



BTX-A Rejuvenation: Regional Botulinum Toxin-A Injection of the Platysma in Patients with Facial Sagging

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Received: 11 November 2018 / Accepted: 28 April 2019 / Published online: 15 May 2019
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Abstract

Objective To establish botulinum toxin-A (BTX-A) rejuvenation as an innovative technique to treat facial sagging with descent of the mid and lower face in Asian females.

Methods Between March 2016 and March 2017, 512 female patients with facial sagging were treated with regional platysma BTX-A injection. Droplet injection into the dermis was performed. Among the patients, 192 were recruited into our retrospective study. Eligible patients were divided into a pre-senile group (28–39 years old) and a senile group (> 40 years old). We analyzed the patient/physician-graded improvement, the mean scores of the 5-point improvement scale, and any reported complications.

Results The overall degree of both patient- and physician-graded mid-face aesthetic improvement was very high. Improvement ratings reached 97.92% for patients and 94.79% for physicians. Improvement ratings were significantly greater in the pre-senile group compared to the senile group ($p < 0.001$), suggesting that the pre-senile patients were more satisfied with their improvement. Moreover, the percent of patients who reported as “much improved” was significantly higher than the percent of physicians ($p < 0.05$), suggesting that patients felt more positively about their aesthetic results than the physicians. No severe side effects were reported.

Conclusions Our results demonstrated that regional BTX-A injection in the dermis for the purpose of aesthetical platysma rejuvenation is safe and effective in patients with facial sagging with descent of the mid and lower face. Specifically, regional platysma injections of BTX-A (BTX-A rejuvenation) can correct descent of the mid and lower face in Asian females, demonstrating clinical utility of this treatment strategy.

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 Botulinum toxin-A · Regional platysma injection · Droplet injection · Deep dermal injection · BTX-A rejuvenation · Descent of mid and lower face

Introduction

As the popularity of facial rejuvenation grows, the number of patients with facial sagging with descent of the mid and lower face who require aesthetic rejuvenation has also grown. Currently, a plethora of injection techniques that focus on facial rejuvenation of the upper and lower face have been developed and used to treat facial sagging. Nevertheless, there is no clear consensus regarding which facial rejuvenation provides optimal management.

Herein, our study investigated the benefits of an innovative injection technique to treat facial sagging with descent of the mid and lower face. We included 192 patients who underwent face rejuvenation for aesthetic outcomes at our hospital. Our innovative injection technique, botulinum toxin-A (BTX-A) rejuvenation, was

Electronic supplementary material The online version of this article (<https://doi.org/10.1007/s00266-019-01396-4>) contains supplementary material, which is available to authorized users.

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formulated for facial rejuvenation of the regional platysma to correct descent of the mid and lower face.

Methods

Study Population

All pre- and postoperative surgical and photographic data, as well as clinical information, were retrospectively reviewed for 512 patients who underwent regional platysma BTX-A injection by the same senior surgeon since 2015. Of these 512 patients, female patients diagnosed with facial sagging at the outpatient clinic of the 117th Hospital of Chinese People's Liberation Army, Hangzhou, Zhejiang 310013, PR China, were recruited into our study between March 2016 and March 2017. Among these patients, 318 female patients met the eligibility criteria and were included in this study. Inclusion criteria were as follows: 18–65 years of age, no history of BTX-A allergy, and varying degrees of facial sagging on the chin, neck, or mid and lower face. The exclusion criteria were as follows: allergy to BTX-A or any BTX-A formula, myasthenia gravis or Lambert-Eaton syndrome, infections at the injection areas, history of injection or surgery on the face and neck within 3 months, history of tumor or facial paralysis, or pregnant and breast-feeding. Patients who received BTX-A therapy within 2 weeks preceding study initiation were excluded. Patients were classified into two age-groups (28–39, pre-senile; and ≥ 40 , senile). All responders were sent a questionnaire to assess their response to the treatment. A 5-point improvement scale was used to simultaneously assess patient responses. Two independent investigators, blinded to patient results, used a physician-graded 5-point scale to assess pictures of each patient before and 1 month after treatment. All questionnaire results were reviewed and analyzed. The present study was approved by our institution's ethics committee, and written informed consent was obtained from all included patients.

BTX-A Rejuvenation Technique

Anatomy of Platysma

The platysma is a broad sheet of cutaneous muscle localized in the superficial fascia of the neck, which arises from the fascia covering the upper parts of the pectoralis major and deltoid; its fibers cross the clavicle and proceed obliquely upward and medially along the side of the neck and insert into the cheilion. From its origin to insertion, the

platysma has two turning points at the junction between the mental floor and neck and at the mandible area.

