

Prospective Evaluation of Intradermal Botulinum Toxin Type A Microinjections for Sebum Reduction and Acne Improvement in Adults: A Single-Centre Interventional Study

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Abstract

Sebum overproduction is a key factor in acne vulgaris and seborrhea. This prospective, single-center, interventional study evaluated the efficacy and safety of standardized intradermal microinjections of botulinum toxin type A (BoNT-A) in 42 adults with mild-to-moderate facial acne and seborrhea. Participants received 40 - 60 units of onabotulinumtoxin A via microdroplet technique. Outcomes included sebum levels (Sebumeter), acne lesion counts, patient satisfaction (Visual Analogue Scale [VAS] and Global Aesthetic Improvement Scale [GAIS]), and adverse events. After treatment, sebum production was observed to decrease by 47.9% at 4 weeks and 35.2% at 12 weeks ($p < 0.01$). Inflammatory lesions were observed to be reduced by 41.8% and non-inflammatory lesions by 31.3%. Mean VAS satisfaction reached 8.2/10. On the GAIS, 81% ($n = 34$) of patients reported their skin as much improved or very much improved. No serious adverse events occurred. Transient mild effects were uncommon and included mild erythema in 11.9% ($n = 5$), minor bruising in 7.1% ($n = 3$), and temporary forehead tightness in 2.4% ($n = 1$) of participants. Intradermal BoNT-A microinjections were associated with marked reductions in sebum production and acne lesion counts, high patient satisfaction, and an excellent safety profile. Because this was a single-arm study without a concurrent control group, the observed changes cannot be attributed solely to the intervention.

Keywords

Botulinum Toxin Type A, Intradermal Microinjections, Acne Vulgaris, Seborrhoea, Sebum Reduction, Microtoxin, Aesthetic Dermatology

1. Introduction

Acne vulgaris can be considered one of the most frequent chronic inflammatory dermatological conditions among people of any age. Globally, this disorder affects up to 9.4% of all people [1]. Despite the popular assumption that acne primarily occurs during puberty, numerous epidemiologic data show that it can persist throughout adult life or occur for the first time during adulthood. The prolonged disease course poses significant psycho-emotional burdens, namely decreased self-esteem, increased anxiety, depression, social isolation, and reduced quality of life [2] [3]. Moreover, due to its appearance as lesions of the skin, including open and closed comedones, inflammatory papules, pustules, nodules, as well as possible scarring, acne results in cosmetic complications. For this reason, successful management of acne lesions is vital both medically and cosmetically [4].

1.1. Pathogenesis

Acne vulgaris is a multifactorial disease which usually develops according to four main stages: sebum hyperproduction (seborrhoea), hyperkeratinization, colonization of *Cutibacterium acnes* (formerly *Propionibacterium acnes*), and resulting immune-mediated inflammation [2] [5]. In turn, seborrhoea, being the upstream component, plays the key role in causing acne. Namely, hyperactivity of sebaceous glands leads to excessive secretion of sebum creating the lipid-rich environment for follicular clogging, bacteria reproduction, and inflammatory cascade activation. At the same time, seborrhoea itself causes other important aesthetic problems, namely increased oily facial skin, visible pores, uneven skin texture, skin shine, and decreased luminosity [5] [6].

Seborrhoea is not a separate disease but rather a factor which increases the medical significance of acne and worsens its cosmetic impact. Despite the limited number of acne lesions, patients often experience discomfort related to the constant oiliness of their skin and prominent pores. For this reason, the treatment strategies should include sebaceous glands' dysfunction as well as other components of the disease [4] [7]. Standard first-line treatment of acne and seborrhoea includes topical retinoids, benzoyl peroxide, topical and oral antibiotics, hormonal modulators (combined oral contraceptives and spironolactone), and systemic isotretinoin. All these methods result in positive outcomes, although they do not provide full efficacy against seborrhea, are characterized by various side effects, cause local irritation, induce dry skin, promote development of antibiotic resistance, and exhibit high levels of recurrences when interrupted [3] [8]. Notably, there exists a subgroup of patients that experience persistent oily skin despite optimally conducted therapy. Thus, there is a need for supplementary or alternative approaches that could modulate sebum production [7].

