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Hering's Law of the Frontal Facial Branch

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Sir,

Ocular muscles work together to regulate accurate control of eye movements, which is described as binocular eye movement by Hering's law (HL)¹. In general, HL is used to describe the following mechanisms associated with ptosis palpebrae: significant ptosis palpebrae with slight impairment on one side may result in extra activity of the levator palpebrae muscle on the other side and by that may camouflage the less severe ptosis on the opposite side.

HL, however, also applies to the frontal branch of the facial nerve, as we clinically experience regularly: damage of the (frontal branch of the) facial nerve causes depression of the ipsilateral eyebrow and acute involuntary elevation of the contralateral eyebrow with concomitant increase in horizontal forehead wrinkles. This is due to bilateral innervation of the upper facial muscles by the facial nerve (VII). The facial nucleus is located in the pons, a part of the brainstem, which consists of two parts; one part for upper facial muscles and the other part for lower facial muscles. Lower facial muscles are contra-unilaterally innervated whereas the upper facial muscles are bilaterally innervated.

A case illustrating Hering's law of the frontal branch: a 52 years old female with sagged jowls, had a short-scar face-lift procedure performed under local anesthesia with "Jungle juice" solution (local anesthesia). Immediately after the procedure, it struck us that the patient had decrease of the left eyebrow position with no ability to lift it actively (Figure 1). This was interpreted as temporary facial palsy of the frontal branch (FPFB) due to the local anesthesia. In contrast, the contralateral eyebrow was significantly elevated as compared to the pre-operative situation with an increase in the number of clearly visible horizontal forehead wrinkles above this eyebrow, indicating excessive activity of the frontalis muscle on this side. Other facial mimics were not disturbed. Our patient had a sixth grade facial palsy according to the House Brackman classification. Within a few hours after the facelift procedure both

eyebrow positions recovered to the original position; the affected eyebrow increased to its normal position and could be elevated again (Figure 2). The contralateral eyebrow decreased in height to its pre-operative normal position and the extra number of horizontal forehead wrinkles had disappeared.

Some authors have described the eyebrow elevation and increased horizontal forehead wrinkles of the contralateral peri-orbital region after permanent hemi-FPFB as being due to frontalis muscle hypertrophy^{2,3}. The assumption of muscle hypertrophy, however, has never been confirmed by histopathologic biopsy nor diagnostic imaging techniques^{4,5}. We think this phenomenon is just due to HL, that, as illustrated by our case just described, can already be observed directly after hemi-FPFB: hemi-FPFB results directly in eyebrow depression of the affected side with instantly over elevation of the contralateral eyebrow.

One-sided damage of the frontal branch of the facial nerve causes bilateral activation of both brain parts in attempt to elevate the depressed eyebrow and thereby resulting in over elevation of the contralateral eyebrow. This bilateral innervation enhances facial asymmetry immediately after peripheral facial nerve damage.

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Legends to the figures

Figure 1 Immediately post-operative evaluation of the patient: local anesthesia induced temporary facial palsy of the frontal branch. There is a decrease of the left eyebrow position and an involuntary elevation of the contralateral eyebrow with an increase in the number of forehead wrinkles which indicates excessive activity of the frontalis muscle on this side.

Figure 2 Post-operative evaluation of the patient. Both eyebrow positions are fully recovered to the original position and the number of forehead wrinkles are decreased.

Figure 1

Figure 2