To facilitate BTX-A injection, the anatomical structure of the platysma was divided into three quadrilateral regions: V1, V2, and V3 (Fig. 1). V1 was defined as the facial part of the platysma, which majorly affects facial dynamics. We drew a quadrilateral area by linking four reference planes (Fig. 1a–c): line joining the tragus and the cheilion, the lower margin of the body of the mandible, the extension line along the nasolabial fold, and the line joining the mandibular angle and the tragus. The platysma in the V1 area fell along the facial superficial muscular aponeurotic system (SMAS) and the malar fat pad and along the descent of the mid and lower face. V2 was defined as the submental area of the platysma (Fig. 1b, c). Its borders were: the lower margin of the body of the mandible, the junction line between the body of the hyoid bone and the venter posterior muscoli digastricita, and the left and right lateral borders of the platysma, the submental triangle in anterior cervical region, and the submandibular triangle on either side. V3 was defined as the cervical portion of the platysma (Fig. 1a–c). The upper border of V3 was the junction line between the body of the hyoid bone and the venter posterior muscoli digastricita. The lower border was the supra-clavicle line. The left and right borders were the lateral borders of the platysma.

Pre-treatment Design

For patients with mid and lower facial descent, we performed BTX-A injection (20–30 units) within the V1 region (Fig. 2a). For patients with both facial descent and sagged mental floor, we performed V1 and V2 injections (40–60 units) (Fig. 2b). For patients with extra descent in the pre-cervical area, we performed V1–V3 injections (60–80 units) (Fig. 2c). If the sagging was severe and BTX-A injection did not sufficiently correct the situation, other aesthetic procedures like thread lift and liposuction along the submandibular line were applied.

Injection Technique

Included patients were injected in the platysma using Botox cosmetic (100 U, Allergan Inc.). A standard 2.5-mL dilution of 100 U Botox was prepared using normal saline. The dilution was then drawn into a 1-mL syringe connected to a 13-mm-long 30 G needle. Droplet injection was performed, and all injection levels were in the dermis. All injections were carefully administered by a senior expert plastic surgeon at 1–2-cm intervals to ensure that each droplet remained in the dermis (Supplementary Fig. 1). The amount within each droplet was 0.3–0.4 U. A total of 10–40 U per side of the face were injected into patients

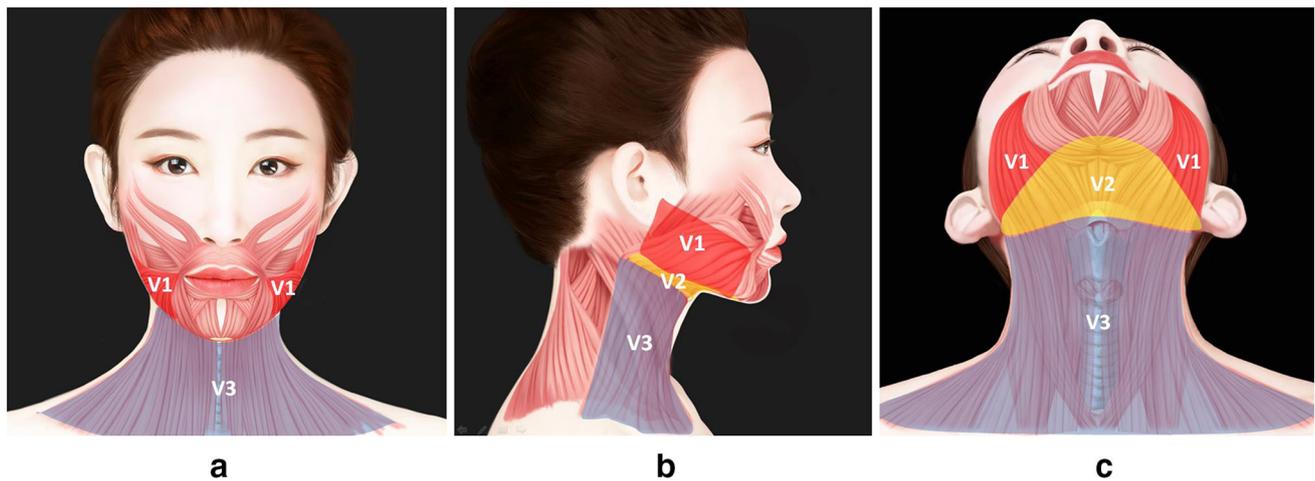


Fig. 1 Illustrations of regions of the platysma, borders of the V1, V2, and V3 regions of the platysma in gross anatomy: **a** (frontal view), **b** (lateral view), **c** (frontal view with head upward)

