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The application of W-plasty combined Botox-A injection in treating sunk scar on the face

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Abstract

This study was aimed to explore the effect of W-plasty combined Botox-A injection in improving appearance of scar.

According to the inclusive and exclusive criteria, patients received W-plasty combined Botox-A injection (study group) or traditional (control group) scar repairment were enrolled in this study. After surgery, a follow-up ranged from 1 to 2 years was conducted. The effectiveness of surgery was assessed by visual analogue scale (VAS).

A total of 38 patients were enrolled in this study, including 21 cases in the study group and 17 cases in the control group. There were no significant difference were identified in age ($t = 0.339$, $P = .736$), gender ratio ($\chi^2 = 0.003$, $P = .955$) and scar forming reason ($\chi^2 = 0.391$, $P = .822$) between 2 groups. After treatment, the VAS score in the study group was significantly higher than that in the control group ($P < .001$).

W-plasty combined Botox-A injection can significantly improve the appearance of sunk scar on the face.

Abbreviations: EGF = epidermal growth factor, FGF = fibroblast growth factor, TGF-β = transforming growth factor β, VAS = visual analogue scale.

Keywords: Botox-A, scar, visual analogue scale, W-plasty

1. Introduction

With the development of society in recent decades, trauma caused by accident and surgery is significantly increased. Followed by this, scar treatment has also become a new challenge for clinicians. Especially on the face and neck, an ugly scar not only can restrict the functional performance of face, but also can result in considerable psychological problems for patients.[1] To date, although there are improved therapies provided, including silicone gel sheets and compression therapy, the outcome of treatment is still unsatisfactory due to different risk factors, such as race, age, lesion size, and length of follow-up.[2] Recently, several literatures have documented that skin tension can affect the process of scar forming via exerting impact on the wound edges.[3,4] This point may indicate that skin tension is a potential approach to improving the scar administration.

Botox-A is a neurotoxin production synthesized by *Clostridium botulinum*. It is reported that Botox-A can bring chemodenervation in muscles for approximately 6 months via inhibiting the release of acetylcholine at the junction of neuromuscular.[5] Clinically, Botox-A has been applied in several symptoms, including spastic dysphonia, blepharospasm, anorthopia, as well as minimizing wrinkles.[6] Commonly, Botox-A is also can be utilized to minimize wrinkle and facial scarring and this history can trace back to its discovery. A recent publication also reveals that Botox-A can decrease the tension of facial muscles via being injected to the wound edges to improve the scar treatment.[7]

According to the above information, a W-plasty combined Botox-A surgery was conducted in this study. Based on this therapy, we hope to identify a new approach to improve the repairment of patients with sunk scar on the face, even other body sites. Detailed information had been showed as follows.

2. Methods

2.1. Patients

From July 2011 to June 2014, a total of 38 patients with obvious scar on their faces were enrolled in this study, including 21 cases treated with W-plasty combined Botox-A injection (study group) and 17 cases treated with traditional repairment (control group). Patients were recruited in accordance with the following terms: mongoloid and age more than 18 years; scar length ranged from 1.0 to 3.0 cm and width less than 1.0 cm; scarring time more than 2 years and not received second-stage repairing surgery. In addition, patients were excluded if they met any of the following terms: clinical information was incomplete; suffered with sever metabolic or autoimmune diseases; suffered with infective diseases or cancers; or did not complete the follow-up. This study was authored by the Ethics committee of Nanjing Medical University and all patients signed informed consent.

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2.2. Surgery program

Traditional scar mending surgery was carried out for patients in the control group. According to the shape of scar, incisions at 2 sides of scar were designed, and then the skin and subcutaneous tissue were cut apart to clear out the scar tissue. Followed by this, the substrate was fully debonding and 2 sides of the flap were separated. Then, the absorbable seam 5-0 (VICRY plus, ETHICON, Shanghai, China) was utilized for de-stretching suture under skin and 6-0 nylon wire was carried out for interrupted suture of skin.

W-plasty combined Botox injection surgery was performed for patients in the study group. Account for the scar shape, W type of incision was designed at the 2 flanks of scar with a 1 to 2 mm distance. For W, each included angle was ranged from 90° to 120° and cusp of "W" were set at the wider place of scar. In addition, heights of 3 "triangles" were approximately as much as possible, and the base of them can be closed as an isosceles triangle. Followed by this, the skin and subcutaneous tissue were cut apart and scar tissue was cleared out. After fully debonding the substrate, 2 sides of the flap were separated and the triangles in the 2 flanks were inserted corresponding. Then, the absorbable seam 5-0 (VICRY plus, ETHICON) was utilized for de-stretching suture under skin and 6-0 nylon wire was carried out for interrupted suture of skin. Until the operation was finished, the A type of Botox was injected into the tissue closed to the incision with 1 cm interval. The dose for each injected pointed was administrated for 1 to 2 U (Fig. 1A). Specially, for deeper surgical scars, the absorbable seam 5-0 (VICRY plus, ETHICON) was utilized to close destretch suture layer by layer, and 6-0 nylon wire was carried out for interrupted suture of skin. Then, A type of Botox (1–2 U) was injected into more points and covering more range near the incision (Fig. 1B).

