The Efficacy of Intradermal Botulinum Toxin Type A in the Treatment of Enlarged Facial Pores: A Pilot Study

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Abstract

Enlarged facial pores are a common dermatologic condition associated with increased sebum production and structural alterations of the pilosebaceous unit, for which effective and minimally invasive treatments remain limited. This study aimed to evaluate the efficacy of intradermal botulinum toxin type A for the treatment of enlarged facial pores, with particular emphasis on objective pore reduction, sebum production, patient satisfaction, and safety outcomes. Methods: A prospective, randomized, single-arm, before-and-after pilot study was conducted in ten patients with visibly enlarged facial pores. Intradermal botulinum toxin type A (10 units) was injected into one randomly assigned cheek using a superficial microdroplet technique. Outcomes were assessed at baseline, 1 month, and 3 months using Antera 3D® for pore volume measurement, a Sebumeter for sebum production, physician-rated pore severity scores, patient satisfaction scales, and adverse event monitoring. Results: Pore volume demonstrated a significant and progressive reduction over time ($p < 0.001$). Sebum production decreased significantly in a time-dependent manner ($p = 0.018$). Physician-rated pore severity scores improved consistently across follow-up visits, while patient satisfaction remained high throughout the study period. Only mild and transient local adverse effects were observed. Conclusions: Intradermal botulinum toxin type A appears to be an effective and safe minimally invasive treatment for enlarged facial pores, providing sustained objective and clinical improvement. Larger controlled studies are warranted to confirm these findings and determine long-term efficacy.

Keywords**:** *enlarged facial pores, botulinum toxin type A, sebum production*

1. Introduction

Enlarged facial pores are a common cosmetic concern affecting individuals across different ages, genders, and ethnicities, and are frequently associated with acne, seborrhea, and photoaging. Epidemiological studies have reported that visible facial pores are among the most frequently reported aesthetic skin concerns, affecting approximately 40–50% of individuals seeking dermatologic or cosmetic consultation. Although not considered a medical disorder, visible facial pores can significantly impair self-perception and quality of life, particularly in individuals with oily or acne-prone skin. In dermatology and cosmetology, the term “facial pores” generally refers to visible topographic openings of the pilosebaceous unit rather than eccrine sweat gland ostia. These structures typically appear as funnel-shaped or cylindrical openings and are most prominent on the nose, cheeks, forehead, and chin (Uhoda et al., 2005; Dong et al., 2016).

The pathogenesis of enlarged facial pores is multifactorial and incompletely understood. Current evidence suggests that excessive sebum excretion, reduced dermal elasticity surrounding follicular openings, and increased hair follicle volume are the principal contributors to pore enlargement (Lee et al., 2016). Additional modifying factors include sex-related hormonal influences, acne, genetic predisposition, ethnicity, and chronic ultraviolet exposure, all of which can alter sebaceous gland activity and perifollicular dermal architecture (Kim et al., 2013; Dong et al., 2016; Jang et al., 2018). Despite its high prevalence, standardized assessment tools and consensus treatment strategies for enlarged facial pores remain limited.

Given the strong association between sebum output and pore size, most therapeutic approaches have focused on sebosuppression and dermal remodeling. Current treatment modalities include topical retinoids, chemical peels, oral isotretinoin, hormonal therapies, lasers, radiofrequency, ultrasound-based devices, and

photodynamic therapy. However, many of these interventions show variable efficacy, require repeated sessions, or are associated with procedure-related discomfort and adverse effects (Dong et al., 2016; Nawwar et al., 2022). In addition, device-based treatments such as laser and radiofrequency commonly require multiple sessions at intervals of approximately 2–4 weeks to achieve clinically meaningful improvement, which may limit patient adherence and increase treatment burden.

In recent years, intradermal botulinum toxin type A (BoNT-A) has emerged as a novel minimally invasive option for managing oily skin and enlarged facial pores. Clinical studies have demonstrated that intradermal BoNT-A can significantly reduce sebum production and improve pore appearance, with high patient satisfaction and minimal downtime (Rose et al., 2013; Nawwar et al., 2022). At a biological level, acetylcholine signaling has been shown to regulate sebaceous gland activity via the nicotinic acetylcholine receptor α7 expressed on human sebocytes, promoting lipid synthesis through ERK and PPAR-γ signaling pathways. By inhibiting acetylcholine release, BoNT-A may downregulate sebocyte activity and reduce sebum production, thereby indirectly improving pore size (Li et al., 2013).

