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Analysis of effectiveness and complications of botulinum toxin A masseter injection and hyaluronic acid chin injection related to lower third of facial contour remodeling.

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Abstract

Objective: The present study was aimed to study the effectiveness of botulinum toxin A masseter injection and hyaluronic acid chin injection in pretext of the lower third facial contour remodeling.
Methods: 60 Chinese cases that underwent a lower third of facial contour remodeling for the first time were selected. Before surgery, a conventional electromyography was performed. The Root Mean Square (RMS) values were calculated through electromyography and were recorded. Surgery was performed on all the subjects in order to compare satisfaction, muscle strength value of masseter and occurrence rate of complications post-surgery. Scores of surgery satisfaction were administered based on the attitude of medical staff, service quality and facial shape improvement through questionnaires distributed to patients.
Results: After one-year of follow-up, there were 38 cases that were very satisfied (63.34%), 20 cases were basically satisfied (33.33%) and 2 were unsatisfied (3.33%). The Root Mean Square (RMS) values were significantly declined after one month of surgery, and it began to increase after 3 months and was back to normal after 12 months. The occurrence rate of complications was high within 3 months after surgery, among which there were 5 muscle atrophy cases (8.33%), 3 facial paralysis cases (5.00%), 4 infection cases (6.67%), 3 anaphylactic reaction cases (5.00%) and 2 toxic reaction cases (3.33%). All cases were back to normal after symptomatic treatment.
Conclusion: Botulinum toxin A masseter injection and hyaluronic acid chin injection on lower third of facial contour remodeling are associated with little trauma and high plasticity.

Keywords: Botulinum toxin A, Hyaluronic acid, Lower third of facial contour, Effectiveness, Complications.

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Introduction

With the improvement of living standards, the pursuit of perfect facial form is increased as well [1]. In China, medical plastic surgery develops towards a "blowout type" where the lower third of facial contour has an important influence in the overall aesthetics of facial contour [2]. According to the aesthetic idea of golden section proportion for some cases, the lower third of facial contour is wide and angular while some are short and sunken. The "oval face" is currently popular, so those people with a wide lower facial contour wants to reach overall coordination through plastic surgery [3]. Minimally invasive plastic technique is featured by small trauma, less complications and a quick recovery. The masseter injection method is a minimally invasive treatment method, and botulinum toxin A is a neurotoxin with a strong biotoxin [4-7]. Hyaluronic acid is one of the matrix components of human skin, and there are more and more cases that use botulinum toxin A masseter injection and hyaluronic acid chin injection to remodel lower third of facial contour [8-10]. This study was aimed to analyze its effectiveness and potential complications, which put forward preventative measures in order to provide references for reasonable clinical treatment.

Materials and Methods

Sample Selection

60 cases that receive a lower third of facial contour remodeling for the first time at this hospital from Jan 2014 to 2016 were selected. The following cases were excluded: Patients, those who were allergic to botulinum toxin A and hyaluronic acid and have a previous history of facial plastic surgery, facial malformations, facial infection and facial neuritis. The Ethics Committee of this Hospital, patients and their families have approved this study. Among which, there were 19 male cases and 41 female cases, their average age is 25.6 ± 6.4 y old.

Study methods

The same surgical and nursing team in accordance with standard medical procedures completed this study. Before surgery, a conventional electromyography was performed. During measurement, patients bit strongly with masseters at both sides. The RMS was calculated through electromyography and then recorded. Before treatment, patients were to clean faces completely and receive an ice compress or superficial anesthesia (compound lidocaine cream) in order to relieve pain. Facial parts were measured in order to determine ideal facial contour. According to Ricketts aesthetic plane, the expected angle and length of chin was estimated.

