

Combined Sequential Bilateral Hypoglossal-to-facial and Masseter-to-facial Transfers for Bilateral Facial Paralysis

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Summary: Bilateral facial paralysis is a challenging situation requiring complex management. Surgical treatment can include nerve transfers, mainly masseter-to-facial, or muscle transfers, gracilis free flap, or temporalis transposition. Deciding on the surgical option depends on the duration of the paralysis and the feasibility of facial muscles. We present the case of a 10-year-old child with permanent bilateral facial paralysis after brainstem tumor surgery. The patient was treated with bilateral simultaneous hypoglossal-to-facial transfer followed by bilateral simultaneous masseter-to-facial 12 months later. After 23 months of follow-up and specific physical therapy, she has good and symmetric resting tone, complete eye closure, moderate bilateral smile excursion, mild lip pucker movement, and good oral competence. The combination of these two nerve transfers, when possible, gives the opportunity of restoring movement taking the best of each technique, with acceptable results and no significant clinical deficits in the donor sites. (*Plast Reconstr Surg Glob Open* 2021;9:e3689; doi: [10.1097/GOX.0000000000003689](https://doi.org/10.1097/GOX.0000000000003689); Published online 12 July 2021.)

Simultaneous bilateral facial paralysis (FP) is a rare clinical condition that can be brought on by Lyme disease, Moebius syndrome, or sequelae of central nervous system tumors among others.¹ Specifically, posterior fossa tumors imply a high risk of neurological deficits, including FP, because of the tumors themselves or their treatment.² Surgical treatment, when needed, includes nerve transfers, mainly masseter-to-facial, or muscle transfers, gracilis free flap or temporalis transposition. Deciding on which surgical option depends on the duration of the paralysis and the feasibility of facial muscles.¹

A 10-year-old female child was referred to our FP unit from another center with a 20-month complete bilateral FP following surgery for a brainstem astrocytoma.

(See Video [online], which displays preoperative evaluation and postoperative results.) Postoperatively, she had bilateral III cranial nerve paralysis from which she recovered spontaneously. Hearing thresholds were within normal limits bilaterally. Facial nerve electromyography (EMG) (Fig. 1a) confirmed a complete bilateral lesion with fibrillation potentials suggesting viable facial musculature. To evaluate possible donor input, masseteric and hypoglossal nerves were tested, being normal on both sides (Fig. 1b). After we thoroughly discussed the case in the FP unit and informed her parents, the patient underwent bilateral simultaneous end-to-side hypoglossal-to-facial transfer (HFT) with partial section of the hypoglossal nerve and transposition of the third portion of intratemporal facial nerve (Fig. 2). No additional nerve grafts were needed. There was no tongue atrophy after surgery. (See Video [online].) After the sixth and seventh month respectively, following surgery she started to move the right and left mouth corners. Twelve months after the HFT, a bilateral simultaneous masseter-to-facial transfer (MFT) coapted to a zygomatic branch was carried out. After 23 months of follow-up and specific physical therapy, she has good and symmetric resting tone, complete eye closure, moderate bilateral smile excursion, mild lip pucker movement, and good oral competence, with clinical evidence of facial muscle

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Received for publication March 12, 2021; accepted May 13, 2021.

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DOI: [10.1097/GOX.0000000000003689](https://doi.org/10.1097/GOX.0000000000003689)

Disclosure: All the authors have no financial interest in relation to the content of this article.