Furthermore, emerging in vitro evidence suggests that intradermal BoNT-A may also influence dermal remodeling. Studies have demonstrated that BoNT-A can modulate fibroblast contraction, collagen synthesis, and matrix metalloproteinase expression, potentially enhancing dermal support around follicular openings and contributing to a pore-tightening effect. Clinically, the sebosuppressive and pore-tightening effects of intradermal BoNT-A have been reported to persist for approximately 3–6 months, after which repeat treatment may be required to maintain the therapeutic outcome (Oh et al., 2012; Wanitphakdeedecha et al., 2019). Nevertheless, while the biological rationale for BoNT-A–mediated sebum reduction and dermal remodeling is increasingly supported, clinical evidence specifically targeting enlarged facial pores as a primary outcome remains limited.

Therefore, the aim of this study was to evaluate the efficacy of intradermal botulinum toxin type A in the treatment of enlarged facial pores, with particular emphasis on its clinical outcomes and relevance to sebum-related pore enlargement. This research sought to provide objective evidence to support intradermal BoNT-A as a potential minimally invasive therapeutic option for patients with enlarged facial pores.

2. Objectives

1) To evaluate the efficacy of intradermal botulinum toxin type A in the treatment of enlarged facial pores by comparing clinical outcomes before and after treatment.

2) To evaluate patient satisfaction following treatment.

3) To evaluate the adverse effects after treatment

3. Materials and Methods

3.1 Study Design and Population

This study was conducted as a prospective, randomized, single-arm, before-and-after pilot study (N = 10). The sample size was selected for pilot investigation to evaluate feasibility and detect preliminary treatment signals rather than to provide definitive confirmation of treatment efficacy. The side of the face to receive treatment was randomly assigned for each participant. Intradermal incobotulinumtoxinA (BoNT-A) was injected into the designated cheek. Although random side allocation was performed, the contralateral untreated cheek was not used as a formal internal control for statistical comparison. The primary analysis focused on within-side changes from baseline on the treated cheek to evaluate preliminary clinical response to the intervention. This approach was chosen because the study was designed as an exploratory pilot study aimed at generating early clinical evidence supporting intradermal BoNT-A for enlarged facial pores rather than establishing definitive comparative efficacy. Clinical outcomes were evaluated by comparing baseline and post-treatment assessments within the same treated side.

Participants with visibly enlarged facial pores on the anterior cheeks who presented to the Dermatology Outpatient Department (OPD) at Tobacco Monopoly Hospital were screened for eligibility. The inclusion criteria were as follows: 1) Thai participants aged 20-60 years; 2) Visible facial pores on both sides of the anterior cheek with a pore size ranging from 0.1–0.6 mm². The exclusion criteria were as follows: 1)

History of allergy to botulinum toxin; 2) Recent topical retinoids (e.g., tretinoin, adapalene, tazarotene) or systemic retinoids (e.g., isotretinoin) within the previous 3 months, as these agents may affect sebaceous gland activity and skin remodeling and therefore act as potential confounding factors for treatment outcomes; 3) Recent chemical peeling within the previous 3 months; 4) Recent laser or energy-based procedures on both cheeks within the previous 3 months; 5) Recent filler or biostimulator injections on both cheeks within the previous 6 months; 6) Botulinum toxin injections to both cheeks within the previous 6 months; 7) Uncontrolled systemic diseases (e.g., autoimmune connective tissue disease); 8) Neurologic disease or coagulopathy; 9) Active infection, acne, or eczema at treatment sites; 10) Pregnancy or lactation; 11) Scars involving both cheeks.

Written informed consent was obtained from all participants prior to enrollment. The consent process was conducted by the study investigator at the Dermatology Outpatient Department before any study-related procedures were performed. The research received approval from the Human Research Ethics Committee of Thammasat University (Medicine) under reference number MTU-EC-OO-0-174/68.