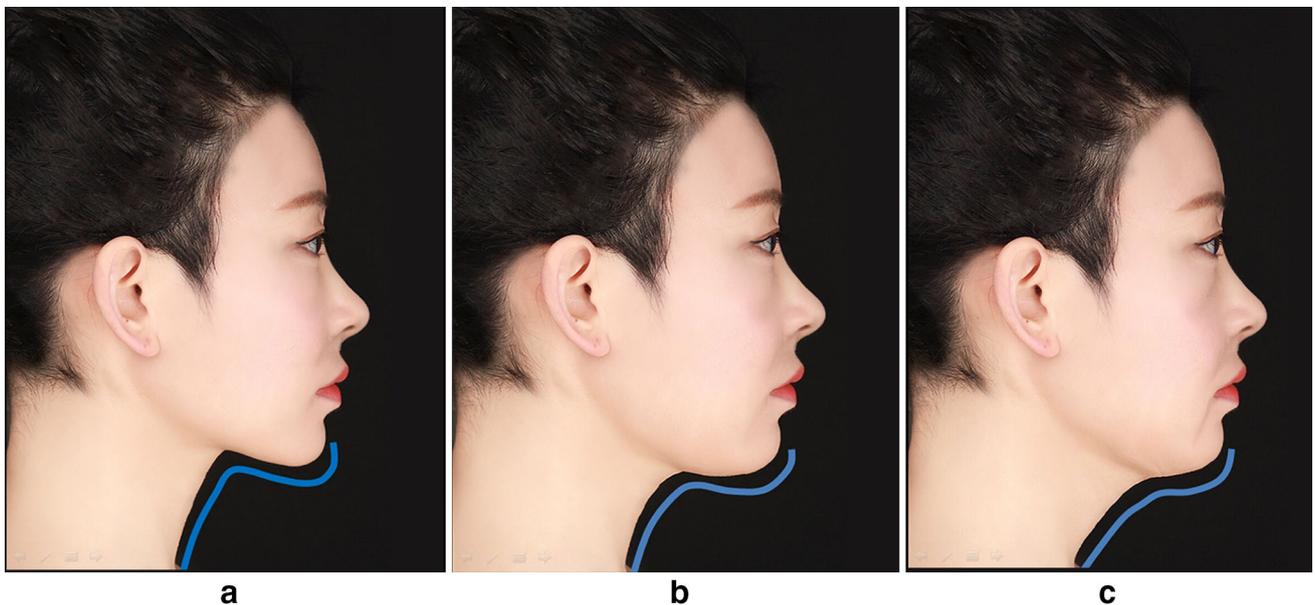


Fig. 2 Injection plans for different patients: **a** (left). V1 injection in pre-senile females with mild mid and lower facial descent, presenting as mild nasolabial folds and marionette lines, and sharp cervical mental angle; **b** (center). V1 and V2 regional injection in patients with moderate mid and lower facial descent, presenting as deepened

nasolabial folds, Marionette lines, and sagged mental floor; **c** (right). V1 + V2 + V3 injection in patients with descent of both face and neck, presenting as deep nasolabial folds and marionette lines, blunt cervical–mental angle (appearance of “turkey neck”). If necessary, other procedures can be combined

according to their severity of sagging. None of the patients experienced severe complications during the injection.

Photographic Data Collection

We acquired two-dimensional (2D) portrait photographs of all included patients. Photographs of the following were taken of all subjects before and after treatment, and at the follow-up visit: frontal view (looking upward and downward, with and without smile), left and right lateral view, and left and right oblique views.

The dimensions of these photographs in relation to the Frankfurt horizontal plane [1] relied on the position of each patient in the head holder. The Frankfurt horizontal plane, also called the eye–ear plane used for anthropometric analysis of facial surface data, was defined as the line linking the orbitale and trignon landmarks of both hemifaces [1].

All photographs with specifically configured studio strobes were taken using the Nikon D50 high-resolution photography system (Nikon Corporation, Tokyo, Japan).

The camera tripod and blue suede backdrop were used as additional equipment for photography.

Outcome Measurements

A 5-point scale rating (1—“much worse,” 2—“worse,” 3—“no change,” 4—“improved,” and 5—“much improved”) was used to assess aesthetic outcomes compared to baseline characteristics. Patients were asked to complete a questionnaire to assess their response after injection, which was modified from Manuel’s study [2]. Aesthetic correction was rated using the 5-point scale.

