

Clinical Assessment of Neurotoxin Injection Botulinum for Treatment of Dynamic Facial Forehead and Frown Wrinkles

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Abstract: The aim of this study is to clinically evaluate the effectiveness and safety of Botox in treating facial wrinkles, specifically horizontal forehead lines and frown lines. The evaluation included the overall quality of life, patient satisfaction, the impact on self-esteem after treatment. Botulinum toxin injection (Botox) is a frequently performed cosmetic procedure for treating facial wrinkles worldwide¹. Botox, a neurotoxic protein produced by Clostridium botulinum bacteria, works by temporarily blocking the release of acetylcholine. Treatment of frown lines and crow's feet, which are the cosmetic indications approved by the U.S. Food and Drug Administration, and horizontal forehead lines, offers predictable results, has few adverse effects, and is associated with high patient satisfaction. Dynamic wrinkles, seen during muscle contraction, yield more dramatic results than static wrinkles, which are visible at rest. This was a singlecenter prospective study involving 20 healthy female participants aged 22–35 years. Inclusion criteria required that participants had not received Botox injections within the 6 months prior to the project's commencement. Exclusion criteria included a history of stomatognathic pain, facial, or neck surgery; chronic diseases (e.g., thyroid disease, systemic lupus erythematosus, immunodeficiency disorders); or any conditions that could potentially interfere with study outcomes. Patients selected with dynamic wrinkles demonstrate the most dramatic improvements from botulinum toxin injection and are ideal candidates for treatment. Patients with static wrinkles that are visible at rest are also candidates, but results are slower, and patients may require two or three consecutive Procedures. reduction of dynamic frown lines one month after treatment of the glabellar complex muscles with 20 units of on a botulinum toxin. Return of muscle function is gradual, typically three to four months after treatment. Subsequent treatment is advised when muscle contraction is visible in the treatment area before facial lines return to their pretreatment appearance. After multiple treatments, botulinum toxin effects may be prolonged and, for some patients, treatment intervals can be extended beyond three to four months.

Keywords: Neurotoxin injection -(Botulinum) - Dynamic Facial Forehead and Frown wrinkles.

Introduction

Botulinum toxin injection (Botox) is a frequently performed cosmetic procedure for treating facial wrinkles worldwide [1]. Botox, a neurotoxic protein produced by *Clostridium botulinum* bacteria, works by temporarily blocking the release of acetylcholine [2]. This blockage will reduce muscle activity, resulting in decrease the appearance of wrinkles and smoother skin [2]. Several health practitioners, including general physicians, plastic surgeons, and dentists incorporate Botox into their practices to help attain a youthful appearance [3].

In 2002, the Food and Drug Administration (FDA) approved the use of Botox for cosmetic treatment of the upper facial area, including horizontal forehead lines and glabellar frown lines [4]. These wrinkles are caused by dermal atrophy as a natural consequence of the aging process [5]. In addition, the repetitive contraction of facial muscles during expressions can lead to the formation of lines that may become more noticeable over time [5]. Facial wrinkles, particularly those that form in the upper facial area, have a significant impact on an individual's appearance and are an obvious sign of aging [6]. The appearance of these wrinkles can lead to a decline in self-esteem and confidence [7]. Consequently, many people seek various effective, non-surgical treatments to address the signs of aging and restore a more youthful look and, in turn, enhance their overall sense of well-being [6].

Among the upper facial wrinkle's treatment options available, Botox became popular because of its effectiveness and safety in the treatment of facial wrinkles [2]. Its full effects of to reduce the wrinkles during muscle contraction take around two weeks and last for three to four months [8]. The increased acceptance of Botox for aesthetic purposes can be attributed to multiple reasons, including its minimally invasive nature, quick recovery time, and impressive results [9]. In addition, the potential side effects are minimal and manageable, they can include edema, bruising, headache, and temporary weakness of adjacent muscles due to dissemination of toxins to nearby areas [1].

A systematic review search which 50 prospective studies were included [10]. Those articles used patient-reported outcomes instruments to evaluate the success of cosmetic Botox intervention and improve patient's satisfaction [10]. The systemic review concluded that over the past 15 years, data have confirmed that cosmetic Botox is both objectively and subjectively effective in improving patient satisfaction, experience, appearance, perception of youthfulness and self-confidence [10]. An evidence-based review and global survey conducted by Michon A. et al, in 2022 on current practice among aesthetic practitioners who use Botox for cosmetic treatments in young adults, demonstrated the effectiveness of Botox treatment in improving the appearance of horizontal lines on the forehead and frown wrinkles, with significant positive satisfaction reported in the results [11]. Understanding the psychological effects of Botox treatment on patients is essential for enhancing their quality of life by increasing satisfaction and positively impacting their self-esteem [12].

In Saudi Arabia, a cross-sectional study in conducted by Alzahrani L. et al, in 2024 included an online questionnaire distributed across the country to patients aged 18 and older seeking minimally invasive cosmetic procedures to assess the reasons for patients seeking cosmetic procedures in Saudi Arabia [13]. The study reported that Botox was one of the most commonly received cosmetic treatments, accounting for 20.6% [13]. Most participants were middle-aged females (87%) who learned about the treatments through various social media platforms [13].