3.2 Allocation and Blinding

The side of the face to receive intradermal botulinum toxin type A injection was determined by random allocation, assigning either the right or left cheek as the treatment side for each participant. The allocation sequence was prepared prior to participant enrollment and implemented at the time of treatment to ensure unbiased side selection. Participants were aware of which facial side received the intervention. The study employed a single-blind design in which outcome assessments at each study visit were performed by an independent dermatologist who was blinded to the treatment side and responsible for pore severity evaluation.

3.3 Intervention and Protocol

A 100-unit vial of botulinum toxin type A was reconstituted with 5 mL of 0.9% normal saline. The injection was performed on the randomly assigned facial side for each participant. A total dose of 10 units of the reconstituted botulinum toxin (0.5 mL) was administered intradermally to the anterior cheek area. Injections were performed using a 32-gauge, 1/2-inch needle inserted at an angle not exceeding 45 degrees relative to the skin surface. The toxin was delivered using a superficial intradermal microdroplet technique, with an injection volume of 0.02 mL per injection point (equivalent to 0.4 units per point), A total of 25 injection points distributed evenly across the treated area, as shown in Figure 1.

For clinical documentation, standardized facial photographs were obtained during each visit. Additional written consent was obtained from the participant whose full-face photograph was included in the manuscript and conference presentation. The use of identifiable facial images complied with the Personal Data Protection Act (PDPA), and the participant provided explicit permission for publication and academic dissemination.

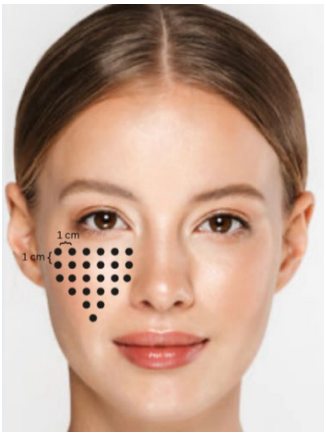

Figure 1 Represents injection point of intradermal Botulinum toxin type A on cheek [13]

3.4 Outcome Assessment

Outcome assessments were performed on the treated facial side at baseline and follow-up visits at 4 and 12 weeks. The primary outcome was treatment efficacy. Objective pore measurement were obtained using Antera 3D® to quantify pore volume at each follow-up time point. Physician-rated pore severity assessed from Trica® images using a 0–3 pore visibility scale within a defined area by a blinded dermatologist. Sebum production (µg/cm2) was measures at each visit using a Sebumeter®. Secondary outcomes included patient satisfaction, assessed at weeks 4 and 12 using a 5-point improvement scale. A score of 0 indicated worsening, 1 indicated <25% improvement, 2 indicated 25–50% improvement, 3 indicated 51–75% improvement, and 4 indicated 75–100% improvement compared with baseline. Safety outcomes were evaluated through dermatologic assessment of local adverse effects, including erythema, edema, bruising, and scarring. Assessments were conducted immediately after the procedure and at each follow-up visit. Participants additionally recorded symptom severity and duration.

3.5 Statistical Analysis

Statistical analyses were performed using SPSS software. Descriptive data were summarized using appropriate measures of central tendency and dispersion. Changes in continuous outcomes, including pore volume and sebum production, across baseline and follow-up visits were analyzed using repeated-measures or paired statistical methods as appropriate after assessment of data distribution assumptions. Ordinal outcomes, including physician-rated pore severity and patient satisfaction scores, were analyzed using nonparametric or ordinal-based statistical approaches. All statistical tests were two-tailed, and a *p-value* < 0.05 was considered statistically significant.

4. Results and Discussion

4.1 Results

A total of 10 participants were enrolled, and all completed the study. The mean age was 27.7 ± 5.0 years (range 22–37 years). The study population included equal numbers of male and female participants (n = 5 each). Fitzpatrick skin types III and IV were represented, with type IV being the most common (70%). The demographic characteristics of the participants are summarized in Table 1.

Pore volume was evaluated at baseline and at 1 and 3 months, as shown in Figure 2. Objective pore volume demonstrated a significant reduction over time following intradermal botulinum toxin type A injection. Repeated-measures analysis revealed a statistically significant change in pore volume across he three time points (baseline, 1 month, and 3 months) ($p < 0.001$). Mean pore volume decreased from 3.34 ± 1.33 at baseline to 2.56 ± 1.42 at 1 month and further to 1.78 ± 1.11 at 3 months. Pairwise comparisons confirmed significant reductions between baseline and 1 month, baseline and 3 months, and between 1 month and 3 months (all $p < 0.01$), indicating a progressive improvement over time.

