



## Botulinum toxin A and/or soft tissue fillers for facial rehabilitation

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**Summary** Botulinum toxin A and soft tissue fillers are cornerstones of facial rejuvenation procedures. They can also be of benefit in facial rehabilitation. We report on three female patients who were treated with botulinum toxin A and/or hyaluronic acid-based fillers, one after orthognathic surgery, two after Bell's palsy, to correct facial asymmetries and loss of volume to restore facial attractiveness and improve their self-esteem and quality of life. These minimally invasive procedures are safe and effective. However, they need to be repeated for the long-term rehabilitation.

**Keywords** Facial rehabilitation · Bell's palsy · Orthognathic surgery · Botulinum toxin A · Soft tissue fillers

### Botulinumtoxin-A und dermale Gewebefiller in der fazialen Rehabilitation

**Zusammenfassung** Botulinumtoxin-A und dermale Gewebefiller zählen zu den Eckpunkten der Gesichtsrejuvenation. Sie können auch im Rahmen einer fazialen Rehabilitation von Nutzen sein. Wir berichten über drei weibliche Patienten, die mit Botulinumtoxin-A und/oder Hyaluronsäure-Filler zur Korrektur von Gesichtsasymmetrien und Volumenverlust nach orthognathen Chirurgie ( $n=1$ ) bzw. Fazialisparese ( $n=2$ ) behandelt wurden, um die Attraktivität des Gesichtes wiederherzustellen und ihr Selbstwertgefühl und ihre Lebensqualität zu verbessern. Diese minimalinvasiven Eingriffe sind sicher und effektiv.

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Allerdings müssen sie wiederholt werden, um eine langzeitige Rehabilitation zu erlauben.

**Schlüsselwörter** Gesichtsrehabilitation · Fazialisparese · Orthognathe Chirurgie · Botulinumtoxin-A · Dermale Gewebefiller

### Introduction

Botulinum toxin A (BoTN) is produced by *Clostridium botulinum*. It consists of a heavy chain of 150 kDa and a light chain of 50 kDa, connected to each other by a disulfide bond. Injected into a target tissue, BoTN becomes pinocytosed by the cells and cleaved intracellularly. The light chain contains a zinc-binding motif and acts as a highly specific endopeptidase. It binds to the SNARE complex (soluble N-ethylmaleimide-sensitive fusion protein receptor), which is essential for exocytosis of acetylcholine. BoTN has been approved for the treatment of muscle spasms, hyperhidrosis, and facial rejuvenation [1].

Soft tissue fillers are used to restore loss of volume, improve skin quality, and improve rhytides. They are subdivided into permanent and non-permanent biodegradable materials. Here we will focus on the latter only. The most popular soft tissue filler is hyaluronic acid (HA). Natural HA is composed of repeating disaccharide units of N-acetyl-D-glucosamine and D-glucuronate. HA is a natural component of the extracellular matrix with a high turnover rate. It becomes rapidly degraded by hyaluronidase with a half-life of around 12 h. Therefore, HA products are stabilized by cross-linking agents. Usually, filler effects can last for 6 to 9 months [2].

In this study we report on the use of BoTN and HA filler for facial rehabilitation after orthognathic surgery and facial synkinesis after palsy.

**Fig. 1** Patient #1 after orthognathic surgery with thin and flat (upper) lips (a) and immediately after augmentation with hyaluronic acid filler (b)



## Case reports

### Patient #1

The first patient was 17 years old. She had undergone orthognathic surgery 4 years previously. Probably due to this procedure, the nasolabial angle became wider, her vermilion was very thin, and the upper lip seemed flattened. She was unhappy with the appearance of her lips after surgery. 0.6 mL HA filler were injected to volumize both the upper and lower lips (Fig. 1).

### Patient #2

The second patient was 26 years old. She had had a car accident approximately 8 years ago, with section of the facial nerve including the temporal, zygomatic, and buccal branches. She suffered from severe facial asymmetry. She was treated by injections of BoNT in the right side of the face (not affected by the accident) every 3 to 4 months. The intention was to reduce the muscular activity of these muscles and improve facial appearance (Fig. 2). Currently, we are planning to insert a small piece of gold in the upper lid to treat enophthalmus paralyticus.

### Patients #3

The third patient was a 52-year-old female with Bell's palsy developing about 5 years ago after herpes infection. She suffered from lower facial asymmetry and soft tissue atrophy of the left side of the upper lip. She was treated by us with repeated BoNT injections around the left side of the mouth every 3 to 4 months and 1 mL of HA filler for the upper lip once a year (Fig. 3).

