Original Article

The Use of Botulinum Toxin-A as an Adjunctive Treatment for Facial Atrophic and Hypertrophic Scars After Surgical Correction

Anagha Samarth, Leelavathy Budamakuntla, Kanathur Shilpa

Department of Dermatology, Blackpool Teaching Hospital NHS Foundation Trust, [1]Department of Dermatology, Bangalore Medical College, Bangalore, India

Abstract

Background: Facial wounds, especially the ones lying perpendicular to the Lines of Langer, heal poorly. Several methods have been attempted to rectify this, but most of them do not target the underlying pathological process of scarring. Botulinum Toxin-A (BTA) has been successfully used for atrophic and hypertrophic scars. **Materials and Methods:** This is a prospective study, where 30 patients who were operated for facial scar revision were divided into two equal groups: The first group was injected with BTA, but the second group was not. They were followed up for three months, and the results were analyzed. **Results:** Manchester scar scale (MSS) was used to assess the scars. In all the cases, the MSS score reduced after surgical correction, which further reduced after the injection of BTA in the first group of patients. The results are statistically significant ($P < 0.01$). **Conclusion:** The BTA plays an important role in the treatment of scars after scar revision surgeries.

Keywords: Botulinum toxin-A, facial scar, hypertrophic scars, manchester scar scale, scar revision surgery

Introduction

Facial wounds, particularly the ones lying across the Lines of Langer, show poor healing with a tendency to scar. Several methods have been attempted to overcome this problem, including irradiation, ultrasound, corticosteroid injections, and silicone applications.[1] As these methods of treatment do not have optimum action on the pathology involved in the formation of scars, that is, combating the opposite pull of the muscle on immature collagen, acceptable results are not obtained. Extensive, hypertrophic, or atrophic scars with sharp borders are undesirable and unappealing. On occasions, a scar requires further management for a better aesthetic outcome with revisions and excisions. Very often, the scar may be oriented against the relaxed skin tension lines. To combat this, techniques such as Z or W plasty have been employed to orient the resulting scar in the desired direction. In addition to causing further scarring, very often, these have not been satisfactorily operative. Hence, in such instances, the BTA can be successfully utilized to eliminate the counteracting muscular forces around the scar. The BTA stimulates a temporary paralysis in the facial muscles, exerting the antagonizing forces against the healing of the wound, allowing it an adequate time frame for rest and collagen maturation and, in turn, optimal healing with a possible reduced chance of undesirable scarring. The BTA has been observed to have a negating influence on the transformation of fibroblast by transforming growth factor-β1 (TGF-β1). This is governed by an anti-heparin sulfate (anti-HS) effect due to the regulation of the phosphatase and tensin homolog (PTEN) methylation and phosphorylation of the responsible pathways.[2] Prevention of hypertrophic scars, better wound healing, and improvement of existing scars and wounds are known to be the benefits of BTA-induced "chemo-immobilization," which is commonly known as BTA-induced paralysis.[3]

Access this article online

Quick Response Code:

Website: www.jcasonline.com

DOI: 10.4103/JCAS.JCAS_8_21

Address for correspondence: Dr. Anagha Samarth, Department of Dermatology, Blackpool Teaching Hospital NHS Foundation Trust. E-mail: dranaghasamarth@gmail.com

How to cite this article: Samarth A, Budamakuntla L, Shilpa K. The use of botulinum toxin-A as an adjunctive treatment for facial atrophic and hypertrophic scars after surgical correction. J Cutan Aesthet Surg 2022;15:131-4.

Objective

To study the effectiveness of BTA as an adjunctive treatment for facial atrophic and hypertrophic scars after surgical correction.

Materials and Methods

Thirty patients with atrophic and hypertrophic scars, attending the dermatology outpatient department in Victoria hospital, BMCRI between April and October 2016, were included in the study. Patients having keloid scarring or keloidal tendency; pregnant and lactating patients; patients with a history of bleeding disorder or on anticoagulant therapy, oral steroid therapy; and patients with active skin infection such as warts, herpes, and bacterial infection were excluded from the study. Ethical clearance was obtained for the study.

Patients who were operated for the revision of scars were divided into two groups, comprising 15 participants each. In the first group, post-procedure, the area of maximum muscle activity, which was against resting skin tension lines (RSTL), was injected with 4–5 units of BTA at every 1-centimeter area radius [Figure 1]. The second group of patients were not injected with BTA post-procedure [Figure 2]. The patients were followed up for three months. The results were recorded, tabulated, and statistically analyzed.

Results

The most common reason for scars was trauma (58%), followed by post-surgical scars (42%). The MSS was used to assess the scars. Student *t*-test and Levene's test were used for data analysis.

In the first group, nine cases had an MSS of 17, two cases had an MSS of 16, and four cases had an MSS of 15. After surgical correction and BTA injection, the MSS reduced from 17 to 7 in seven cases, to 8 in two cases, and from 16 to 7 in two cases. The MSS reduced from 15 to 7 in three cases and to 8 in one case [Table 1].

In the second group, scars in eight cases had an MSS of 17, one had an MSS of 16, and six had an MSS of 15. After surgical correction, MSS reduced from 17 to 11 in five cases, to 10 in three cases, and from 16 to 10 in one case; similarly, MSS reduced from 15 to 11 in cases and to 10 in three cases. Results were statistically significant at a 95% confidence interval ($P < 0.01$).

Discussion

Key functions of the perioral musculature include facial expression; action of the oral sphincter, including articulation. For wounds around the operated areas, it is recognized that the tensile strength and the exerting forces during the healing process provide a rather unfavorable effect on the scars, which, many times, results in a poor and unpleasant nature in healed scars. These actions are reduced with the BTA injection. With the resulting immobilization of perioral wounds, temporary functional insufficiencies may be expected.