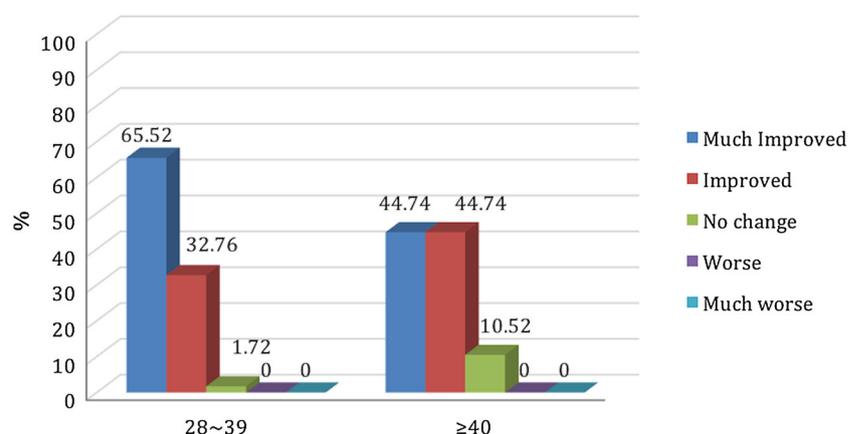
Specifically, the questionnaire was presented as follows: (1) Rate each item on the 5-point scale with regard to how you rate your aesthetic outcomes. (2) Would you recommend our treatment to others? (Yes/Not sure/No); (3) Will you consider further regional platysma BTX-A injections with our treatment? (Yes/Not sure/No); and (4) Have you experienced any side effects with our treatment? If yes, please describe. (Yes/Not sure/No).

All images were compiled for the 192 patients. Two independent investigators, blinded to the patient questionnaire responses, completed the same 5-point correction scale by comparing the results of the baseline (preoperative) photographs to those taken at the 1-month follow-up (Fig. 3).

Statistical Analysis

Statistical analyses were conducted using SPSS 19.0 for Windows (SPSS Inc, Chicago, IL, USA). A p value less than 0.05 was considered statistically significant. Descriptive statistics were used for ratings and aesthetic correction data. The Pearson Chi-square test was used to compare data within each group.

Fig. 3 Physician-graded rating using the 5-point improvement scale at 1 month. (left) Pre-senile group, (right) senile group



Results

Baseline Demographics

All injections were administered successfully. The patients ranged in age from 26 to 62 years, with a mean age of 38.2 ± 6.7 years. All patients were Asian females. Table 1 provides the characteristics of all subjects. Table 2 shows the overall results of our study.

Efficacy

Patient-Graded Improvement

Overall patient-graded mid and lower face aesthetic outcomes were rated as significantly “improved” (Fig. 4). In the pre-senile group (116 patients), 100 patients (86.21%) reported being “much improved” and 16 (13.79%) reported being “improved.” These data indicate that the patients experienced significant improvement compared to their baselines. In the senile group (76 patients), 40 patients (52.63%) reported being “much improved,” 32 patients (42.11%) reported being “improved,” and four patients (5.26%) reported “no change.” Moreover, there were significantly more patients who reported “much improved” in the pre-senile group compared to the senile group ($p < 0.001$), which suggests that the pre-senile patients were more satisfied with their aesthetic improvement.

Physician-Graded Improvement

Overall physician-graded mid-face aesthetic outcomes were rated as significantly “improved” post-injection. Physician grading was significantly higher in the pre-senile group compared to the senile group ($p < 0.01$). Among the pre-senile group, pictures of 76 patients (65.52%) were recorded as “much improved,” 38 (32.76%) were “improved,” and 2 (1.72%) were “no change.” However, in

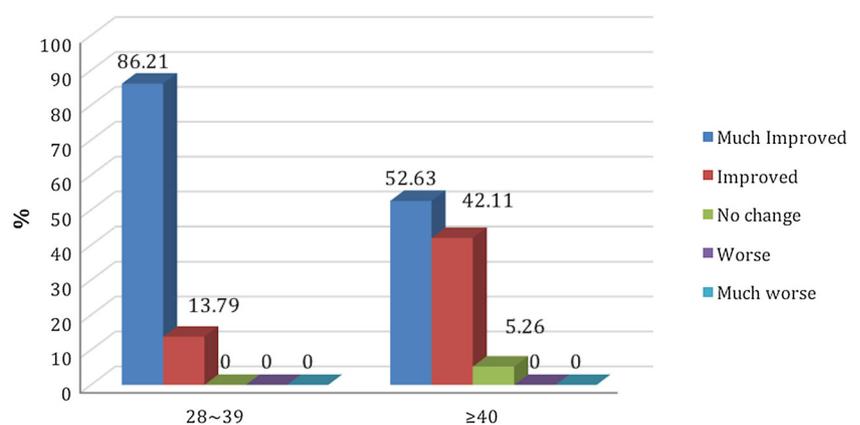
Table 1 Patient characteristics

Age, yrs	Pre-senile group (28–39)	Senile group (≥ 40)	Total
No. of patients n (%)	116 (60.42)	76 (39.58)	192 (100)
Mean \pm SD	32.76 \pm 2.3	46.5 \pm 4.6	38.2 \pm 6.7

