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Electromyography in rhinoplasty

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SUMMARY

The function of the nasal muscles in rhinoplasty has not been investigated sufficiently. On this reason electromyographical and neuromyographical investigations were done in a group of rhinoplastics before and immediately after surgery but also at least 8 weeks later on. By performing a conservative technique the initial disturbance of the muscles immediately after surgery disappears in a high percentage and voluntarily movements of the nasal muscles can be observed. Different results are discussed.

INTRODUCTION

After rhinoplasty some patients complain about a rather immobile nosetip, the so-called "Stiff-Nose-Syndrome". This could be related to damage of the small nasal muscles, especially in cases, where the lower lateral nasal cartilages were operated on. According to the rhino-laryngology manual, this malfunction could be related to lesion of the small nasal muscles during surgery, even if one took care to avoid straining these muscles during septorhinoplasty (Converse et al., 1964). In order to control these muscles of the nose before and after rhinoplasty we looked for a method of direct measuring the functions of the small nasal muscles. This tool was found in electromyography with bipolar surface electrodes (Buchtal, 1958), which provides rather good insight into the muscle function during voluntary movement (Van Dishoeck, 1937). In addition, the more objective neuromyography method of stimulation of the facial nerve was used to control the nasal muscles (Hopf et al., 1979).

METHODS AND MATERIAL

The electromyograms were performed with a four channel electromyograph from Medelec, one channel for each side of the nose, and another channel for the time-base. The potentials were measured with a velocity of 5 cm/s for the interference pattern or 10 ms/cm for single action potentials. The amplifier unit made it possible to achieve an amplitude range from 200 µV to 1 mV.

Neuromyographic investigations of the nasal muscles were carried out with

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Figure 1.
Electromyography of the nasal muscles with bipolar surface electrodes in place.

stimulation of the facial nerve of each side in the stylo-mastoid region (Hopf and Struppler, 1974). Stimulation intensity varied from 40–120 volts.

The bipolar surface electrodes of 3 mm diameter were placed about 1 cm apart in the region of the upper and lower nasal cartilages, in order to facilitate selection of nasal muscle activity observation (Figure 1). Electrode placement was photographed.

Four groups of patients were investigated with these methods. In order to monitor representative nasal muscle potentials a group of ten persons with normal nose configuration and function was tested electromyographically. During relaxed respiration and forced respiration after 20 knee bending exercises reaction of the nasal muscles was tested. In addition, the nose was obturated with small cotton pieces in the vestibulum on each side to observe muscular reaction to nasal pathway obstruction.

In a second group of 42 patients nasal muscle functioning was investigated before, as well as two weeks, six weeks and six months after septorhinoplasty. Musclefunction was tested during relaxed respiration and during maximal voluntary omnidirectional nose movements as far as possible. Neuromyographic investigations were carried out using supramaximal stimulation of the facial nerve on each side.

In a third group of eleven patients with corrected nasal ala cartilages, pre- and postoperative investigations were undertaken in similar manner.

Finally, in a fourth group of five patients with facial nerve palsy of varied origin

nasal muscle functioning on each side was recorded, to compare electromyograms in cases of neural diseases of the mimic muscles.

RESULTS

In the first group with normal nasal function no or only minor basic nasal muscle activity was observed during relaxed respiration. Activity increased during obturation of the nose with cotton pieces. Immediately after physical stress a high amplitude interference pattern could be seen in accordance with nasal movement during forced respiration.

In the second group of septorhinoplasties the preoperative electromyogram showed similar results as in the first normal group. The preoperative electromyograms exhibited side differences only in considerably disformed cases. Occasionally the nose remained swollen for up to two weeks after surgery, permitting only minimal movement without pain. In addition, the distance between electrodes and nasal muscles increased in such cases, causing reduced muscle potential amplitudes. Therefore, only a reduced inference pattern was seen. Only in 4 cases of these 42 patients did the electromyogram show spontaneous activity signifying neuromuscular damage (Figure 2).