2.3. Effectiveness assessment

The effectiveness of mending surgery was assessed by visual analogue scale (VAS). The estimation was performed by 2 independent experienced orthopedists with a blind manner at the end of follow-up. In addition, the follow-ups of them were also performed and ended by wound union and no complication.

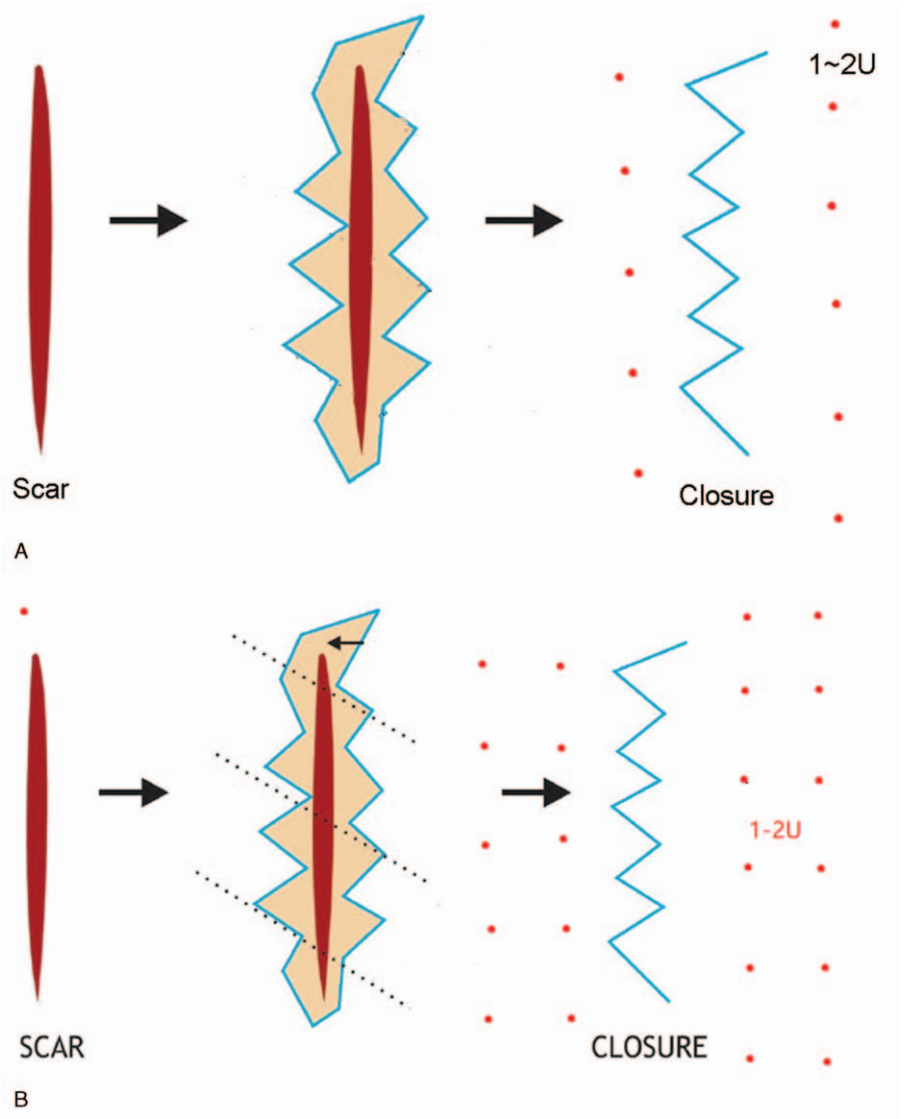

Figure 1. Schematic diagrams for W-plasty and Botox-A injection surgery. (A) Schematic diagram for normal scar in face; (B) schematic diagram for deeper surgical scar.

Table 1

Clinical characteristics of patients included in the study and control groups.