Sebum production was measured at baseline and at 1 and 3 months, as shown in Figure 3. Sebum production significantly decreased following treatment. Mean sebum production decreased from 125.4 µg/cm² at baseline to 80.3 µg/cm² at 1 month and further to 74.3 µg/cm² at 3 months. Linear mixed-effects modeling demonstrated a significant time-dependent reduction in sebum production, with an estimated decrease of approximately 15.0 µg/cm² per month ($p = 0.018$). Pairwise comparisons revealed a significant reduction in sebum production at 1 month compared with baseline ($p = 0.001$) and at 3 months compared with baseline ($p < 0.001$), indicating a sustained suppressive effect on sebaceous activity during follow-up.

Physician-rated pore severity scores were used to assess changes in pore appearance at each follow-up visit. Scores ranged from Grade 0 to Grade 3, representing least to most visible pores, as presented in Figure 4. A marked improvement was observed over time following treatment. At baseline, the majority of participants were graded as having moderate to severe pore severity, with 70% classified as Grade 2 and 20% as Grade 3, while only 10% were classified as Grade 1. At 1 month, the distribution shifted substantially toward lower severity grades, with 70% of participants graded as Grade 1 and 30% as Grade 2, and no participants remaining in Grade 3. By 3 months, further improvement was observed, with 90% of participants classified as Grade 1 and only 10% as Grade 2. Ordinal mixed-effects analysis demonstrated that increasing

time was significantly associated with decreasing pore severity grades ($p < 0.001$), indicating a consistent and progressive clinical improvement over the follow-up period.

Patient satisfaction scores showed a sustained trend toward improvement at 1 and 3 months, as illustrated in Figure 5. At 1 month, 80% of participants reported ≥51% improvement, and this proportion remained high at 3 months (70%). However, ordinal mixed-model analysis demonstrated no significant difference in satisfaction scores between follow-up visits ($p = 0.698$). These findings indicate a stable perceived improvement over time, consistent with the progressive reduction in physician-rated pore severity. The clinical outcomes based on photographs obtained using Trica® and the Antera3D® system , comparing the initial baseline assessment with the follow-up examination conducted after three months, are demonstrated in Figure 6.

All participants completed the study without serious adverse events. Mild and transient local reactions, including erythema, edema, and bruising at the injection sites, were observed immediately after treatment and resolved spontaneously. No cases of scarring, prolonged complications, or treatment-related discontinuations were reported during the follow-up period.

Table 1 Demographic data of subjects enrolled in the study (n = 10)

Characteristic	Value
Age (years)	
Mean ± SD	27.7 ± 5.0
Median (range)	28 (22-37)
Sex, n (%)	
Female	5 (50.0)
Male	5 (50.0)
Fitzpatrick skin type, n (%)	
Type III	3 (30.0)
Type IV	7 (70.0)

