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Lengthening temporalis myoplasty versus free muscle transfer with the gracilis flap for long-standing facial paralysis: A systematic review of outcomes

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ABSTRACT

Background: Our aim was to compare the outcomes of reconstructive surgery for long-standing facial paralysis by gracilis free flap transfer versus lengthening temporalis myoplasty (LTM) according to Daniel Labbé.

Materials and methods: PubMed, Web of Science, Wiley Online Library, Cochrane Library, Directory of Open Access Journals, and SAGE Premier 2011 database were electronically searched. Randomized controlled trials (RCTs), controlled clinical trials (CCTs), and case series with a sample size > 5 were sought. Data were extracted by a single investigator.

Results: Sixteen articles met the selection criteria. All of these studies were retrospective case series. Efficacy outcomes were analyzed by assessing mouth symmetry both at rest and upon smiling, as well as the quality and the spontaneanity of the smile. Commissural displacement in patients operated by the gracilis flap was greater after surgery involving masseteric nerve reinnervation than a cross-facial nerve graft reinnervation. Patients with double innervation had similar results to those who had surgery involving only masseteric nerve reinnervation. These results are in accordance with the subjective evaluations. Patients operated by the lengthening temporalis myoplasty achieve less lateral movement of the commissure, with controversial evidence of spontaneity (only "automatic").

Conclusions: There are currently no published RCTs or CCTs regarding facial reanimation surgery. Thus, only very weak evidence is available to support the use of one type of surgery over another. However, our review suggests that LTM achieves results that are at least equal to those obtained with gracilis transfer, but LTM is a less extensive procedure that provides quicker results without the need for more than one operation. LTM, therefore, seems a good alternative to free muscle flap.

Level of evidence: IV.

1. Introduction

Long-standing facial paralysis has substantial functional, morphological, and psychological effects on the affected person. The lack of facial expression on the paralyzed side is not only an aesthetic issue but also a functional one, as the affected individual cannot communicate effectively, which may lead to social isolation. When managing facial paralysis, the primary interest focuses on reanimation of the smile and eyelid (Momeni et al., 2013). This review will focus on smile reanimation. The inability to smile is unfortunately not the only dynamic problem in the midface. The paralyzed side also remains static upon talking, which is equally embarrassing to the patients.

The main challenge of facial reanimation surgery is to provide symmetry at rest and with facial expressions. The current gold standard is revascularised and reinnervated free muscle transfer, mainly with a gracilis free muscle flap (Biglioli et al., 2013). Pedicled regional muscle flaps, such as temporalis muscle flaps, have received renewed interest. The indications for the 2 types of flaps are very similar, if not identical (Labbé and Bénateau, 2002). The gracilis flap can be innervated by either the contralateral facial

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nerve, masseteric nerve (the motor branch of the trigeminal nerve to the masseter muscle), or both (Ferreira and Marques, 2002; Manktelow et al., 2006; Biglioli et al., 2013). The different approaches have the same goal: providing symmetry at rest and with voluntary motion, oral competence, and a consistent spontaneous smile (a spontaneous smile can be "automatic," such as upon greeting, or "emotional," such as when listening to a funny story without being watched), as well as preventing synkinesis (Momeni et al., 2013). It is important to know the difference between a voluntary smile (a smile for which the patient has to actively think to produce a smile, such as upon smiling for a photograph), and a spontaneous smile, which can be both "automatic" and "emotional." The presence of an emotional spontaneous smile can be objectified only by seeing patients smile after letting them watch funny videos.

The aim of this article is to compare the outcomes of reconstruction of long-standing facial paralysis using either a gracilis free flap transfer or a lengthening temporalis myoplasty (LTM) according to Daniel Labbé. To accomplish this, we performed a systematic review of the available literature assessing outcomes of the 2 techniques.

