Chapter 24

Facial Nerve Reconstruction

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Core Features

- Implications of facial nerve damage on related central and peripheral structures
- Time schedule for facial nerve repair
- Decision criteria for facial nerve reconstruction
- Importance of normal function of the trigeminal nerve in cases of hypoglossal-facial reanimation (basic functional triad between Vth, VIIth, and XIIth cranial nerves)
- Disadvantages of cross-face anastomosis

General Aspects

Before going into detail of the different surgical techniques available, it is necessary to outline some basic facts that should be considered.

Consequences of Facial Nerve Damage Leading to Axon Degeneration

The facial nerve itself is the structure to be operated on and, although it is important, it is a relatively simple “connecting cable” between the central nervous system (CNS) and the facial mimic musculature, thus being only a small part within a much more complex system. Not only the morphology of the nerve but also the vital condition of the central and peripheral structures of this threefold system have to be taken into account, especially in cases of delayed reconstruction.

As a consequence of any severe facial nerve damage leading to axon degeneration, this degeneration results:
a) Centrally, in retrograde changes to the motoneurons and their cellular environment [2, 7–11, 15, 30, 31] and
b) Peripherally, in the degeneration of muscle fibres [6, 12].

The reversibility or irreversibility of these degenerative processes depends on the time that has elapsed between nerve injury and reinnervation of the musculature.

**Time Schedule for Facial Nerve Repair**

Since the relationship between the elapsed time and the extent of these retrograde and anterograde morphological (and as a consequence, functional) changes differs for each species, it is not possible to draw any conclusions relating to human beings from animal experiments. Our knowledge is therefore limited to clinical experience. Based on our considerable empirical experience, we would make the recommendations compiled in the table about the time schedule for facial nerve repair (Table 24.1).

However, for recovery of facial expression following partial or subtotal resection of the facial nerve and/or the peripheral nerve plexus, an immediate surgical reconstruction should be performed when at all possible for the following reasons:

1. The surgeon should be aware that facial expression, with its unique arbitrary and spontaneous nature, plays an extremely important role in the social life of humans. Thus if it is lost or distorted this can have profound psychological consequences.
2. As already mentioned above, reconstructive nerve surgery should be performed as a one-stage operation together with tumour resection or, if a histomorpho-
logical analysis of the specimen is necessary, within 10–14 days at most, otherwise the rapid development of scar tissue may jeopardise the success of this delicate surgery.
3. The general health of the patient is to be considered, since with a reduced tolerance to anesthesia, more complex and therefore longer procedures must be replaced with simpler methods.
4. The biological age of the patient plays a role in the choice of procedure. With advancing age, the regeneration strength diminishes in nerve tissue, and preference is to be given to procedures that make a safe and fast reinnervation of the paralysed musculature possible. These are all procedures with end-to-end anastomoses, thus avoiding the use of interposition grafts.

5. The same decision criteria apply to patients who are particularly psychologically unstable, and may find it more difficult to live with a failed procedure than more stable or indifferent individuals.

6. The length of the interposition graft has a substantial influence on the final functional result after reconstruction. In principle, the rule can be applied that the longer the graft, the worse the final outcome will be, particularly when the graft is longer than 4–5 cm. The main reason for this is that the axons need more time to penetrate the endoneural tubes, while at the same time, degeneration of the Schwann cells and fibrosis occurs. In particular the penetration of the distal anastomosis will be handicapped through meanwhile development of scar tissue.

**Table 24.1. Time schedule for facial nerve repair**

<table>
<thead>
<tr>
<th>Duration of paralysis (years*)</th>
<th>Functional recovery of facial musculature</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–1</td>
<td>Absolutely certain</td>
</tr>
<tr>
<td>1–2</td>
<td>Expected, therefore recommendable</td>
</tr>
<tr>
<td>2–3</td>
<td>Probable, with delay and decrease in function</td>
</tr>
<tr>
<td>3–5</td>
<td>Increasingly questionable, patient must be notified</td>
</tr>
<tr>
<td>5+</td>
<td>Improbable, therefore not to be recommended</td>
</tr>
</tbody>
</table>

* Time interval between onset of denervation and probable reinnervation

**Fundamental Questions Prior to Nerve Surgery**

In cases of delayed nerve reconstruction, the following questions should be addressed before planning the surgery.

**Peripheral Nervous System (Facial Nerve and Plexus)**

a) To what extent has the nerve plexus been resected? In other words, is there still enough nerve tissue of the