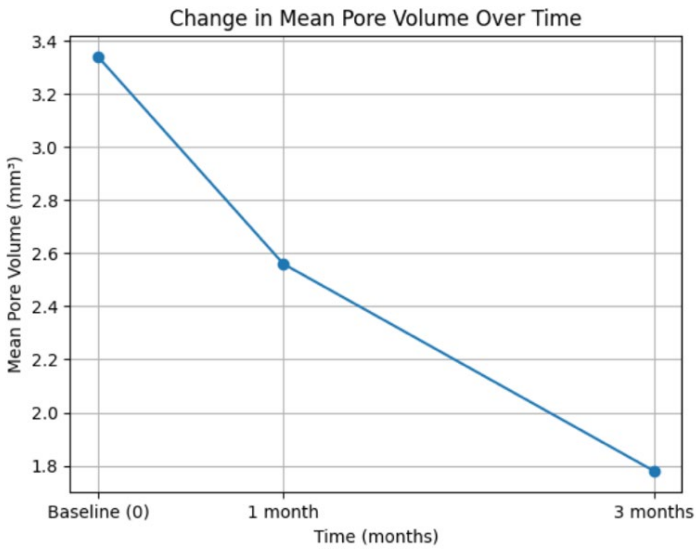

Figure 2 Mean pore volume

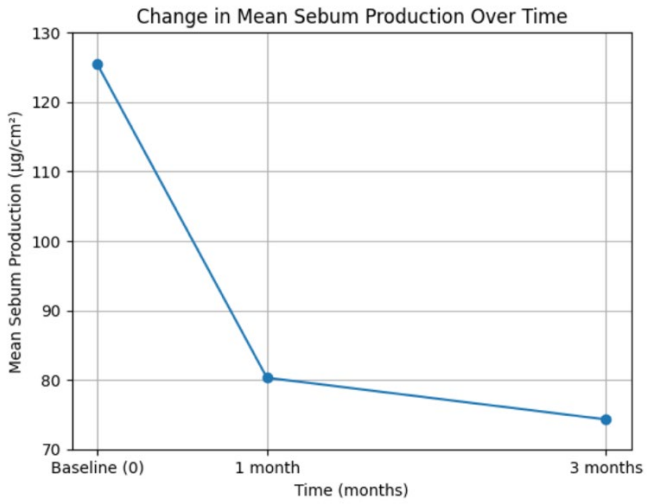

Figure 3 Mean sebum production

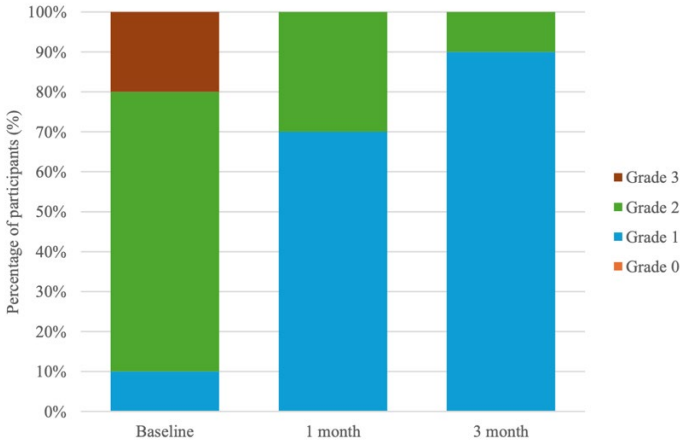

Figure 4 Physician-rated pore severity scores

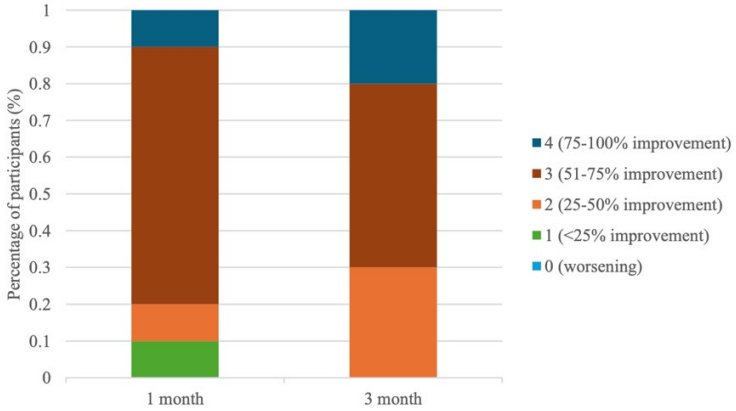

Figure 5 Patient satisfaction scores

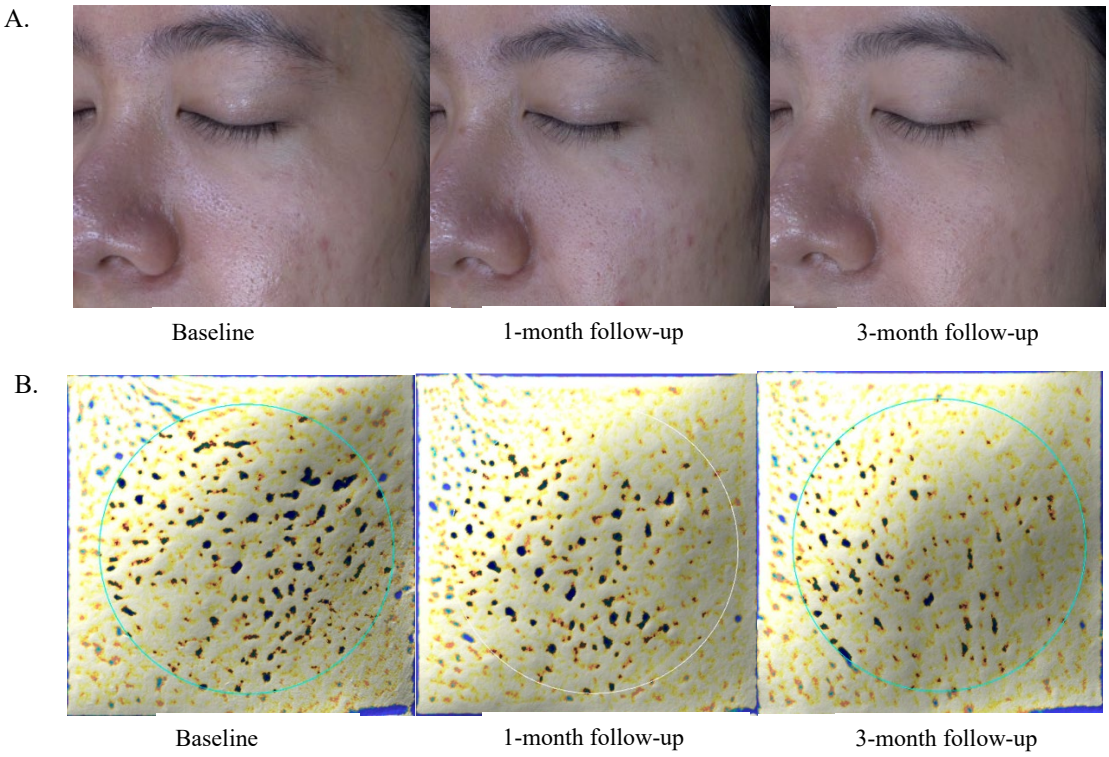

Figure 6 The clinical photograph from Trica® (A) and pore size detection image from Antera3D® (B) of represent subject at baseline, 1-, and 3-month follow-up visit

4.2 Discussion

Enlarged facial pores are a common dermatologic condition characterized by visibly dilated pilosebaceous openings, particularly in sebaceous-rich areas of the face. This condition has been associated with increased sebum production, reduced dermal elasticity, and structural alterations of the pilosebaceous unit (Ahmed El Attar & Nofal, 2021). Excessive sebum secretion has been identified as a key contributor to the development and persistence of enlarged facial pores (Shuo et al., 2019). Alterations in sebum activity and skin elasticity have also been shown to impair texture and overall skin quality in affected individuals (Vachiramon et al., 2025). Despite the availability of multiple treatment modalities, including topical agents, lasers, and energy-based devices, clinical outcomes remain inconsistent, and optimal management strategies have not been clearly established (Fabi et al., 2023).

In the present study, intradermal botulinum toxin type A demonstrated significant clinical improvement in enlarged facial pores when post-treatment outcomes were compared with baseline measurements in the treated facial area (Rose et al., 2013). Objective evaluation revealed a reduction in pore volume as assessed by Antera imaging (Vachiramon et al., 2025). A concurrent decrease in sebum production measured using a Sebumeter was also observed following treatment (Shuo et al., 2019). In addition, physician-rated pore severity scores showed consistent improvement after intradermal botulinum toxin administration (Sayed et al., 2021). These findings suggest that intradermal botulinum toxin effectively improves pore appearance through modulation of sebaceous activity and structural changes within the dermis. Comparable improvements in pore size and skin oiliness have been reported in previous clinical studies evaluating microbotox and intradermal botulinum toxin, including those employing objective Antera-based measurements (Francois et al., 2010; Ahmed El Attar & Nofal, 2021).