Terms	Study group (n = 21)	Control group (n = 17)	t/χ^2	*P*
Age	27.19 ± 6.76	26.41 ± 7.36	0.339	.736
Gender [n (%)]				
Male	15 (71.43)	12 (70.59)	0.003	.955
Female	6 (28.57)	5 (29.41)		
Reason [n (%)]				
Trauma surgery	16 (76.19)	14 (82.35)	0.391	.822
Nevus removing	4 (19.05)	2 (11.76)		
Sebaceous cyst surgery	1 (4.76)	1 (5.88)		

2.4. Statistical analyses

SPSS 15.0 was utilized to perform the comparisons included in this study. Mean and standard deviation were utilized to present measurement data and comparison between 2 groups was estimated by Student *t* test. Case and percent were used to show the enumeration data and comparison between 2 groups was evaluated by χ^2. $P < .05$ was considered difference significant.

3. Results

3.1. Clinical characteristics of patients

Clinical characteristics of patients included in this study are tabulated in Table 1. The ages of patients in the study group were ranged from 18 to 43 years and the mean age was 27.19 ± 6.67, and the ages in the study group were ranged from 18 to 41 years and the mean age was 26.41 ± 7.36. The male/female in the study group was 15/6 and in the control group was 12/5. There were no significant difference identified in age and gender ratio between 2 groups ($t = 0.339$, $P = .736$; $\chi^2 = 0.003$, $P = .955$). In the study group, scars in 16 of them were caused by trauma surgery, 14 caused by nevus removing and 1 caused by sebaceous cyst surgery. Meanwhile, in the control group, scars in 14 of them were caused by trauma surgery, 2 caused by nevus removing and 1 caused by sebaceous cyst surgery. Same as age and gender, there was also no obvious difference detected in the scar forming reasons between 2 groups ($\chi^2 = 0.391$, $P = .822$).

3.2. Effectiveness assessment

After surgery, follow-up of all patients were carried out. The follow-up time was ranged from 1 to 2 years and all patients have been completed except one died from traffic accident. According to VAS, final effectiveness of scar mending was assessed and a better outcome was observed in the study group compared with the control group (8.43 ± 0.56 vs 7.19 ± 0.95, $P < .001$). Meanwhile, 92% patients of the study group had obtained a more than 9 of VAS score. Two patients with typical healing performance were chosen and presented in this study. For case 1 (Fig. 2), a 41-aged women with a line concave scar in cheek was showed. After accepted W-plasty combined 2 U of Botox mending surgery, a satisfactory repaired outcome was obtained after 2 years later. Figure 3 reveals a 35-aged women who had a 2 cm × 0.5 cm scar in the periphery of the right eye socket caused by surgical suture. After received a W-plasty combined 1.5 U of Botox mending surgery, a satisfactory repaired performance was obtained after 1 year later.

4. Discussion

Preventing the formation of scar is primary task after surgery or trauma. Although traditional methods for scar mending are

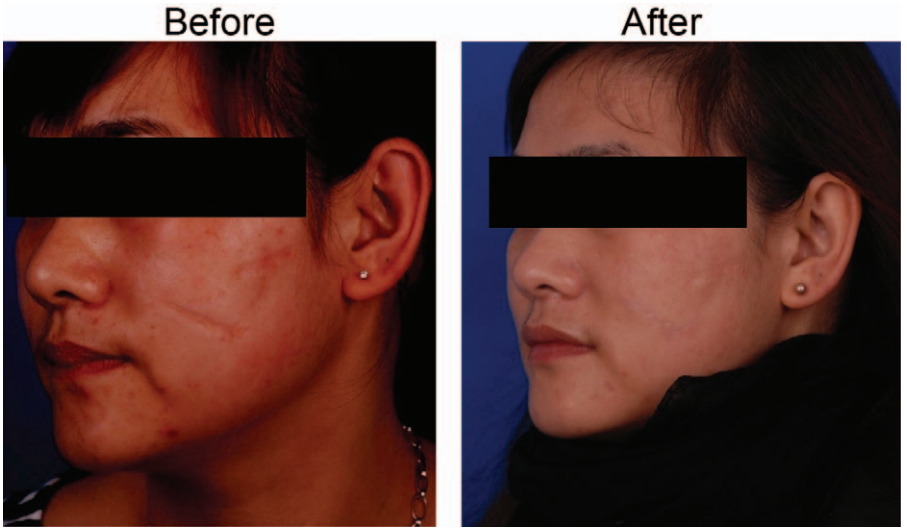

Figure 2. A 41-aged women with a line concave scar in cheek before and after surgery.