The results of neuromyography in this series of patients certify, as the normal latency shows, that no neural damage of the nasal motoric innervation had

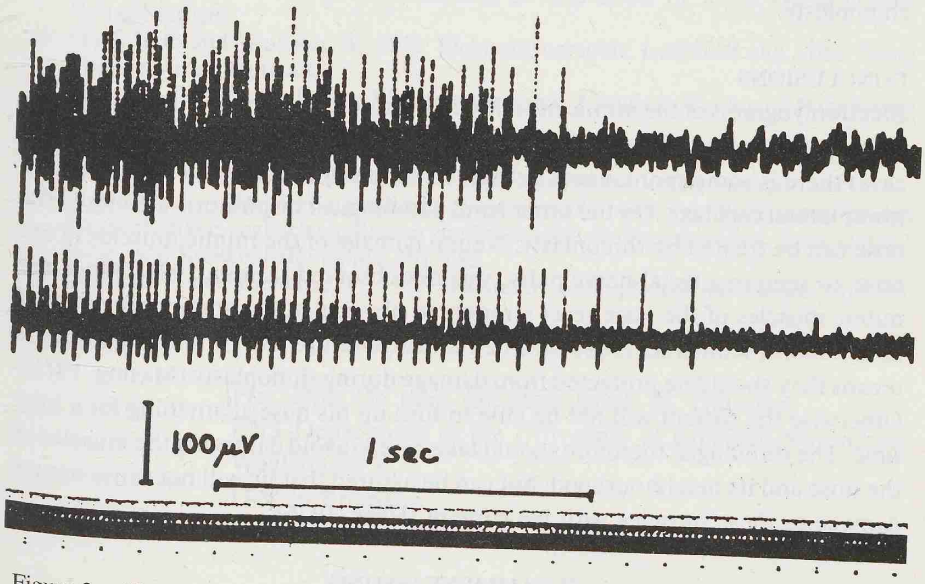

Figure 2. Electromyogram of the nasal muscles after rhinoplasty. Normal activity on the right side (upper track), pathological activity on the left side, indicating muscular malfunction (lower track).

occurred. Notable differences in muscle potential amplitudes were observed only in comparisons between one side and another. Six months after septorhinoplasty significant reduction in the EMG-amplitude of one side of the nose was recorded in only 2 out of the 42 patients. Spontaneous activity had occurred indicating some muscular disturbance. The other 40 patients exhibited a normal voluntary activity pattern as well as a normal neuromyogram.

In seven of the eleven cases of patients with rhinoplasty involving in particular the lower lateral cartilage, a preoperative voluntary activity of the alaris muscle had appeared during inspiration. Two weeks after surgery continuous activity was evident at least on one side in 4 cases. In addition, a unilateral postoperative reduction of amplitudes occurred on the electromyogram as well as in the neuromyogram of 3 patients. This must be seen as a consequence of muscular damage during cartilage surgery. Six weeks after surgery preoperative inspiratory activity levels were attained in 4 patients. In the remaining cases these activity patterns had disappeared. Voluntary activity could be induced in the nasal muscles only during forced inspiration.

In five patients with unilateral facial nerve palsy the nasal electromyogram showed typical diminished electrical activity of the paretic side. In 3 cases with neurapraxia, neuromyography of the nasal muscles was possible. 2 cases with a degenerative palsy showed spontaneous activity in the electromyogram and no reaction during electric stimulation. This could never be observed in cases after rhinoplasty.

CONCLUSIONS

Electromyograms of the mimic muscles of the nose after various rhinoplastic procedures demonstrated no significant long-term muscular damage. In exceptional cases there is some spontaneous activity in the nasal mucles after surgery of the lower lateral cartilage. On the other hand pathological inspiratoric activity of the nose can be treated by rhinoplasty. Neural damage of the mimic muscles of the nose, as seen in a facial nerve palsy, was not observed (Ludin, 1981). Since the mimic muscles of the nose react strongly to physical stress and increased nasal obstruction (Schmalix, 1968; Stoksted and Kjellerup, 1977), their importance means they should be protected from damage during rhinoplasty (Masing, 1971). Otherwise the patient will not be able to turn up his nose at anything for a long time. The rhinologist therefore should take care to avoid damaging the muscles of the nose and its neighbourhood, but can be assured that he will not cause neural damage to these muscles with his surgery (Haas, 1976).

ZUSAMMENFASSUNG

Die Funktion der kleinen Nasenmuskeln vor und nach Rhinoplastiken wurde bisher noch nicht ausreichend untersucht. Als objektive Prüfmethoden für die

Funktion dieser dem N. facialis angeschlossenen Gesichtsmuskulatur bieten sich die Elektromyographie und Neuromyographie an. Unmittelbar vor und nach Rhinoplastiken, sowie in einem Zeitraum von acht Wochen nach der Rhinoplastik und später wurden deshalb elektromyographische und neuromyographische Testungen der kleinen Nasenmuskeln durchgeführt. Befleißigt man sich einer konservativen Operationstechnik, so verschwinden die unmittelbar nach der Operation vorhandenen Störungen der Muskelfunktionen in mehr als 95% der Fälle. Die Ergebnisse der Messungen vor und nach Rhinoplastiken werden mit anderen Störungen, z.B. Fazialislähmungen im Bereich der Gesichtsmuskulatur verglichen.

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