The reduction in sebum production observed in this study is consistent with the proposed biological mechanisms of botulinum toxin action. Sebaceous glands express nicotinic acetylcholine receptors, and acetylcholine stimulation promotes sebocyte differentiation and lipid synthesis (Li et al., 2013). Inhibition of acetylcholine release by botulinum toxin may downregulate sebaceous gland activity, leading to decreased sebum output and secondary improvement in pore size (Shuo et al., 2019). Greater responsiveness to intradermal botulinum toxin has been observed in patients with a history of oily skin. This association was further supported by recent clinical evidence demonstrating superior outcomes in patients with sebum-rich skin treated with botulinum toxin monotherapy (Vachiramon et al., 2025). In addition, neuromodulation of the arrector pili muscles may reduce follicular dilation, further contributing to pore size reduction (Rose et al., 2013).

Physician-rated improvement in pore severity observed in the present study is consistent with findings from previous clinical investigations reporting visible pore reduction following intradermal botulinum toxin treatment (Ning et al., 2017; Sayed et al., 2021). Similar improvements have been demonstrated using microbotox techniques (Ahmed El Attar & Nofal, 2021). Objective confirmation of these outcomes using standardized imaging modalities has also been reported in recent studies (Vachiramon et al., 2025). The incorporation of objective assessment tools such as Antera imaging and a Sebumeter in the present study strengthens the validity of the findings and addresses limitations of earlier studies that relied primarily on subjective photographic evaluation (Kim et al., 2013; Fabi et al., 2023).

High patient satisfaction observed in this study further supports the clinical applicability of intradermal botulinum toxin for the management of enlarged facial pores. Improvements in skin texture and reduction in facial oiliness are likely contributors to favorable patient-reported outcomes (Shuo et al., 2019). Comparable satisfaction levels have been reported in recent controlled trials using both objective measurements and patient-reported assessment scales (Vachiramon et al., 2025).

Regarding safety, intradermal botulinum toxin type A was well tolerated, with only mild and transient adverse effects observed. A low incidence of serious adverse events has been consistently reported when appropriate dilution, injection depth, and microdroplet techniques are employed (Sayed et al., 2021). Proper injection technique remains critical to minimize toxin diffusion and unintended muscle weakness.

Several limitations should be acknowledged. The small sample size reflects the pilot nature of this study and limits the generalizability of the findings. In addition, the absence of histopathologic evaluation precludes direct assessment of sebaceous gland and dermal structural changes. Future studies with larger cohorts, longer follow-up durations, and controlled designs are warranted to further clarify treatment durability and optimize injection protocols.

5. Conclusion

In conclusion, intradermal botulinum toxin type A appears to be an effective and safe treatment for enlarged facial pores. Significant improvements were observed in pore volume, sebum production, and physician-rated pore severity when comparing post-treatment outcomes with baseline measurements, accompanied by high patient satisfaction and minimal adverse effects. These findings support the role of intradermal botulinum toxin as a minimally invasive therapeutic option for patients with enlarged facial pores. Further large-scale, long-term studies are warranted to confirm these results.

6. Acknowledgements

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7. References

Ahmed El Attar, Y., & Nofal, A. (2021). Microbotox for the treatment of wide facial pores: A promising therapeutic approach. *Journal of Cosmetic Dermatology*, *20*(5), 1361-1366. https://doi.org/10.1111/jocd.13675

Dong, J., Lanoue, J., & Goldenberg, G. (2016). Enlarged facial pores: An update on treatments. *Cutis*, *98*(1), 33-36.

Fabi, S. G., Park, J. Y., Goldie, K., & Wu, W. (2023). Microtoxin for improving pore size, skin laxity, sebum control, and scars: A roundtable on integrating intradermal botulinum toxin type A microdoses into clinical practice. *Aesthetic Surgery Journal*, *43*(9), 1015-1024. https://doi.org/10.1093/asj/sjad044

François, G., Maudet, A., McDaniel, D. H., Giron, F., & Bazin, R. (2010). Quantification of facial pores using image analysis. *Cosmetic Dermatology*, *22*(9), 457-465.

