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ORIGINAL ARTICLE FACIAL SURGERY

Synkinesis Between Orbicularis Oculi and Procerus Muscles: Video Presentation of an Unusual Type of Aberrant Innervation after Cosmetic Rhinoplasty

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Abstract

Background Synkinesis is a recognized complication following peripheral facial nerve paralysis. Different types of synkinesis have been described, with oral–ocular and ocular–oral synkinesis being the most common. Ocular–nasal synkinesis has been reported in two patients following cosmetic rhinoplasty. However, synkinesis between the orbicularis oculi and procerus muscles has not been reported by now.

Methods This is an interventional case report.

Results Two women, aged 42 and 37 years, presented with unilateral contraction of the medial eyebrow muscles (procerus) with spontaneous or voluntary blinking, 4 and 5 months after cosmetic rhinoplasty, respectively. Both were successfully treated with injection of botulinum toxin A.

Conclusions Surgical trauma is inevitable during every procedure, including rhinoplasty, and may damage the fine structures including branches of the facial nerve innervating the muscles. Gentle tissue handling may minimize iatrogenic injury to the fine motor branches of the facial nerve and prevent subsequent aberrant innervation and synkinesis. Botulinum toxin A injection can effectively, yet temporarily, resolve the unintentional contractions and provide significant patient comfort.

Level of Evidence V This journal requires that authors assign a level of evidence to each article. For a full description of these evidence-based medicine ratings, please refer to the table of contents or the online instructions to authors www.springer.com/00266.

Keywords Esthetics · Botulinum toxin type A · Facial nerve · Rhinoplasty · Synkinesis

Introduction

Synkinesis is defined as involuntary contraction of facial muscles of one area, elicited by voluntary contraction of a different muscle [1]. Synkinesis typically develops after recovery from facial nerve paralysis due to various etiologies including trauma, neoplasia, inflammation, infection and surgical manipulation [2]. Cosmetic rhinoplasty is one of the most common plastic surgical procedures [3] and necessitates manipulation of various anatomical structures of the nose [4], which may occasionally include the procerus muscle on the nasal dorsum. Surgical trauma from compression, traction, laceration, thermal or chemical injury can occur during the procedure and may damage the fine structures including branches of the facial nerve innervating the muscles [5]. Herein, we present an unusual synkinesis observed in two patients following cosmetic rhinoplasty.

Case Report

Two patients are presented in this study. The patients provided written informed consent to participate in the study and have their photographs and videos published.

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The study followed the tenets of the Declaration of Helsinki.

Patient #1 is an otherwise healthy 42-year-old woman who underwent primary uncomplicated open-approach cosmetic rhinoplasty 12 months ago. According to her plastic surgeon, lateral dissection was performed in the subperiosteal plane by elevating the tissues with scissors and the extent of lateral dissection was approximately twice the size of the resected hump. Lateral osteotomy was performed through the submucosal (internal) approach.

Four months after surgery, she began experiencing contraction of muscles of the medial right eyebrow simultaneous with every voluntary or reflex blinking (Figs. 1 and 2, and Video 1). Her findings aggravated with time, and at the time of our examination, she had hypertrophy and spastic contractions of the right procerus muscle. There were occasional spasms of the procerus in the absence of blinking. She was treated with deep intramuscular injection of 8 units of incobotulinum toxin A (Xeomin, Merz Pharmaceuticals GmbH, Frankfurt, Germany) in the procerus muscle (2 mm above the center of the horizontal plane that intersects both medial canthi) and the synkinesis improved (Video 2).

Patient #2 is a 37-year-old woman who developed similar synkinesis between the left procerus and orbicularis oculi muscles 5 months after primary uncomplicated cosmetic rhinoplasty by another surgeon. Based on the operation notes, an open-approach rhinoplasty with transmucosal lateral osteotomy was performed. Lateral dissection twice the size of the resected hump through dissection in the subperiosteal plane with an elevator had been undertaken. She showed satisfactory response to treatment with 10 units of abobotulinum toxin A (Dysport, Ipsen Limited, Slough, Berkshire, UK), injected in the midline, 2 mm above the intercanthal line, similar to the other patient (Video 3).

Fig. 1 Photograph of patient #1 with open eyes

Fig. 2 Photograph of the same patient during closure of the eyes. Note medial and downward movement of right eyebrow and the horizontal skin fold on the nasal radix of the right side due to synkinetic contraction of the right procerus muscle

Discussion

Aberrant nerve regeneration is a recognized complication of peripheral facial nerve palsy, affecting 9% to 55% of patients, according to different sources [6]. Although the pathophysiology of aberrant facial nerve regeneration and facial synkinesis is not yet completely understood, three mechanisms have been proposed. Aberrant fiber regeneration, ephaptic transmission between adjacent axons, and nuclear hyperexcitability are the suggested hypotheses, with the first being the most widely accepted [7]. Synkinetic movements are among the most troubling sequelae of facial nerve paralysis, sometimes more distressing than the facial palsy itself, because of disturbances in social interactions and the conveyance of emotions through distorted facial expressions [8–10].

Synkinesis is often named by combining the two involved motor groups: The voluntarily contracted muscle group is named first, followed by the unintended muscle movement [8]. A variety of synkinesis have been described due to co-contraction of different muscles innervated by facial, oculomotor or trigeminal nerves [9]. The most common types of facial synkinesis are oral–ocular and ocular–oral synkinesis followed by ocular–nasal, ocular–chin, ocular–stapedial, chin–ocular, chin–oral and platysma synkinesis [11]. However, to our knowledge, synkinesis

between the orbicularis oculi and procerus has not been previously reported.