In a meta-analysis conducted by Guo *et al.*, it was found that the patients given the BTA injection fared better than the placebo or blank control group in terms of enhancing scar quality and better healing of wounds. The undesirable effects for BTA treatment in these patients were only negligible adverse events.[3]

Numerous studies advocate that superior wound healing results from BTA-induced immobilization of facial wounds.[4-9] Chemoimmobilization of cutaneous wounds is employed to reduce active strain on the healing tissues. A study conducted by Gassner *et al.* showed there was an enhanced quality of wounds in terms of cosmetic appearance in postoperative scars of rabbit ears after the BTA injection. This possibility resulted from the muscle paralysis and decreased muscle tension during healing.[4] The BTA injection has been utilized for more than 20 years in the treatment of many varied cosmetic and non-cosmetic conditions such as strabismus, nystagmus, achalasia, anal fissure; dystonias, including cerebral palsy, torticollis, dysphonia, blepharospasm, hemifacial spasm, and hyperhidrosis. It has been famously employed in the treatment of hyperkinetic lines.

The BTA injection is used as an adjunctive treatment. It has also been used in conjunction with other treatment modalities such as intense pulsed light, resurfacing, and

Figure 1: With botulinum toxin-A injection

Figure 2: Without botulinum toxin-A injection

Table 1: Mean MSS

	Group	*N*	Mean	Std. deviation	Std. error mean
Before with BTA	1	15	16.33	0.900	0.232
	2	15	16.13	0.990	0.256
After with BTA	1	15	7.20	0.414	0.107
	2	15	10.53	0.516	0.133

fillers, constituting a comprehensive "rejuvenation" plan.[10] To avoid unwanted action on the deeper muscle, it would be better to inject a low dose (5 units would be sufficient in most cases) of the BTA at the time of the procedure or if desired at suture removal. Care should be especially taken in cases on the cheek and not involving the midline, if not as much on other areas of the body.

The BTA is also known to cause inhibition of the fibroblasts, therefore providing us with another significant function utilized for the therapy of challenging scars. This is in addition to the reduced expression of connective tissue growth factor, which functions as a downstream regulator of TGF-β1,[11] in turn reducing the levels of TGF-β1 in fibroblasts.[12] The BTA also functions by reducing the infiltration of inflammatory cells during wound healing, and it also leads to an extension of its length.[13] A study conducted by Wang *et al.* explained that the usage of BTA in scars inhibited collagen production and the fibroblasts' cell cycle *in vivo*.[14]

In our study, we establish a significant reduction in the severity of scars measured by the MSS after the BTA injection around the suture line post-procedure, as opposed to a reduced betterment of scar tissue in cases where the BTA was not used.

Conclusion

This study demonstrates the positive effect of BTA as an adjunctive treatment for the betterment of the surgical correction of atrophic and hypertrophic scars.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published, and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Wilson AM. Use of botulinum toxin type A to prevent widening of facial scars. Plast Reconstr Surg 2006;117:1758-66; discussion 1767-8.
2. Zhang X, Lan D, Ning S, Jia H, Yu S. Botulinum toxin type A prevents the phenotypic transformation of fibroblasts induced by TGF-β1 via the PTEN/PI3K/akt signaling pathway. Int J Mol Med 2019;44:661-71.
3. Guo X, Song G, Zhang D, Jin X. Efficacy of botulinum toxin type A in improving scar quality and wound healing: A systematic review and meta-analysis of randomized controlled trials. Aesthet Surg J 2019;40:NP273-85.
4. Gassner HG, Sherris DA, Otley CC. Treatment of facial wounds with botulinum toxin A improves cosmetic outcome in primates. Plast Reconstr Surg 2000;105:1948-53; discussion 1954-5.
5. Sherris DA, Gassner HG. Botulinum toxin to minimize facial scarring. Facial Plast Surg 2002;18:35-9.
6. Gassner HG, Sherris DA. Chemoimmobilization:improving predictability in the treatment of facial scars. Plast Reconstr Surg 2003;112:1464-6.
7. Choi JC, Lucarelli MJ, Shore JW. Use of botulinum A toxin in patients at risk of wound complications following eyelid reconstruction. Ophthalmic Plast Reconstr Surg 1997;13:259-64.
8. Zimbler M, Holds J, Kokoska M, Glaser D, Prendiville S, Hollenbeak C, *et al.* Effect of botulinum toxin pretreatment on laser resurfacing results. Arch Facial Plast Surg 2001;3:165-96.

9. Tollefson TT, Senders CM, Sykes JM, Byorth PJ. Botulinum toxin to improve results in cleft lip repair. Arch Facial Plast Surg 2006;8:221-2.
10. Goodman GJ. The use of botulinum toxin as primary or adjunctive treatment for post acne and traumatic scarring. J Cutan Aesthet Surg 2010;3:90-2.
11. Xiao Z, Zhang M, Liu Y, Ren L. Botulinum toxin type a inhibits connective tissue growth factor expression in fibroblasts derived from hypertrophic scar. Aesthetic Plast Surg 2011;35:802-7.
12. Xiao Z, Zhang F, Cui Z. Treatment of hypertrophic scars with intralesional botulinum toxin type A injections: A preliminary report. Aesthetic Plast Surg 2009;33:409-12.
13. Lee BJ, Jeong JH, Wang SG, Lee JC, Goh EK, Kim HW. Effect of botulinum toxin type a on a rat surgical wound model. Clin Exp Otorhinolaryngol 2009;2:20-7.
14. Wang L, Tai NZ, Fan ZH. [Effect of botulinum toxin type A injection on hypertrophic scar in rabbit ear model]. Zhonghua Zheng Xing Wai Ke Za Zhi 2009;25:284-7.