Smile reconstruction in flaccid facial paralysis – optimization of oral symmetry by combining static and dynamic techniques

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Introduction
For dynamic reanimation of the oral commissure, microsurgical reconstruction with free functional muscle transfer has become the standard technique. The combined technique of the contralateral facial nerve for innervation of the transferred muscle frequently produces pleasanter results and potentially creates spontaneous emotional smile. However, with increasing skin laxity and soft tissue ptosis, the functionality and aesthetics of the oral region worsen notably in patients with long-standing facial paralysis. Thus, reanimation of the smile in these cases is technically challenging. Firstly, dropping of the oral commissure of the affected side at rest is a frequent problem in patients with flaccid facial paralysis, which is difficult to correct with a free functional muscle transfer alone. The advanced physiological soft tissue ptosis often leads to flattening of the muscle and lateral displacement of the ideal muscle insertion. Secondly, CFCG does not reliably result in an adequate upper lip contour to trigger a sufficient muscle contraction for symmetric oral commissure excursion even in young and older patients. Taken together, correction of the oral asymmetry in paralyzed patients with significant soft tissue ptosis by using a free functional muscle transfer alone or two-stage reanimation procedure with CFCG frequently remain unsatisfactory.

In this study, we addressed the above-mentioned problems of dynamic smile reconstruction by facilitating fascia lata grafts for static suspension in patients with flaccid facial paralysis. This combination of dynamic and static reconstruction may achieve improvement in facial symmetry as well as facial and phlarial deviation when using the combined technique compared to functional muscle transfer alone.

Figure 1. Introduction views of the surgical technique. Surgical approach of the single-stage dynamic reanimation using a free functional gracilis muscle transfer and fascia lata strips as static support. A. After preparation of the pocket for the gracilis muscle segment and identifying the fascia vessels and artery, an additional strip of fascia lata is excised and used for static support. The gracilis muscle is transferred to the nasolabial fold and the corresponding edge of the nasolabial fold. B. The fascia lata strips are marked with sutures. C. The strip is inserted in the line of the nasolabial fold and to the lower lip. D. Suture fixation of the flap to the nasolabial fold. E. Evaluation of the nasolabial fold and the lower lip. F. After fixation, the nasolabial fold is assessed in the presence of the transfer of the pocket and the flap is placed in upper lip position.

Patients and Methods
Surgical procedure
The surgical technique for single-stage smile reanimation with free functional gracilis transfer innervated by the masseteric motor nerve is described briefly in Figure 1.

In a retrospective chart review, we evaluated 6 patients (mean age 58.7±5.2) who received the combined single-stage procedure (group A) for postoperative facial symmetry. To match group A, we further identified 6 patients (mean age 52.5±7.5) who were treated before introduction of the combined technique and thus underwent dynamic facial reanimation without additional fascia lata grafts for static suspension (group B). Standardized photographs were taken pre- and postoperatively (3 and 6 months) to assess symmetry using the FACE-Gram software, both at rest and upon smiling. The software allows for an objective analysis of facial symmetry (Figure 2). Here, the improvement of oral commissure positioning was assessed by calculating the corresponding ratio of the length of line 3 between both the healthy and affected side, and the corresponding angle α. A perfectly symmetric smile yielded a symmetry ratio of 1 which was set to 100%. The nasal and phrilar deviation was defined by measuring the difference in vertical displacement of the nostrils in millimeter and the difference in horizontal displacement of the philtrum in millimeter, respectively. For both measurements, a perfectly symmetric result yielded a symmetry ratio of 0 mm.

Figure 2. The symmetry of the smile was measured by calculating the corresponding ratio of the length of line 3 between both the healthy and affected side, and the corresponding angle – between both sides. Perfect symmetry yields a symmetry ratio of line 3 which was set as 100%. Postoperatively, static symmetry in rest was significantly improved in both groups (p<0.05). Patients who received dynamic facial reanimation with additional fascia lata strips (group A) showed a significantly larger alignment of oral commissures and were found to benefit from this additional static support (p<0.05). A significant difference between both treatment groups appeared when compared with the preoperative photographs (p<0.05). Panel a indicates standard deviation (SD), significant differences between groups are marked with asterisks.

Figure 3. The philtral deviation was defined by the difference in horizontal displacement of the philtrum in millimeter. A perfectly symmetric result yields a symmetrical result. In group A, the philtral deviation was significantly improved compared to group B (p<0.05). The difference in the horizontal displacement of the philtrum was also significantly improved in group A (p<0.05). The border of significance between groups is marked with asterisks.

Figure 4. The postoperative improvement of the nasal deviation was measured by the difference in vertical displacement of the nostrils in the nasolabial area (green area). A perfectly symmetric result yields a symmetrical result. In group A, a significant difference in the vertical nasal deviation compared to patients without additional static support (group B) is seen. In group A, a significant difference between groups is marked with asterisks.

Conclusions
We present a suitable single-stage procedure of the functional and aesthetic outcome of smile reconstruction in flaccid facial paralysis. The addition of fascia lata strips to microsurgical smile reanimation proved to immediately correct oral asymmetry at rest and procedure, and improve functional deficits such as loss of oral fluids or speech impairments. The combined single-stage reconstruction for facial asymmetry is inferior in patients with significant soft tissue ptosis.

Reference
Paukner U, Jager D, Thiele D, Barancik H, Stark GB, Eisenhardt S. “Comparison of static and dynamic facial reanimation in patients with flaccid facial paralysis with combined functional gracilis transfer and fascia lata grafts for static suspension or functional donor site.” Medizin und Klinik, 2018

Figure 5. A 65-year-old woman with a complete facial paralysis of her left side after multiple reactions of an endocrine adenoma in the middle ear. The patient underwent dynamic facial reanimation with a free functional gracilis muscle transfer coupled to the nasolabial nerve of the affected side and additional fascia lata strips for static support in a single-stage procedure. Photographs were taken preoperatively and 6 months postoperatively. The symmetry of smile was significantly improved after the single-stage reconstruction both at rest and upon smiling.