Procedures of the botulinum toxin injection were as follows: Botulinum toxin A produced by Lanzhou Institute of Biological Products Co., Ltd. was used. We stored botulinum toxin A in the cryogenic refrigerator and for the procedure, obtained 100 U and added it in 2 ml stroke-physiological saline solution for dilution, bubbles were avoided during dilution. Patients were kept in a prostration position and received 2 times partial disinfection on the chin with povidone iodine. Sterile towels and sheets were used and patients were told to bite strongly. Doctors found the lower third position of the left masseter and avoided the lower part of the zygomatic arch (when masseter at lower zygomatic arch is atrophic, the zygomatic arch will be more obvious and the facial contour will be more angular). A perpendicular puncture was performed till the muscle layer for injection towards five directions (vertical injection, up, down, left and right). The injection volume at each direction is 5 U and 25 U at each point; then the needle was administered subcutaneously. We took the first puncture point as the central point, and injected towards four points (that is 3 o'clock, 6 o'clock, 9 o'clock and 12 o'clock) and 25 U at each point. When the needle was into the skin, patients were told to relax. After treatment, pressure on the injection region or partial massage was forbidden in order to prevent medicine from expanding to the other mimetic muscles and causes facial paralysis. However, normal chewing activities were as usual; pinhole shall not be wet. Aspirin and aminoglycoside antibiotics were stopped two weeks before the botulinum toxin injection. Injections at the right side were of the same procedures.

Procedures of hyaluronic acid injection are as follows: medical hydroxypropyl methyl cellulose-hyaluronic acid sodium solution (Yimei) was used, which was produced by Beijing Imeik Technology Development Co., Ltd. The "Three points sector injection method' was used, that is, the upper central and lower mentolabial sulcus injection region, lower chin injection and lower edge of chin injection. The injection point was 0.3 cm away from the edges of injection region. The first and second points were injected firstly with larger volume to keep smooth. Injection and needle withdrawing was of constant speed to avoid "bead-like" condition. Proper rubbing is acceptable after injection and total injection volume is 1-2 ml.

The follow-up was performed at 7^{th} d, 21^{st} d, 3^{rd} month, 6^{th} month and 12^{th} month after surgery to evaluate treatment results.

Observation index and evaluation standard

Scores of surgery satisfaction were administered based on the attitude of medical staff, service quality and facial shape improvement through questionnaires. We took 100 points as the full score, over 90 points as very satisfied, 60-90 points as basically satisfied and less than 60 points as unsatisfied. The masseter strength recovery conditions at both sides before and after surgery were compared and presented as RMS. Complications in surgery were recorded, including muscle atrophy, facial paralysis, infection, anaphylactic reaction and toxic reaction.

Statistical method

The SPSS20.0 software was used for statistical analysis, and measurement data was presented as average value ± standard deviation. Analysis of variance by repeated data testing was used to compare conditions before and after treatment and enumeration data are shown as cases or (%). $P<0.05$ refers to differences of statistical significance.

Results

Satisfaction survey

There were 38 cases that were very satisfied (63.34%), 20 cases that were basically satisfied (33.33%) and 2 cases that were unsatisfied (3.33%).

RMS value of masseter

For average values, before surgery the RMS value was 100 ± 6.27, one month after surgery was 86.28 ± 13.26, three months after surgery was 92.47 ± 15.34 and twelve months after surgery was 100 ± 8.62. The RMS value was greatly lowered one month after surgery, and it began to increase after 3 months and was back to normal after 12 months; comparison was statistically significant ($F=12.306$, $P<0.001$).

Analysis of complications

The occurrence rate of complications was high within 3 months after surgery, among which there were 5 muscle atrophy cases (8.33%), 3 facial paralysis cases (5.00%), 4 infection cases (6.67%), 3 anaphylactic reaction cases (5.00%) and 2 toxic reaction cases (3.33%). All cases were back to normal after symptomatic treatment.

