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The split hypoglossal nerve versus the cross-face nerve graft to supply the free functional muscle transfer for facial reanimation: A comparative study

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Summary Long-standing cases of facial paralysis are currently treated with free functional muscle transfer. Several nerves are mentioned in the literature to supply the free muscle transfer. The aim of this study is to compare the split hypoglossal nerve and the cross-face nerve graft to supply the free functional muscle transfer in facial reanimation.

Of 94 patients with long-standing, unilateral facial palsy, 49 were treated using the latissimus dorsi muscle supplied by the split hypoglossal nerve, and 45 patients were treated using the latissmus dorsi muscle supplied by healthy contralateral buccal branch of the facial nerve.

The excursion gained by the free muscle transfer supplied by the split hypoglossal nerve (mean 19.20 ± 6.321) was significantly higher (P value 0.001) than that obtained by the contralateral buccal branch of the facial nerve (mean 14.59 ± 6.245).

The split hypoglossal nerve appears to be a good possible option to supply the free vascularised muscle transfer in facial reanimation. It yields a stronger excursion in less time than the contralateral cross-face nerve graft.

Introduction

Long-standing facial palsy still represents a difficult management challenge. Several options are available for treatment, but no single technique enables the restoration of ocular and oral sphincter control and natural smile. Free neurovascularised muscle transfer offers a dependable, dynamic reanimation of the mouth with adequate vector of pull of the oral commissure.[1] Several nerves are used to reinnervate the newly transferred muscle.[2–8] One of the most important goals of facial reanimation is to achieve adequate excursion on the paralysed side. The aim of this study is to

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evaluate and compare the excursion gained by free muscle transfer when supplied with the split hypoglossal nerve versus the healthy contralateral buccal branch of the facial nerve (through a nerve graft). The literature does not discuss any efforts to do so before.

Patients and methods

The study was registered with and approved by the Research Ethics Committee at Cairo University hospitals. The work complied with relevant aspects of the Declaration of Helsinki. Each patient was offered a range of surgical reanimation options, and all patients in this cohort chose to undergo free functional muscle transfer after providing a full informed consent. Data are expressed according to Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.

Ninety-four patients with long-standing (more than one year), unilateral facial palsy were treated in the period from 2009 to 2014 by the first author, using the latissimus dorsi muscle at Cairo University hospitals. This study included only cases of free latissimus dorsi flap supplied by a single nerve (either the split hypoglossal or the cross-face nerve graft). Cases in which the author used the gracilis muscle, the masseteric nerve or dual innervation to supply the free muscle transfer were excluded from the study. Patients were divided into two nonrandomised groups according to the donor nerve supply. Group A contained 49 patients, who had one stage procedure with the thoracodorsal nerve directly coapted to the split hypoglossal nerve; Group B contained 45 patients, who had two stages of facial reanimation. In the first stage, a cross-face nerve graft was done and, in the second stage, the latissimus dorsi muscle was transplanted. Selection of the technique used was decided on individual bases. For patients refusing a longer waiting period for recovery or surgical procedure on the healthy side, the split hypoglossal nerve was offered. Conversely, for patients refusing to be innervated by a non-facial source, the cross-face nerve graft was offered.

Surgical technique

Group A (using the split hypoglossal nerve)

This technique was previously described in full detail by the author.[4] The whole procedure is done as a single stage. After preparation of the facial pocket and identification of the facial artery and vein, the hypoglossal nerve is identified by elevation and upward retraction of the submandibular gland to expose the digastric tendon. The digastric tendon is then elevated to identify the hypoglossal nerve. One of the terminal branches of the hypoglossal nerve is selected. The branch represents 25% of the hypoglossal nerve diameter. This branch is dissected (with inter-fascicular dissection) from the rest of the nerve. Dissection proceeds in a retrograde fashion for an appropriate distance to reach the thoracodorsal nerve without the need for a nerve graft. Finally, the distal end of the branch is transected, and the branch is rotated to reach the thoracodorsal nerve, leaving the rest of the hypoglossal nerve intact.

Group B (using the contralateral buccal branch of the facial nerve)

The standard two-stage procedure is employed. The first stage consists of a cross-face sural nerve graft sutured on the healthy side to the buccal branch of the facial nerve and left on the paralysed side over the zygomatic area and marked with Prolene 5-0. After 10 months, the second stage is performed, insetting the muscle and anastomosing the thoracodorsal vessels to the facial vessels and the thoracodorsal nerve to the end of the sural nerve graft.

Harvesting the flap, preparation of the facial pocket, site of muscle insertion and suturing were similar in both groups. In all cases, the recipient vessels were the facial vessels on the paralysed side.

Patients in both groups were strictly followed up at 3, 4, 5, 6, 8, 10, 12 and 18 months after the free muscle transfer. Measurements were taken by the second author without knowing which technique was used (single blind study). Measurements were taken from preoperative photos and at 18 months after the muscle transfer. We used the SMILE system of Bray et al[9] and Adobe Photoshop CS4 Extended v.11 (Adobe Systems Inc., San Jose, California) for measurements.

One modification was introduced by the first author to the SMILE system of Bray et al,[9] where the excursion is calculated as the change in distance from midline to commissure on smiling from the preoperative to postoperative situation.

The distance from where the midline crosses the lower vermilion border to the commissure is measured on maximum smiling (referred to as distance X). This distance is measured pre- and postoperatively on the paralysed side (X1 and X2, respectively). This distance is also measured on the healthy side postoperatively (X3). The excursion gained by the muscle is considered the difference between the preoperative and postoperative distances on the treated sides (X2–X1). Figure 1 indicates the nomenclature used (X1, X2 and X3).

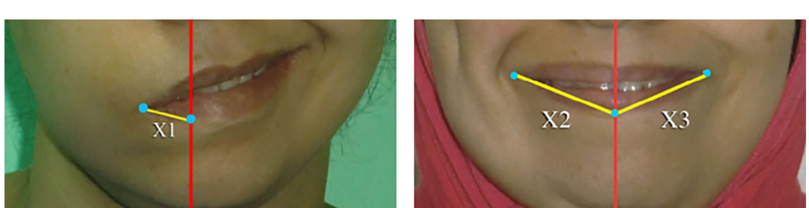

Figure 1 The nomenclature used. (Left) Preoperative view on smiling. (Right) Postoperative view on smiling.