The aim of this study is to clinically evaluate the effectiveness and safety of Botox in treating facial wrinkles, specifically horizontal forehead lines and frown lines. The evaluation included the overall quality of life, patient satisfaction, the impact on self-esteem after treatment.

Patients and Methods

Study Design

This was a singlecenter prospective study involving 20 healthy female participants aged 22–35 years. Inclusion criteria required that participants had not received Botox injections within the 6 months prior to the project's commencement. Exclusion criteria included a history of stomatognathic pain, facial, or neck surgery; chronic diseases (e.g., thyroid disease, systemic lupus erythematosus, immunodeficiency disorders); or any conditions that could potentially interfere with study outcomes.

Patients Selection

Patients selected with dynamic wrinkles demonstrate the most dramatic improvements from botulinum toxin injection and are ideal candidates for treatment. Patients with static wrinkles that are visible at rest are also candidates, but results are slower, and patients may require two or three consecutive Procedures.

Baseline Assessment

The Baseline assessment before the intervention, participants were photographed with various facial expressions with clinical assessment and satisfaction of patient Postintervention. Immediately following the injection, participants were asked to evaluate their pain scores on a 10point scale. At subsequent visits, participants were photographed again with and without facial expressions and satisfaction



Figure 1: Ideal candidate for botulinum toxin treatment demonstrating Frontal view of a 33-year-old female presenting with (A) dynamic frown lines with glabellar complex muscle contraction (B) lack of wrinkles static lines with glabellar muscles at rest.

The patient was quite satisfied with the appearance, and therefore no additional injections were applied.

Procedure and Preparation

In this study all the patients were operated under local anesthesia is typically necessary for botulinum toxin treatments. Dynamic and static photographs of treatment areas are typically taken before treatment and two weeks after treatment as showing in fig1, once clinical effects are evident. Botulinum Toxin Injection: Botulinum toxin is supplied as a powder and is reconstituted at the time of treatment into a solution using sterile normal saline. Dilution volumes range from 1 to 4 mL per 100-unit vial. The botulinum toxin dose injected into glabellar complex muscles for the treatment of frown lines is based on the specific botulinum toxin product used and mass of the target muscles. The minimum dose for treating glabellar frown lines is 20 Units as it was found that dosing 20–40 Units of Botox was more effective than 10 Units alone for reducing glabellar frown lines.

Men require higher doses of Botox as they have a greater muscle mass than women. The botulinum toxin dose injected into glabellar complex muscles for the treatment of frown lines is based on the specific botulinum toxin product used and mass of the target muscles

Preparation of Botulinum

In preparation for botulinum toxin treatment, or any injectable procedure, bruising can be minimized by advising patients to discontinue aspirin and any medication or dietary supplement that has anticoagulant effects two weeks before treatment. Contraindications with the use of Botox include patients with myasthenia gravis, amyotrophic lateral sclerosis, multiple sclerosis, Eaton Lambert syndrome, women who are pregnant and breastfeeding, neonate and children, patients with focal and systemic infections, patients who are hypersensitive or allergic to Botox and patients who had previously undergone lower eyelid surgery.

Clinical Effects

The clinical effects of Botox are seen on the first to the fourth days after injection, followed by 1–4 weeks of maximum effect, which will resolve after 3–4 months. In order to prolong the effects of Botox from six months to one year, the treatment should be repeated for one year or more. The duration of Botox effect varies among individuals due to differences in muscle arrangements, meaning that different individuals may require different doses of Botox.

Glabellar Complex Muscles

The targeted glabellar complex muscles can be identified by having the patient actively frown, and injections are placed into the contracted muscles small volumes of botulinum toxin solution are injected, typically 1 mL or less, using a 30-gauge, 1-inch needle. There are five injection sites, one injection in the procerus muscle and two in each of the corrugator super-cilii muscles.

Botulinum toxin is commonly used to treat other lines in the upper one third of the face, such as horizontal forehead lines with injection in the frontalis muscle, and crow's feet with injection in the lateral orbicularis oculi muscles. Localized burning or stinging sensation during injection is commonly reported and resolves within a few minutes.

After Care: Patients are advised to avoid lying supine following treatment for four hours. They are also advised to avoid massaging or applying heat to the treatment area, and to avoid activities that cause flushing (such as exercising heavily, consuming alcohol, and hot tub use) on the day of treatment.

Post Operative: Mild erythema, edema, and tenderness at injection sites are expected and resolve within a day. Bruising is common and ranges from pinpoint needle insertion marks to quarter-sized ecchymoses that can take up to two weeks to resolve. Application of ice and pressure to a bruise can minimize enlargement. Headache can occur with facial injections; most are mild and spontaneously resolve a few days after treatment.

Side Effects of Botox: The possible side effects of Botox include bleeding, swelling, erythema and pain at the injection sites. These side effects can be avoided by using thinner needles and diluting Botox with saline. Headaches may also occur following Botox injections but will resolve after 2–4 weeks. This side effect can be treated using systemic analgesics.