Adverse effects associated with these procedures were temporary and mild in nature. They included pain at the injection site, swelling, and minor bruising. All patients were highly satisfied with the results and rated the adverse effects as tolerable. They reported improved self-esteem and a better quality of life.

## Discussion

Orthognathic surgery aligns the patient's jaws into a desired, more appropriate position. The procedure, however, may leave other esthetic problems unaddressed or cause undesired esthetic changes months to years after surgery [4].

We corrected thin and flat lips by injecting small amounts of HA soft tissue filler into the upper and lower lips. The procedure is comparable to lip augmentation. The effect will usually last for up to 4 to 6 months, depending on the stiffness, concentration, and crosslinking of the filler product [2, 3].

Surgical repair of cleft lip, while correcting deformity and dysfunction, may leave residual cosmetic imperfections. The resultant asymmetry and low volume of the upper lip can be addressed surgically and via less invasive methods, such as soft tissue fillers. Schweiger et al. (2008) reported good esthetic effects that lasted about 4 months [5].

The two other patients suffered from facial nerve palsy. The incidence of this disease has been estimated at 23–35 per 100,000. Most frequently, it is caused by idiopathic facial nerve paralysis, also called Bell's palsy or facial palsy. Other causes include trauma, tumors, and infections [6]. Facial nerve palsy may be followed by incomplete recovery. Such patients will suffer from facial muscle weakness, contracture, hyperkinesis, hyperlacrimation, soft tissue atrophy, and synkinesis. The most debilitating sequelae of peripheral facial palsy and incomplete recovery are synkinesis and asymmetry of the face leading to an unsightly facial appearance [6, 7].

Synkinesis is defined as an abnormal involuntary facial movement that occurs with a voluntary movement of a different facial muscle group and has been observed in up to 55 % of patients with incomplete recovery from facial nerve palsy. It starts 3 to 4 months after regeneration of facial nerve palsy and continues for up to 2 years. The most common types are oral-ocular (involuntary eye closure during voluntary mouth movement) and oculo-oral (involuntary mouth movement during voluntary eye closure) [8]. Fortunately, none of our patients suffered from synkinesis.



**Fig. 2** Patient #2 with traumatic facial nerve palsy on the left side: **a, c, e** before treatment; **b, d, f** after BoTN injections. **a** Activity of orbicularis oris and zygomatic muscles produced an asymmetrical appearance of the mouth with upward lifting of the corner of the mouth on the unaffected side. **b** When the patient was asked to purse her lips, the deviation of the philtrum to the unaffected side became clearly visible. **c** Frontalis muscle elevated the brow on the unaffected side. Asymmetries were harmonized after treatment

Loss of facial symmetry, synkinesis, and unsightly appearance drastically reduce the quality of life of patients [9]. Common interventions include surgery (neurolysis and myectomy), physical therapy modalities, and biofeedback. BoTN has been used to improve synkinesis either alone or in combination with biofeedback [1–12].



**Fig. 3** Patient #3 with infectious facial nerve palsy and soft tissue volume loss of the upper lip. **a, b** Before treatment; **c, d** after treatment with BoTN injections and volume substitution by HA filler. The mouth at rest (**a** and **c**) and smiling (**b** and **d**). Treatment reduced asymmetry of the mouth and led to an almost symmetrical smile

We treated two patients with facial nerve palsy. Patient #2 suffered from severe facial asymmetry. Injection of BoTN to the contralateral site of the injury caused a relaxation of facial muscles and led to an improved facial appearance. The treatment has to be repeated every 3 to 4 months.

In patient #3, there was not only a facial asymmetry around the mouth but soft tissue atrophy. Here, we started with BoTN injections followed by volumizing with HA filler. Due to the combination, the filler will last longer compared to filler alone. Nevertheless, the application of HA filler has to be repeated after approximately 9 months [13]. All patients spontaneously reported a marked improvement in quality of life and self-esteem.

The use of dermal fillers and/or BoTN belongs to minimally invasive procedures. With fillers, the result is seen immediately after filler placement. BoTN injections show a response with a delay of about 2–3 weeks. Both procedures are useful adjuncts in the rehabilitation of patients, either after orthognathic surgery or facial nerve palsy. They can be used alone or in combination, tailored to the individual needs of the patient.

#### Compliance with ethical guidelines

**Conflict of interest** U. Wollina and A. Goldman declare that they have no competing interests.

**Ethical standards** All procedures performed in studies involving human participants were in accordance with the

ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study. Additional informed consent was obtained from all individual participants from whom identifying information is included in this article.

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