Discussion

For the lower third of facial contour remodeling patients, 30% have "baby face" or round cheeks possibly with malformed or fat mandibular angle bone [11]. The rest have a normal mandibular angle, but they have square face because of fat cheeks and an over-developed masseter [12]. The main methods are operation, medical injection and radio-frequency technique. A curved osteotomy of the mandibular angle and masseter resection cause severe damages to marginal mandibular branch of the facial nerve and large bleeding

volume, therefore their clinical applications are limited [13]. The masseter injection is a minimally invasive method. The mechanism of botulinum toxin A is to enter into the motor nerve endings surrounding masseter through mediating cytophagy and inhibit the synaptobrevin of ach vesicle membrane [14]. It then reduces the fusion, release and docking of acetylcholine. A denervation function would be generated, which causes the masseter to be relaxed and paralytic, Further, contraction, tension of masseter and disuse atrophy is used to achieve treatment results [15]. One point and the five directions methods are able to guarantee the evenness of injection to the utmost extent [16]. During injection, a temporal-mandibular joint region was avoided in order to prevent from dislocation of joint or dysfunction [17]. Antibody of botulinum toxin was generated through several injections, influencing treatment effects [18]. It was observed in an earlier study that results are visible after 2-3 weeks of the botulinum toxin masseter injection and treatment effects are most obvious at 8-12 weeks. One week after injection, the chewing strength went down and reached the lowest after four weeks, but it began to recover after three months. Nevertheless, decreased muscular strength doesn't influence daily life [19].

Hyaluronic acid is a macromolecule non-protein acid mucopolysaccharide that is widely distributed in the human body, and nearly half of the hyaluronic acid is in skin [20]. Hyaluronic acid in dermis provides a spatial frame for collagen and elastin fiber and maintains skin elasticity [21]. In addition, there was a highly efficient absorbing capacity and was able to adjust the osmotic pressure of cells, transfer macro-molecular substance, forms effective physical barrier and generates degrading enzyme with biodegradability [22]. After an intradermal injection, facial subcutaneous moisture is sufficient and the skin elasticity is maintained. Meanwhile, the effects are better if it is combined with botulinum toxin A injection [23]. Common complications of hyaluronic acid injection include partial hyperpigmentation, cutaneous necrosis and embolism. Hyaluronic acid was not injected into blood vessels during injection in order to avoid severe complications [24].

Muscle atrophy generally manifests as masseter weakness, swollen molar region and difficulties in chewing hard food. The main cause is due to the high injection volume of botulinum toxin, and the solution decreases the volume properly based on RMS and masseter thickening condition that were examined before surgery. Facial paralysis is one of the facioplegia signs after injection and its main symptoms are unnatural expression, shallow nasolabial groove and deflective angle of mouth when speaking and laughing. The causes include improper operation, botulinum toxin dispersion and penetration into the buccinators due to partial pressure [25,26]. Key solutions include prevention, improving the doctor's degree of familiarity to facial nerve dissection, keeping injection range within front and back edges of masseter during operation and controlling injection depth well. Meanwhile, the injection speed was even and slows [27]. A partial massage was forbidden after injection and the medical was spread slowly through normal chewing. Other medicines were taken when necessary, such as the surface antihistamine drug and Tropicamide eye drops that contain α-epinephrine [28]. Anaphylactic reaction, which manifests as skin erythema, pruritus and edema that is caused by immune and anaphylactic reaction and the treatment measures are comprehensive examination, knowing the patient's allergic history and using anti-allergic medicines if necessary, such as hexadecadrol and Zyrtec and as a result, symptoms were alleviated within one week generally. Discontinuous cold compress within 2 h after treatment is also an option. The toxic reaction is as follows, which mainly manifests as anhelation, accompanying with dizziness, headache, nausea, sleepiness, dysphagia and even loss of consciousness [29,30]. The solutions utilized were non-invasive mechanical ventilation and antitoxin treatment.

Conclusions

The present study concludes that the botulinum toxin A masseter injection and hyaluronic acid chin injection were able to effectively remodel the lower third of facial contour, which is featured by small trauma, high plasticity. However, they are safe, reliable and have application value in clinical practice.

Conflicts of Interest

The authors declare that they have no conflict of interest.

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