Results and Follow Up

15 patients were included in this study. The highest incidence was between the ages of 22 and 32. Partial reduction in function of the targeted glabellar complex muscles is seen by the third day after botulinum toxin injection, with maximal reduction visible two weeks after injection. Dynamic wrinkles, seen during muscle contraction, yield more dramatic results than static wrinkles, which are visible at rest. Deep static lines may not fully respond to botulinum toxin injection alone and may require combination treatment with dermal fillers or other cosmetic procedures to achieve optimal results. Figure 2,3,4 and 5 shows a reduction of dynamic frown lines one month after treatment of the glabellar complex muscles with 20 units of on a botulinum toxin. Return of muscle function is gradual, typically three to four months after treatment. Subsequent treatment is advised when muscle contraction is visible in the treatment area before facial lines return to their pretreatment appearance. After multiple treatments, botulinum toxin effects may be prolonged and, for some patients, treatment intervals can be extended beyond three to four months.

Four weeks following the botulinum toxin showing lack of static lines with frontalis muscles at rest with no Wrinkles. The patient was quite satisfied with the appearance, and therefore no additional injections were applied. Eighth weeks Postoperatively, showing lack of static lines with frontalis muscles at rest with no Wrinkles after injection. Lack of wrinkles static lines with glabellar muscles at rest. The patient was quite satisfied with the appearance, and therefore no additional injections were applied as showing in fig 2,3,4 and 5.



Figure 2: Ideal candidate for botulinum toxin treatment demonstrating Preoperatively, wrinkles horizontal lines with severe dynamic wrinkles over her forehead contraction (B)one month Postoperatively, showing lack of static lines with frontalis muscles at rest with no Wrinkles after injection.



Figure 3: Case 1 Dynamic frown lines with glabellar complex muscle contraction (A) before and (B) one month after Botox treatment.



Figure 4: Case 2 Ideal candidate for botulinum toxin treatment demonstrating Frontal view of a 32-year-old female presenting with (A) dynamic frown lines with glabellar complex muscle contraction (B) lack of wrinkles static lines with glabellar muscles at rest.

The patient was quite satisfied with the appearance, and therefore no additional injections were applied.



Figure 5: Case 2 A) Frontal view of a 32-year-old female presenting severe forehead wrinkles in the upper forehead when animated with severe dynamic wrinkles over the entire forehead. (B) Four weeks following the botulinum toxin showing lack of static lines with frontalis muscles at rest with no Wrinkles.

The patient was quite satisfied with the appearance, and therefore no additional injections were applied.

Discussion

This prospective study investigated the use of botulinum toxin injections for Wrinkles purposes has witnessed a surge in popularity in recent years, with numerous pharmaceutical companies offering various brands 1-2. Our study reported a slightly higher satisfied of forehead wrinkles in the upper forehead with the appearance, and therefore no additional injections were applied which coincides with a study conducted by Stariyases et al which evaluated the forehead wrinkles in the upper forehead among the population and reported a higher incidence in females than in males. In contrast to the gender findings in the current study, some previous studies have reported opposite findings (4 and 5)

The findings of the current study aligned with those reported by staircases et al. This prospective study investigated the use of botulinum toxin injections for Wrinkles purposes has witnessed a surge in popularity in recent years, with numerous pharmaceutical companies offering various brands 1-2. These brands exhibit distinct structures of complexing proteins or, in some cases, lack such proteins 9. The role of complex proteins has been a subject of discussion for over a decade, as they are believed to facilitate muscle tissue adherence and may influence the diffusion of BoNT/A from the target area 4-6. While injection of the AboA and PraboA brands resulted in significant reductions in MVBF (MVBF) that persisted longer than injection with the other brands, the reduction in bite force at 16 weeks was significantly higher at the 16-week post-injection time point compared to 12 weeks. The current study found that the one possible explanation is that the masseter muscle regained normal function, while the reduced bite force compared to baseline could be attributed to the disuse atrophy effect of BoNT/A. Consequently, it would appear that the longevity of BoNT/A injections for masseter hypertrophy does not significantly differ among the different BoNT/A types. However, the initiation of the effect may vary in terms of the pain score and adverse events associated with Botox injection, no significant differences among the various types were reported. Pain scores may primarily result from the needle puncture through the skin, rather than being related to the type used. Adverse events, such as bruises occur in 3 cases.

Conclusion

The findings of this study shed light on the treatment for facial wrinkles and bite force reduction typically lasts for at least 12 weeks following injection. It is a simple procedure and improves the psychological of the patient. These results highlight the critical need for close monitoring and prompt intervention for this. Complications related to botulinum toxin effects occur less frequently than injection reactions and are primarily caused by temporary denervation of adjacent muscles outside of the intended treatment area. Clinicians should carefully evaluate all cases before starting. These complications are technique-dependent; incidence declines as injector skill improves and to optimize long-term oral health outcomes for their patients. A limitation of this study is that the use of a lower number of patients may not provide as high a clear line of this case. Additionally, the prospective, single-patient design of the study may be susceptible to selection bias and the findings may not be fully representative of the broader population.

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