pectoralis Major Transfers*

#### **Introduction**

Utilization of the pectoralis major to restore elbow flexion has been described and performed for almost a century. Procedures include pectoralis flexorplasty, unipolar and bipolar reconstructions, combined pectoralis minor and major transfers, and isolated pectoralis minor transfers.

#### **Anatomy**

The pectoralis major is composed of 2 anatomic components: the clavicular and sternocostal portions. The clavicular head originates from the medial clavicle and is innervated by the lateral pectoral nerve (C5–C7). It is nourished primarily by the pectoral branch of the thoracoacromial artery. The sternocostal head arises from the manubrium and sternum, the costal portion of the first 6 ribs, and the aponeurosis of the external oblique muscle. Innervation of the proximal half to two-thirds of the sternocostal head is also by the lateral pectoral nerve, whereas the inferior portion is by the medial pectoral nerve (C8–T1). Blood is supplied primarily by the lateral thoracic artery. The tendinous portions of both heads converge and attach to the lateral lip of the bicipital groove. The primary function of the pectoralis major is to adduct and internally rotate the humerus; it can also extend the arm.

#### **Indications**

The most common indications for use of the pectoralis for restoration of elbow flexion are brachial plexopathy and arthrogryposis. Historically, it has been used for the treatment of poliomyelitis as well.

#### **Contraindications**

Complete brachial plexopathy, compromised pectoralis strength (<M4), elbow contracture that has not or cannot be corrected, tissue disequilibrium, cognitive impairment that precludes rehabilitation and meaningful use, and an unmotivated patient are relative contraindications for a pectoralis transfer. Some investigators discourage using the pectoralis major transfer in women secondary to cosmetic concerns.

#### **Review of pectoralis transfer options**

**Tendon transfer** Release of the insertion of the pectoralis major tendon with transfer to the biceps muscle was described by Schulze-Berge in 1917.<sup>1</sup> This technique also may be referred to as a pectoralis flexorplasty. Over the years, surgeons began to transfer the pectoralis tendon into the biceps tendon with and without interpositional tendon

graft. Tendon transfer to the ulna also has been reported.

**Unipolar transfer** Clark described a unipolar pectoralis major transfer technique, mobilizing the lower 2.5 inches of the sternocostal head from its origin and transferring it to the biceps tendon through a subcutaneous tunnel.<sup>2</sup> This technique has been modified by adding a strip of fascia from the rectus abdominis inferiorly to provide more substantial tissue to transfer into the biceps tendon. Care must be taken to protect the neurovascular pedicle while elevating the pectoralis.

Transfer of the entire origin of the sternocostal and clavicular heads while maintaining its tendinous insertion on the humerus was later described by Seddon.<sup>3</sup>

**Bipolar transfer** Bipolar transfer (**Fig. 1**) of a portion or the entire pectoralis major also has been described.<sup>4</sup> With this operation, both origin and insertion are completely released and the muscle is rotated on its neurovascular pedicle. A new origin and insertion of the muscle is created. Initial descriptions recommended suturing the pectoralis tendon into the coracoid process and mobilizing the sternocostal origin for transfer distally. Carroll and Kleinman's<sup>4</sup> technique recommended transferring the pectoralis major tendon to the acromion while the origins of the clavicular and sternocostal heads with fascia of the rectus abdominis were tubularized and transferred into the biceps tendon distally. The investigators indicated that their modification placed the transfer into a position that was in alignment with the native position of the biceps and increased the mechanical advantage compared with other previously described techniques. Other investigators have transferred the pectoralis minor along with the major in a unipolar fashion.

#### **Results**

Multiple studies have reported small case series to accompany their surgical technique. Brooks and Seddon<sup>5</sup> reported on 10 patients in whom the pectoralis major tendon was released from the humerus and transferred into the long head of the biceps tendon. Nine of the 10 patients obtained at least M3 or M4 strength. One patient obtained M2 strength and was considered a failure. No patients obtained M5 strength. Active range of motion (AROM) in the successful patients was from 20° to "full" flexion. Beaton and colleagues<sup>6</sup> also evaluated pectoralis flexorplasty with fascia lata as an interposition graft. The mean AROM in their group of 5 patients was 25/116°. The mean strength at 90° of elbow flexion was 16% of the contralateral extremity.

Three of the 4 patients treated with bipolar pectoralis major transfer by Carroll and Kleinman<sup>4</sup> obtained

Download English Version:

<https://daneshyari.com/en/article/4058808>

Download Persian Version:

<https://daneshyari.com/article/4058808>

[Daneshyari.com](https://daneshyari.com)