Jang, S. I., Kim, E. J., & Lee, H. K. (2018). A method of evaluating facial pores using optical 2D images and analysis of age-dependent changes in facial pores in Koreans. *Skin Research and Technology*, *24*(2), 304-308. https://doi.org/10.1111/srt.12430

Kim, B. Y., Choi, J. W., Park, K. C., & Youn, S. W. (2013). Sebum, acne, skin elasticity, and gender difference - which is the major influencing factor for facial pores?. *Skin Research and Technology*, *19*(1), e45-53. https://doi.org/10.1111/j.1600-0846.2011.00605.x

Lee, S. J., Seok, J., Jeong, S. Y., Park, K. Y., Li, K., & Seo, S. J. (2016). Facial pores: Definition, causes, and treatment options. *Dermatologic Surgery*, *42*(3), 277-285. https://doi.org/10.1097/dss.0000000000000657

Li, Z. J., Park, S. B., Sohn, K. C., Lee, Y., Seo, Y. J., Kim, C. D., . . . Im, M. (2013). Regulation of lipid production by acetylcholine signalling in human sebaceous glands. *Journal of Dermatological Science*, *72*(2), 116-122. https://doi.org/10.1016/j.jdermsci.2013.06.009

Nawwar, E. M. A., Kandil, A. H., & El-Kholy, B. M. (2022). New insight in the treatment of wide facial pores: Review article. *The Egyptian Journal of Hospital Medicine*, *86*(1), 759-761. https://doi.org/10.21608/ejhm.2022.216040

Ning, Y., Qing, Z., Qing, W., & Li, L. (2017). Evaluating photographic scales of facial pores and diagnostic agreement of tests using latent class models. *Journal of Cosmetic and Laser Therapy*, *19*(1), 64-67. https://doi.org/10.1080/14764172.2016.1247969

Oh, S. H., Lee, Y., Seo, Y. J., Lee, J. H., Yang, J. D., Chung, H. Y., & Cho, B. C. (2012). The potential effect of botulinum toxin type A on human dermal fibroblasts: An in vitro study. *Dermatologic Surgery*, *38*(10), 1689-1694. https://doi.org/10.1111/j.1524-4725.2012.02504.x

Parvar, S. Y., Amani, M., Shafiei, M., Rastaghi, F., Hosseini, S. A., & Ahramiyanpour, N. (2023). The efficacy and adverse effects of treatment options for facial pores: A review article. *Journal of Cosmetic Dermatology*, *22*(3), 763-775. https://doi.org/10.1111/jocd.15502

Rose, A. E., & Goldberg, D. J. (2013). Safety and efficacy of intradermal injection of botulinum toxin for the treatment of oily skin. *Dermatologic Surgery*, 39(3 Pt 1), 443-448. https://doi.org/10.1111/dsu.12097

Sayed, K. S., Hegazy, R., Gawdat, H. I., Abdel Hay, R. M., Ahmed, M. M., Mohammed, F. N., . . . Fahim, A. (2021). The efficacy of intradermal injections of botulinum toxin in the management of enlarged facial pores and seborrhea: A split face-controlled study. *Journal of Dermatological Treatment*, *32*(7), 771-777. https://doi.org/10.1080/09546634.2019.1708241

Shuo, L., Ting, Y., KeLun, W., Rui, Z., Rui, Z., & Hang, W. (2019). Efficacy and possible mechanisms of botulinum toxin treatment of oily skin. *Journal of Cosmetic Dermatology*, *18*(2), 451-457. https://doi.org/10.1111/jocd.12866

Uhoda, E., Piérard-Franchimont, C., Petit, L., & Piérard, G. E. (2005). The conundrum of skin pores in dermocosmetology. *Dermatology*, *210*(1), 3-7. https://doi.org/10.1159/000081474

Vachiramon, V., Chirasuthat, S., Boonpethkaew, S., Sakpuwadol, N., Yongpisarn, T., & Jurairattanaporn, N. (2025). A study of combined onabotulinumtoxin A and hyaluronic acid filler for the treatment of enlarged facial pores. *Toxins*, *17*(1), Article 38. https://doi.org/10.3390/toxins17010038

Wanitphakdeedecha, R., Kaewkes, A., Ungaksornpairote, C., Limsaengurai, S., Panich, U., & Manuskiatti, W. (2019). The effect of botulinum toxin type A in different dilution on the contraction of fibroblast-In vitro study. *Journal of Cosmetic Dermatology*, *18*(5), 1215-1223. https://doi.org/10.1111/jocd.13058