N number, *SD* standard deviation

Table 2 Study outcomes

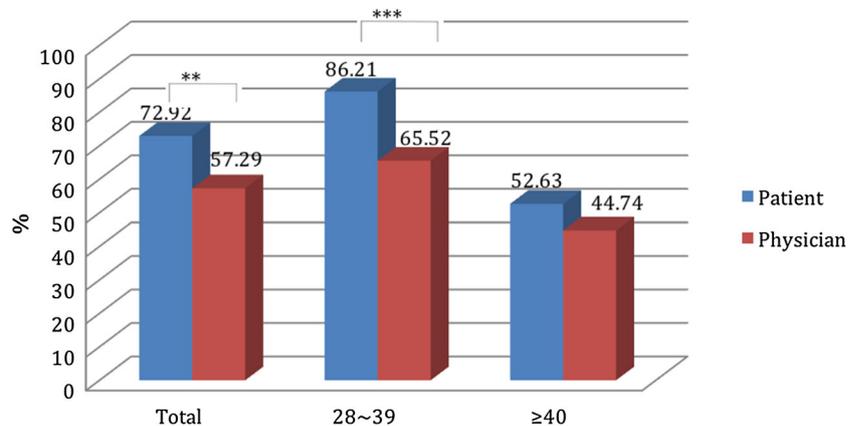
Term	Pre-senile group n (%)	Senile group n (%)	Total n (%)
<i>Physician assessment</i>			
Much improved	76 (65.52)	34 (44.74)	110 (57.29)
Improved	38 (32.76)	34 (44.74)	72 (37.50)
No change	2 (1.72)	8 (10.52)	10 (5.21)
Worse	0 (0)	0 (0)	0 (0)
Much worse	0 (0)	0 (0)	0 (0)
<i>Patient assessment</i>			
Much improved	100 (86.21)	40 (52.63)	140 (72.92)
Improved	16 (13.79)	32 (41.11)	48 (25.00)
No change	0 (0)	4 (5.26)	4 (2.08)
Worse	0 (0)	0 (0)	0 (0)
Much worse	0 (0)	0 (0)	0 (0)
<i>Recommend?</i>			
Yes	108 (93.10)	68 (89.47)	176 (91.67)
Not sure	8 (6.90)	8 (10.53)	16 (8.33)
No	0 (0)	0 (0)	0 (0)
<i>Further injections?</i>			
Yes	104 (89.66)	72 (94.74)	176 (91.67)
Not sure	12 (10.34)	4 (5.26)	16 (8.33)
No	0 (0)	0 (0)	0 (0)
<i>Side effects?</i>			
Yes	12 (10.34)	0 (0)	12 (6.25)
Not sure	12 (10.34)	8 (10.53)	20 (10.42)
No	92 (79.32)	68 (89.47)	160 (83.33)

Fig. 4 Patient-graded rating using the 5-point improvement scale at 1 month. (left) Pre-senile group, (right) senile group

the senile group, 34 (44.74%) pictures were rated as “much improved,” 34 (44.74%) were rated as “improved,” and eight (10.52%) were rated as no change. Again, none of the pictures was rated at “worse.”

We observed a statistically significant difference in questionnaires between patients and physicians (Fig. 5). The patients’ ratings were significantly higher compared to the physicians’ ratings. The number of patients who rated

Fig. 5 Percentage of both physicians and patients rating “much improved”



as “much improved” was significantly greater than the number of physicians who rated as “much improved” ($p < 0.01$). Results from the pre-senile group showed greater statistical significance when compared to the senile group ($p < 0.001$).

Safety

Overall, 160 of the 192 patients (83.33%) reported no side effects during regional platysma BTX-A injection treatment. In the questionnaire, 12 patients (6.25%) selected “not sure” and 20 (10.42%) chose “yes.” Of these 20 patients, all were from the pre-senile group. The most common complaint of side effects (10/20) was acne around the injection site (Supplementary Fig. 2). Three patients complained about “fat-apple phenomenon” 2 weeks after post-injection (Supplementary Fig. 3), but this perception disappeared at 1 month. Five patients showed “disconnected jaw” (Supplementary Fig. 4), which resulted from insufficient injection.

Patient Opinions Regarding Treatment

Overall, 171 of the 192 patients (91.67%) reported that they would recommend our treatment to others. Among these patients, the number from the pre-senile group was slightly greater than that of the senile group (93.1% in the pre-senile group vs 89.47% in the senile group).

The lift lasted for 3–6 months. Overall, the effect was presented as “mild and natural,” and patients usually reported their face as “younger and more tightened.” Again, 171 patients (91.67%) suggested they would consider further injections. The rate of patients over 40 in the senile group was slightly higher than that of the pre-senile group (89.66% in the pre-senile group vs 94.74% in the senile group), yet these two groups failed to reach any statistical significance. Results of the survey are listed in Table 2.