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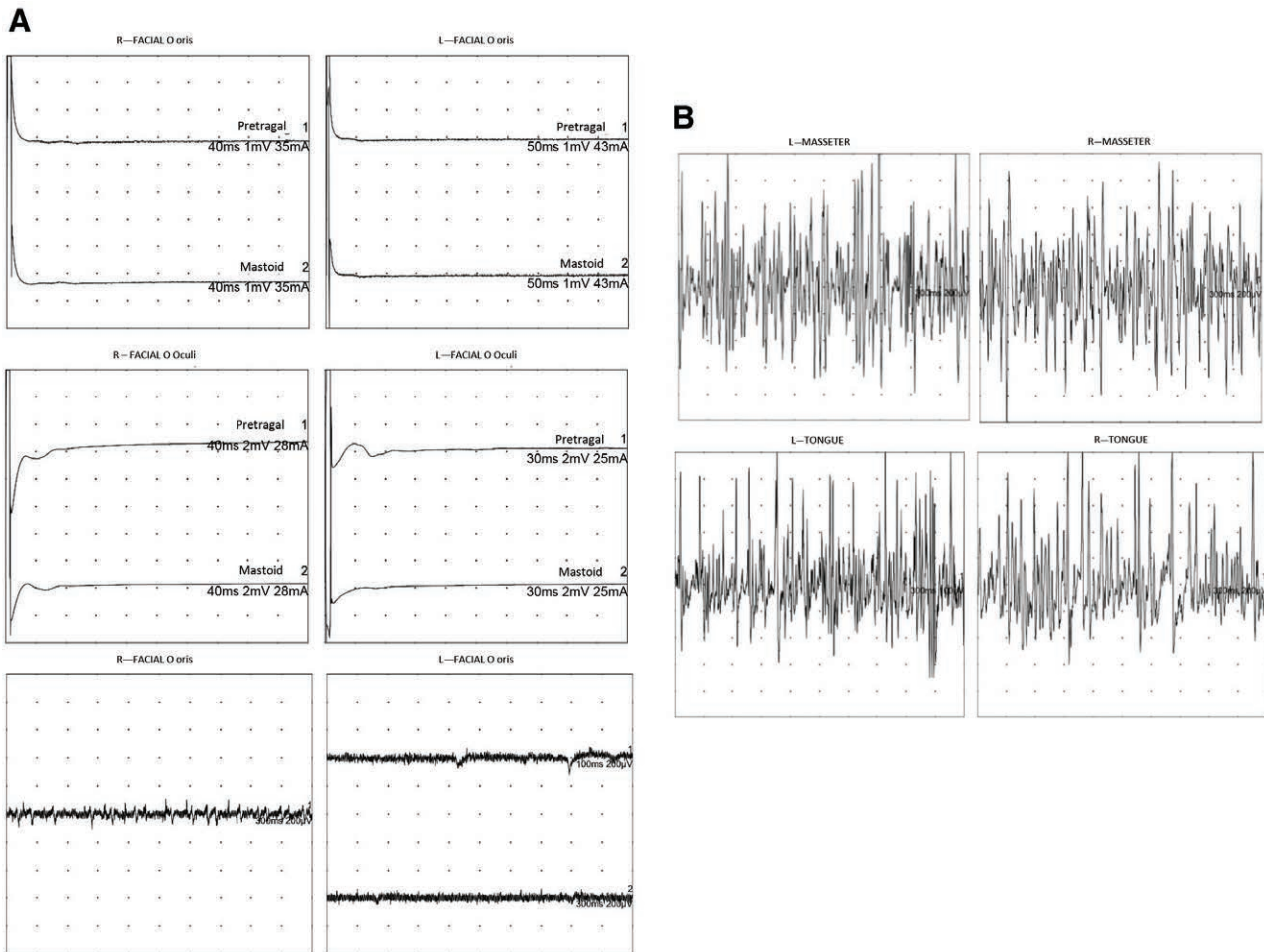


Fig. 1. Electromyography. A, Absence of muscular response in orbicularis oris (top row) and orbicularis oculi (middle row) during voluntary movement. Typical fibrillation potentials in orbicularis oris (bottom row) suggesting denervated but still viable musculature. B, Motor unit potentials during voluntary contraction of masseter muscle and tongue. L: left. R: right.

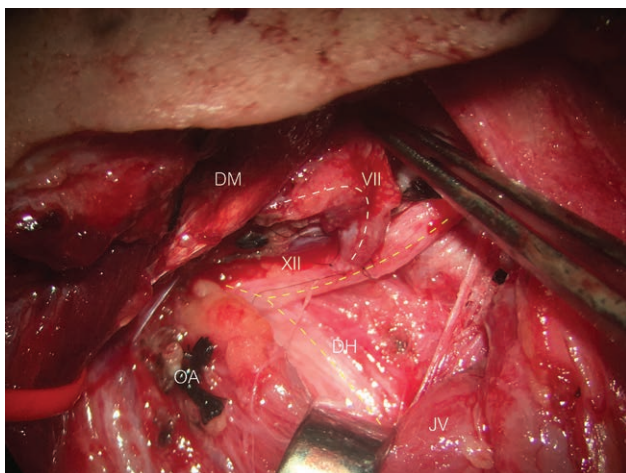


Fig. 2. Right end-to-side HFT. White dashed line: facial nerve (VII). Yellow dashed line: hypoglossal nerve (XII) and descending hypoglossal (DH). DM: digastric muscle. JV: jugular vein. OA: occipital artery.

contraction with either hypoglossal or masseteric activation. (See Video [online].) There is no impairment in tongue function, mastication problems, swallowing defects, or any speech difficulty. Mild synkinesis is present in orbicularis oris, mentalis, and left orbicularis oculi. No eye lid surgery has been needed. To the best of our knowledge this is the first reported case of bilateral HFT-MFT facial reanimation.