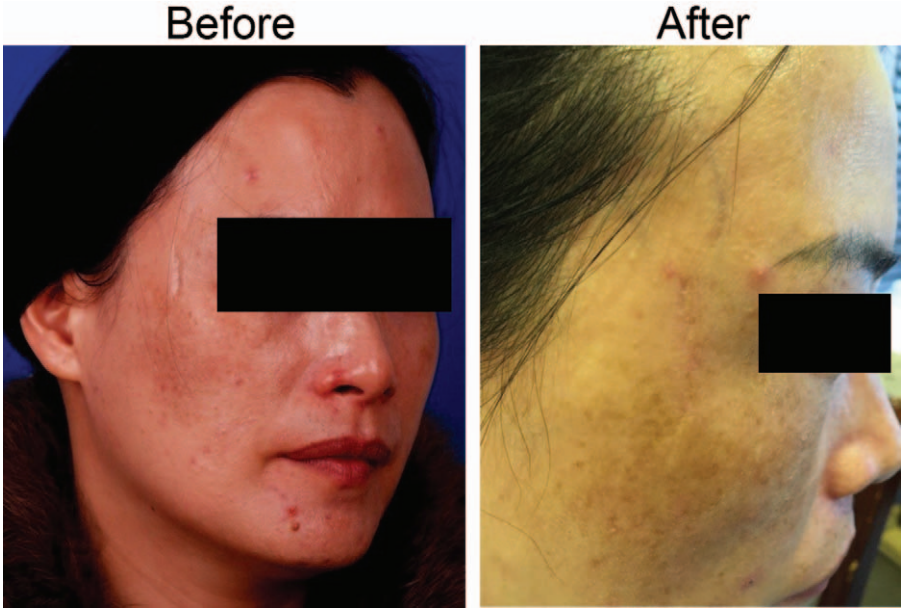

Figure 3. A 35-aged women with a scar in the periphery of right eye socket before and after surgery.

simple suture or W-plasty suture can significantly improve the phenotype of scar, the satisfactory outcome is still difficult obtained.[8–10] In this study, W-plasty and Botox-A combined surgery was carried out. With a parallel patient's base, a significant VAS score was identified in the study group while compared with the control group which was only received the traditional repaired method.

Scar formed in the face is mostly caused by inadequacy debridement or improper suture, including the big size of needles or lines, sutured not accorded with dermal ridge or anatomical feature and so on. Synergistic contractions of facial muscles are necessary for the facial expression and these actions can exert certain tension on the adjacent skin and subcutaneous tissue. Chang et al[11] have demonstrated that this tension can impose a negative effect on wound healing via inducing the formations of widened or hypertrophic scars in face. Meanwhile, the other studies also indicated that alleviated the tension exerted by facial muscle will significantly improve the quality of wound healing and decrease the formation of hypertrophic scar.[12,13] The design of W-plasty is aimed to change the straight shape of wound and alleviate the tension on the scar.[14] Thus, the traditional W-plasty can remarkably improve the scar quality.[9] The same result was also obtained in this study.

Excessive proliferation of fibroblast and deposition of extracellular matrix are 2 common characteristics of hypertrophic scars,[15,16] and cytokines and growth factor are the important regulators during this process, such as transforming growth factor β (TGF-β), fibroblast growth factor (FGF), epidermal growth factor (EGF).[17] Except the chemodenervation, Xiao et al[18,19] also have identified that Botox-A can obviously inhibit the synthesis of TGF-β to suppress the proliferation of fibroblast, so that to decrease the deposition of collagen I and III. The study of Gassner has showed that injected the Botox-A to the adjacent of wound per 2 cm after closure surgery within 24 hours can obtain an enhanced wound healing and less district scar than placebo.[20] A prospective study has also revealed that the injection of Botox-A can markedly decrease the occurrence risk of hypertrophic scars.[21] In the present study, an obvious improvement was identified in the study group compared with the control group. All of these evidences might indicate that W-plasty combined Botox-A injection can significantly perfect the appearance of scar.

There were still some limitations in this study. The sample sizes of these 2 groups were comparatively small, thus, the relate subgroup analysis was not carried out. Meanwhile, due to the small sample size, a potential criterion for the dose of Botox-A was not documented. Moreover, to further explore the effect of Botox-A injection in improving appearance of scar, healing ability of scars underlying different muscles should be concerned in the future. In addition, to draw a valid conclusion, a single W-plasty or Botox-A injection control group should be considered.

In conclusion, W-plasty combined Botox-A injection can significantly improve the appearance of sunk scar in the face. This approach might provide a new insight in the treatment of scar repairment. However, to draw a valid conclusion, a further investigation with a larger sample size might be required.

Author contributions

Conceptualization: Haihua Chen, Qian Tan.
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Formal analysis: Wei Pan, Jufang Zhang.
Writing – original draft: Haihua Chen.
Writing – review & editing: Qian Tan.

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