Discussion

Efficacy and Safety

The results of our study demonstrate the efficacy of regional BTX-A droplet injection for aesthetical platysma rejuvenation in patients with facial sagging with descent of the mid and lower face. Using patient/physician-graded improvement ratings, we found a high satisfaction rate among both patients and physicians. We found that 100% of the pre-senile patients and 89% of the senile patients reported improvement, which was similar to the 95% satisfaction rate in a previous Botox study [3]. Since facial sagging is commonly milder in pre-senile patients, regional BTX-A injection was sufficient to correct the descent of the mid and lower face. Senile patients usually present with facial sagging, depression, and deep rhytides. Therefore, a more detailed rejuvenation plan may be required for patients over 40 years. In general, the droplet BTX-A rejuvenation is suitable as a basic treatment method for any age-group.

Interestingly, when comparing the results between patients and physicians, the patient ratings were significantly higher compared to the physician ratings. We attribute this finding to the fact that all images were two-dimensional. Three-dimensional changes may not be observed by the investigators. In addition, patient satisfaction comes from objective changes, for which emotional aesthetics can play a positive effect. When patients feel that a supportive power is helping to alleviate their facial sagging, they will have a sense of pleasure and safety.

Twenty patients reported side effects during the follow-up visits, all of whom were from the pre-senile group. The most common complaint (10/20) was acne around the injection site, which could be attributed to inhibition of the sebaceous glands at the injection site, resulting in compensatory over-secretion of nearby glands. Acne usually

appears in areas around the cheilion, pre-auricular, and submandibular line.

Anatomical Basis of BTX-A Rejuvenation

Platysma Regional Anatomy

BTX-A injection in the V1 area corrects over-contraction of the platysma. This single relaxation can result in a series lift effect, which leads to correction of temporal and sub-orbital depression. Moreover, rising of the mid face can result in shallowing of nasolabial folds and correction of jowls (Fig. 6 and Supplementary Fig. 5). In 2016, Jung-HeeBae [4] performed dissection of the platysma in the cheek region of 34 middle-aged cadaveric specimens. He described three types of platysma according to morphology: straight, straight-curved, and curved. This suggests that the vector of the platysma muscle is downward and outward, with the straight type being mostly down and the latter two types being mostly outward. He concluded that the platysma acts as a major depressor in the mid and lower face and can be regarded as one of the mid face muscles because it extends almost to the level of H2 (horizontal line through the point of alare) in 85.3% of cases. Jung's study provides theoretical support to our study [4].

After injection into the V1 area, the down and out traction of the platysma relaxes, leading to an upward and

inward support of the facial soft tissue. In patients who have straight platysma, the relaxation will mainly result in an upward lift of the face (Fig. 7a). This lift may result as “swollen” since the malar fat pad can be raised to the level of the zygomatic arch. This phenomenon is referred to as the “fat-apple phenomenon,” which can be frequently observed in patients with abundant facial soft tissue. The “fat-apple phenomenon” usually completely subsides within a month. In patients with a straight-curved or curved type V1, the relaxation mainly results in an inward tightening of the face (Fig. 7b), making the face appear “shrunk.” Since it was impossible to determine the type of V1 during consultation, we suggested a comprehension discussion with these patients prior to any injections, especially in patients with abundant facial soft tissue.