DISCUSSION

Bilateral FP is a striking condition, which has to be approached in a multidisciplinary basis.³⁻⁵ For patients requiring surgery, bilateral free gracilis muscle transfer and bilateral MFT are the preferred techniques, the decision on which technique to choose depends mainly on how long the paralysis has been in play.¹ It is usually considered that facial muscles are viable for nerve transfers up to 18–24 months, and maybe longer in children. Beyond this time limit, muscle transfers would be needed.⁶ Bilateral HFT has been reported

only in four cases as a treatment for bilateral FP.^{7,8} In the present case, the duration of the paralysis was considered too short not to try a reinnervation procedure, but too long to perform a bilateral MFT. An injury to the masseter nerves would have compromised an eventual bilateral gracilis transfer if the reinnervation procedure failed. As a general rule, HFT is contraindicated in patients with bilateral FP, concomitant lower cranial nerve impairment, or those with underlying risk of cranial nerve neuropathies as neurofibromatosis type two patients, because of the possible tongue dysfunction secondary to this procedure.^{8,9} However, partial HFT techniques have been proven to be safe in terms of lingual function preservation.⁵ In hindsight, taking into account that the patient was within the time limit for nerve transfers, bilateral simultaneous HFT had a secondary beneficial effect apart from the reinnervation benefit itself. Once the functionality of the initial surgery has been proven, bilateral simultaneous HFT acts on a “baby-sitter” basis,¹⁰ providing neural stimulus to the facial musculature that would receive the bilateral simultaneous MFT several months later.

In the present case, the mastoid portions of the facial nerve were transposed and sutured directly to the hypoglossal nerves with no tongue dysfunction. In the four aforementioned cases of bilateral FP treated with HFT, jump grafts were interposed and surgery was performed in two stages.^{7,8} We believe that an additional nerve graft should be avoided if possible, as it adds a second neurotomy. According to our previous experience, side-to-end HFT is a safe procedure that can be performed in certain “high-risk” cases such as bilateral FP when other reanimation procedures are not indicated.

In addition to lingual function preservation, the patient did benefit from both reinnervation procedures. The combination of HFT and MFT brings together the best of both techniques with good facial resting tone provided by the hypoglossal nerve and wider smile reanimation provided by the masseteric nerve.^{2,11} Performing the dual nerve transfer bilateral reanimation surgery gives the opportunity of a balanced symmetry of the face both at rest and with movement due to a similar time for recovery in each neurotomy. Having the same donor inputs in each hemiface lessens the possibility of right-left discrepancies.^{12–14}

Although 24 months is generally accepted as a time limit for reinnervation procedures,⁶ children seem to preserve neuromuscular regeneration capacity for a longer period as long as EMG shows the typical fibrillation potentials of denervated muscles.¹⁵ Experimental studies have demonstrated that axonal regeneration is age-related with better results in younger individuals.¹⁶

Physical therapy is crucial to reach optimal results following facial reanimation surgery.¹⁷ It has been suggested that children older than five years are able to stay focused on the rehabilitation exercises.² Bilateral cases add an extra grade of difficulty to individualize each movement on each side. A specialized rehabilitation focused on swallowing, saliva management, facial movement coordination, compensatory strategies, speech

intelligibility, and social skills is required.^{2,17} Mirror biofeedback, massage therapy, and botulinum toxin may help in these complex cases. Exercises at home complement the therapist’s work and provide better recovery.² Due to children’s brain plasticity, in certain cases, spontaneous smile may be achieved.^{17–19}

CONCLUSION

In cases of bilateral FP, a combination of hypoglossal and masseteric nerve transfers, when possible, gives the opportunity to restore movement, obtaining the best from each technique, with acceptable long-term results and no significant clinical deficits in the donor sites.

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