The orbicularis oculi is a complex periocular striated muscle innervated by temporal and zygomatic branches of the facial nerve that acts to close the eyelids and plays the main role in blinking. The procerus is a small pyramidal muscle that arises from the periosteum of the lower portion of the nasal bone and the perichondrium of the upper lateral nasal cartilage and inserts onto the dermis of the skin over the lower forehead. Contraction of the procerus muscle draws the medial angle of the brow downward and produces transverse wrinkles over the nasal bridge [12]. The procerus muscle is supplied by a nerve from the buccal branch of the facial nerve, after having received a contribution from the zygomatic branch [13]. This nerve courses inferomedially around the orbicularis muscle and between the nasion and medial canthal angle, and has been termed the angular nerve [13]. We hypothesize that the angular nerve might have been damaged most probably during the lateral osteotomy of the nasal bone (Fig. 3).

Occurrence of synkinesis following rhinoplasty has been reported by Guarro et al. They observed ocular–nasal synkinesis (contraction of the compressor narium minor muscles surrounding the alar cartilages upon blinking) in two patients after rhinoplasty [14]. Nevertheless, whether the pathogenesis is iatrogenic or the patients have had abnormal anatomy and/or neural connections remains to be elucidated [15]. Ocular–nasal synkinesis has been observed in a series of patients without a history of facial surgery or trauma, and it is unclear whether this type of synkinesis is congenital or due to subtle trauma resulting in misdirected reinnervation [16]. Yet, iatrogenic trauma to motor fibers of the facial nerve during rhinoplasty is probable due to compression, traction, laceration, thermal or chemical injury which can damage several components of the peripheral nerves, including the myelin, axons or supporting nerve structures (endoneurium, epineurium and perineurium) [5]. To minimize iatrogenic damage to branches of the facial nerve during rhinoplasty, dissection in a total subperichondrial–subperiosteal plane, as advocated by Cakir [17], has been recommended [15]. Another atypical feature of our cases was their relatively older age (around 40) than the common age for rhinoplasty (around twenties). Although the small number of cases precludes us from drawing certain conclusions, the relatively older age of our patients may have had a role in their development of synkinesis. It has been shown that with increasing age, successful recovery from facial paralysis becomes less probable [18] due to several factors including the loss of myelinated fibers during the aging process [19].

Abnormal synkinetic movements in our patients were successfully treated using botulinum toxin A. For achieving symmetric facial expressions, botulinum toxin was injected in the midline to immobilize both the right- and left-side procerus muscles. A double-blind placebo-controlled trial in 36 patients with facial synkinesis demonstrated significant improvement in quality of life, social interactions, perception of self-appearance, visual function and perception of problem severity with botulinum toxin injection [20]. However, the temporary effect of

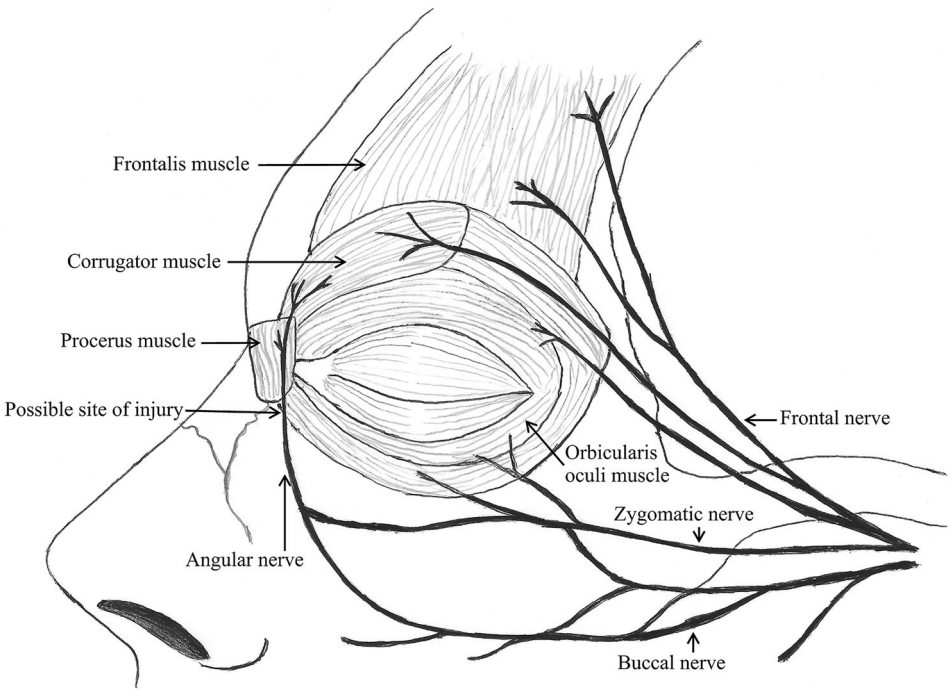

Fig. 3 Schematic diagram of the innervation of upper facial muscles, demonstrating the course of the angular nerve and the possible site of injury during rhinoplasty in our cases

chemodenervation lasting approximately 3 months is a limitation for botulinum toxin therapy, as further injections are required for treatment. Other therapeutic options are facial neuromuscular retraining and surgical interventions such as selective myectomy [8, 10].

In conclusion, two cases of an extremely rare type of synkinesis between the orbicularis oculi and procerus muscles after cosmetic rhinoplasty were presented. Gentle tissue handling during rhinoplasty may minimize iatrogenic damage to the fine motor branches of the facial nerve and prevent subsequent aberrant innervation and synkinesis. Botulinum toxin A injection can effectively resolve the unintentional contractions and provide significant patient comfort.

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Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical Approval All procedures performed in participants were in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

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