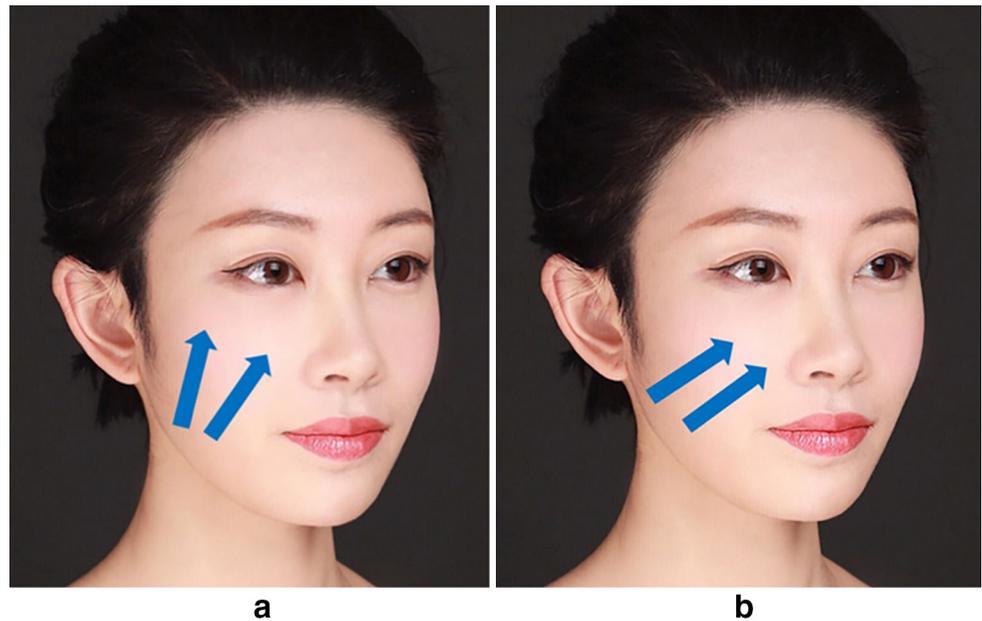
The V2 and V3 regions of the platysma make up the cervical mental angle. While contracting, the angle becomes obtuse. In patients with a sagged mental floor, injection of the V1 alone results in a compensatory contraction of the V2 and V3 areas that will dull the cervical mental angle, making the sagging more severe. This phenomenon is called “disconnected jaw,” since tissue beyond the jaw line is lifted but tissue underneath remains accumulated. Therefore, we suggest that the V1 and V2 areas should be injected in patients with a sagged mental floor. In patients with severe sagging, a V3 injection should be added to improve the cervical mental angle.



Fig. 6 A 30-year-old female came to our clinic complaining of facial sagging. Upon physical examination, her mid face was mildly sagging and her submandibular line was slightly blurred. She also had nasolabial folds and marionette lines. We gave her V1 + V2 platysma regional injections, with 25 units per side. At 1 month

follow-up, her mid-face descent was remarkably corrected, and her submandibular line became sharp and clear. Injection in the V2 area tightened her submental area. Her mental cervical angle also became sharper. Patient's picture before (left) and after (right) V1 + V2 platysma regional injection; left iliac view

Fig. 7 **a** (left) upward lift of mid-face, **b** (right) inward lift of mid face



Based on “micro-botox” injection theory [5], we injected the entire platysma with an intradermal injection that was slowly inserted into the undersurface of the face and neck skin to weaken the superficial fibers, thus achieving skin tightening. We further divided the platysma into three regions and found that the V1 regional injection also corrected descent of the mid face. We think that platysma BTX-A injection is a more complete technique for facial rejuvenation. Upon preparation, we diluted the 100 U Botox into a 2.5-mL dilution, without further dilution using lidocaine, which differed from Wu’s technique.

We considered what would be the most suitable concentration for the different parts of the face and neck. In theory, applying the same dosage of BTX-A, at the lower concentration, should result in larger real injection liquid volume and more obvious irritation. Hence, for the V1 area, which has higher risks (because it involves facial expressions and the need to avoid spreading to the zygomaticus major muscle, musculus risorius, and other mimetic muscles), we selected a typical concentration; we applied 2.5 ml liquid matching 100 U BTX-A rather than 5 ml/4 ml liquid matching 100 U BTX-A) similar to the report by Wu et al. [5]. As such, we could guarantee that we applied a sufficient therapeutic dose (20–30 U) as well as prevent irritation by injecting too much liquid. In addition, generally, for the intradermal injection it is difficult to inject too much liquid. A larger single-point liquid volume injection can result in more pain for the patient even with adopting the hemp processing. In contrast, there

is a greater chance of bursting the needle, especially in patients whose skin is more compact. Furthermore, we tried halving the V1 injection dose and diluting it to the original volume, but the effects and duration were, respectively, weaker and shorter. Thus, we selected a 2.5-ml concentration (this dosage did not cause any obvious facial expression abnormalities). Relative to the V1 area, the V2 and V3 area injection scopes were larger, the skin dermal tissues were looser, and the painful feeling was less apparent. Therefore, at this injection dose, we observed attenuation, especially for those patients whose faciocervical scope was larger, which could prove more beneficial, as well as avoid the embarrassing phenomena of “part of areas are still not covered fully after injecting the liquid medicine.” Of course, the procedure is dependent on the physician’s injection skills. We recommend that prior to the procedure, physicians should carefully evaluate and rationally distribute the dose. When injecting, it is necessary to avoid leakage and waste. In particular, it is necessary to empty air from the needle tubing to avoid liquid leakage and spraying.

Lift of the Superficial Muscular Aponeurotic System

SMAS is a layer of tissue overlying the face and neck. Upward, it continues with superficial temporalis fascia and orbicularis oculi. Inferiorly, it extends downward and attaches to the platysma. The SMAS forms an intermediate bond and creates tension over the face. When the platysma

over contracts, the tension will be passed onto surrounding muscles and tissue, pulling the mid and lower face downward and outward. Therefore, BTX-A injection can relax the platysma, decrease the downward and outward tension, and create an indirect facial lift.