2. Material and methods

2.1. Surgical procedure

2.1.1. Gracilis free muscle transfer

The gracilis free muscle transfer for facial reanimation was first introduced by Harii et al. in 1976 (Ylä-Kotola et al., 2004; Terzis and Olivares, 2009; Faria et al., 2007). To achieve a spontaneous smile, the contralateral facial nerve was used to innervate the flap by using a cross-facial nerve graft (CFNG). This is considered the first choice by most authors, since reconstitution of both the automatic (upon greeting) and emotional smile (involuntary, e.g., when listening to a funny story) can be expected because of the stimulation by the contralateral facial nerve. The technique is usually performed in two stages: a first stage, during which the CFNG is created; and a second stage, during which the muscle is transplanted and the neurovascular anastomoses are performed. The second surgery is conducted when a positive Tinel sign is observed at the free end of the grafted nerve (Ylä-Kotola et al., 2004). Generally, the sural nerve is used (Ferreira and Marques, 2002). When the contralateral facial nerve is not available, or in patients with bilateral facial paralysis, the masseteric nerve is a good alternative. Initially, an "automatic" spontaneous smile was not expected with use of this nerve, but several authors found that some patients were able to achieve an "automatic" spontaneous smile over time with intensive smile training by a speech-language pathologist using mirror exercises, but the appearance of the "automatic" spontaneous smile was not consequent. This is due to cerebral plasticity (Manktelow et al., 2006; Nduka et al., 2012; Faria et al., 2007; Momeni et al., 2013). Although some results were contradictory (Terzis and Olivares, 2009), reinnervation of the gracilis muscle flap with the masseteric nerve became more and more popular because of its predictable results, rapid innervation, low donor site morbidity, and potential to achieve an "automatic" spontaneous smile through cerebral plasticity (Faria et al., 2007).

Some authors explored the possibility of combining the advantages of each technique through double innervation (Labbé and Huault, 2000; Cardenas-Mejia et al., 2015; Sforza et al., 2015). With this strategy, the masseteric nerve graft provides rapid reinnervation, thereby avoiding atrophy of the transplanted muscle and producing a strong contraction on voluntary smiling and "automatic" spontaneous smiling, whereas the CFNG facilitates both an "automatic" and "emotional" spontaneous smile (Faria et al., 2007).

2.1.2. Lengthening temporalis myoplasty

Lengthening temporalis myoplasty (LTM) was described by Daniel Labbé in 1997 as a modification of the temporalis myoplasty according to McLaughlin (1953). The advantage of Labbé's technique is that use of a tendon graft is avoided, which provides better long-term results because there is no late stretching of the tendon. Recent studies describing the outcomes of LTM surgery found that an "automatic" spontaneous smile can be achieved in all patients, but it should be noted that an "automatic" spontaneous smile occurs seldom in some patients. This is remarkable and unexpected, as use of the masseteric nerve for reinnervation of the gracilis free muscle flap resulted in an "automatic" spontaneous smile in only two-thirds of patients (Labbé et al. 2012).

A significant disadvantage of the Gillies technique and its modifications is that temporal hollowing occurs as a result of muscle harvesting, thus exaggerating facial asymmetry. LTM according to Labbé avoids temporal hollowing by 2 maneuvers: preserving the superficial temporal fat pad, and dissecting just above the deep temporal fascia. The muscle should be released from the temporal fossa with care for the neurovascular pedicle.

When using the LTM technique, preoperative determination of the key-points is extremely important in order to achieve a smile as symmetrical as possible. The key-points are placed in the plane of the mimic muscles and are reached by subcutaneous dissection medial to the nasolabial fold incision. During the procedure, the tendon, which is still attached to the coronoid process, is accessed via a nasolabial fold incision. It is then stripped from the coronoid process, while ensuring that as many fibers as possible are preserved. The tendon is subsequently stretched to the length of the nasolabial incision. The anterior and longest part of the tendon will be attached at the alar base and will correct the nasal scoliosis. The shortest part will be sutured at the commissure and create symmetry at rest. Then, the 3 key-points are attached to the tendon.

2.2. Literature search and data extraction

2.2.1. Search strategy and results

The literature search was performed using several databases: PubMed, Web of Science, Wiley Online Library, Cochrane Library, Directory of Open Access Journals, and SAGE Premier 2011 database. In PubMed, the search strategy consisted of the MeSH term "facial paralysis" AND free text words "temporalis lengthening myoplasty" OR "myoplastie d'allongement" OR "Labbe" OR "facial reanimation" OR "pedicled regional muscle flaps" OR "free muscle flaps" OR "gracilis muscle transfer" OR gracilis free muscle flap" OR "gracilis flap." The search strategy was adapted for the other databases, using these free text words: "facial paralysis" AND "facial reanimation" AND "temporalis" OR "gracilis."

2.2.2. Study selection criteria (Fig. 1)

No articles were excluded on the basis of language. The inclusion criteria were as follows: (1) studies involving patients with longstanding facial paralysis; (2) studies involving patients who underwent facial reanimation with gracilis free muscle flap transfer or LTM according to Labbé; (3) randomized controlled trials (RCTs), controlled clinical trials (CCTs), or case series with a sample size greater than 5. The exclusion criteria were studies with a level of evidence rated as V or studies involving patients who had undergone irradiation.

2.2.3. Data extraction

Data were extracted from each of the included studies by a single investigator. The extracted data were as follows: number of patients, sex and age of the patients, cause of the facial paralysis, the surgical treatment used to reanimate the smile and the time