Lift of the Malar Fat Pad

The malar fat pad is shaped like an inverted triangle. Superficially, the pad bonds tightly to skin over the cheek and jowl. It deeply connects to the underlying structures with six retaining ligaments [6]. In the periorbital area, the malar fat pad attaches to the orbicularis oculi through the orbicularis retaining ligament upper layer of lower eyelid (ORLU) and the orbicularis retaining ligament substratum of the lower eyelid (ORLS). Platysma cutaneous forward ligament (PCFL) connects the malar fat pad to the upper part of the platysma (Fig. 8). When the platysma contracts, it directly pulls the malar fat pad down and outward through the PCFL. Meanwhile, since the platysma continues with the SMAS, the latter will transmit the tension upward to the orbicularis oculi and then to the ORLU and ORLS. The downward traction of these ligaments will further pull the malar fat pad down and out. Because the ORLU, ORLS, and PCFL lie separately under the upper and lower part of the malar fat pad, repositioning these three ligaments will bring the malar fat pad inward and upward.

BTX-A Rejuvenation Technique

Our regional injection is mostly suitable for patients with moderate facial sagging and depression. Based on the efficacy described above, we think this injection technique

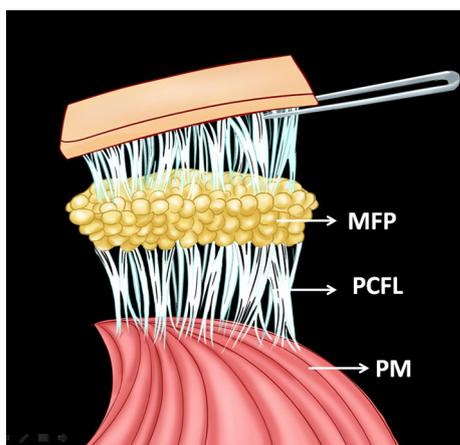


Fig. 8 Platysma connects the malar fat pad through the platysma cutaneous forward ligament. *MFP* malar fat pad, *PCFL* platysma cutaneous forward ligament, *PM* platysma

can result in multi-repositioning of facial soft tissue. However, the use of lift in “fat and sagged” patients needs to be discussed. In Asian aesthetics, there is an admiration of “small and oval face.” Injection in a “fat” patient may result in a round face, which may not suit the patient’s desired outcome. Moreover, we should evaluate the descent of the mental floor before injection. In patients with potential sagging, it is better to perform V1 and V2 injection or combined injection. Commonly, these combined injection methods were injected into the masseters to prevent soft tissue sagging followed by masseter atrophy. In treating these patients, the effect usually appeared most natural 1 month after injection.

Based on our experience, the injection dose should be adjusted based on the severity of facial sagging. We found that the optimal dose was 10–15 U per side in the V1, 10–15 U per side in the V2, and 10–20 U per side in the V3. All injections were carefully administered at 1–2-cm intervals at the level of the dermis. None of the patients in our study experienced any severe complications.

Recommendation and Loyalty

Pre-senile patients seemed to be more willing to recommend our treatment to others. We think this can be explained by the fact that younger people are more open-minded. There are many online sharing apps like “XinYang” and “GengMei” in China. Young people are willing to share their experiences through these apps. In contrast, senile patients scored higher in loyalty. More senile patients revealed they would consider further injections. Once a procedure works, senile people seemed to continue with our treatment, while younger people were more willing to try different treatments.

Combined Therapy

In the future, we think there could be a trend to combine platysma BTX-A injection with other techniques. Releasing the platysma decreases downward traction of the face and neck, while thread lift and HA fillers provide an upward support. Together, combined therapy has a longer lasting synergic effect, with less side effects, compared to other single procedures.

Adjustments should be taken into consideration when performing combined treatment. For example, since the BTX-A rejuvenation decreases facial depression, the amount of HA fillers injected should be minimized. For patients with facial sagging and excessive fat accumulation, it is better to perform liposuction before BTX-A rejuvenation.

This study also has several limitations. First, photographs used for assessment were 2D portrait images of all subjects, which may not fully represent the outcomes for all patients. Furthermore, objective evaluation tools were not used in our study. In the future, we would like to apply 3D cameras, more sample sizes, and objective measuring tools. Lastly, this procedure more closely resembles a skin tightening or tonifying procedure rather than a real soft tissue lift, which is also related to the injection site (dermis) and targets anatomical structures (mainly a reduced connection between platysma and skin), but not the platysma specifically.

Compliance with Ethical Standards

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

Ethical Approval This study was approved by our institution's ethics committee. All procedures performed in studies involving human 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.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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