1.2. Novel Treatment Approach: Intradermal Administration of Botulinum Toxin Type A (BoNT-A)

Recent developments suggest that intradermal administration of botulinum toxin

type A can be used as an effective therapeutic approach for the treatment of seborrhoea and acne vulgaris. Known as an injectable cosmetic procedure aimed to paralyze muscles of the face, BoNT-A is supposed to lower sebum production through the inhibition of acetylcholine release at nerve terminals connected to sebaceous glands [2] [5]. In this way, BoNT-A acts on a different pathway than antibacterial, comedolytic, or anti-inflammatory mechanisms involved in the development of acne and seborrhoea. Namely, the injection technique that uses micro-droplets does not affect muscle tissue [9] [10].

1.3. Supportive Evidence of Efficacy

Clinical observations and further studies proved the beneficial effect of BoNT-A administration on patients with acne vulgaris and seborrhoea. First, initial reports showed improvements in terms of facial oiliness, decreased pores, and improved skin texture [8]. More reliable information came from randomized and split-face controlled trials where a decrease in the production of sebum was observed, along with a reduction in the number of acne lesions and improved skin condition [10]-[12]. Reviews of off-label uses of BoNT-A suggested the possibility of improvement of skin quality factors, including reduction of sebum secretion and increase in luminosity due to microtoxin technique implementation [4] [6] [13].

However, despite such promising results, there are some limitations in the existing literature. Studies are characterized by the small sample size, relatively short period of follow-up (mostly up to 4 - 12 weeks), heterogeneity of injection technique (diffuse or varying amounts of micro-droplets of the drug), absence of a standard measure of efficacy (sebum level measured with sebumetry devices), and lack of long-term follow-up [7] [10]. In addition, there are issues associated with the inability of BoNT-A to completely eliminate bacterial infection and inflammation and the possible side effects related to the use of this method (e.g. temporary ptosis or asymmetry in expressive areas of the face) [14]-[16]. Since this is an off-label indication, more prospective evidence needs to be collected to integrate it into practice.

1.4. Research Gap and Need

Thus, there is a lack of information concerning the real efficiency and safety of BoNT-A injections for the treatment of seborrhoea and acne vulgaris. It is needed to carry out prospective interventional studies where the standard protocol will be followed (consisting of a particular micro-droplet intradermal technique), objective and subjective criteria will be used for the assessment of outcome (including sebumetry and lesion count, as well as validated scales for patients), sufficient follow-up period will be provided within the pharmacodynamic period, and safety analysis will be conducted. Such a study will give an opportunity to obtain clinically valuable information about the effectiveness of BoNT-A microinjections as the adjunctive procedure.

In order to fill the gap identified above, the current prospective study was de-

signed to evaluate the efficacy and safety of standardized intradermal BoNT-A injections in patients with mild-to-moderate acne vulgaris and seborrhoea. Primary data will be provided concerning objective and subjective changes, including reduced sebum content and acne lesion number and patients' satisfaction, duration of treatment efficacy, and adverse events.

1.5. Aim

The aim of this prospective single-centre interventional study is to examine the efficacy and safety of standardized intradermal botulinum toxin type A microinjections for sebum reduction and improvement of acne vulgaris in adults with concurrent facial seborrhoea.

1.6. Objectives

To estimate objective sebum reduction through sebumetry measurements in pre-post protocol.

To measure changes in inflammatory and non-inflammatory acne lesion counts based on standard assessment and photographs.

To measure patient-reported outcomes using Visual Analogue Scale (VAS) and global aesthetic improvement score.

To record the safety profile and adverse events.

To investigate the duration of BoNT-A effects and its potential role as an adjunctive modality in aesthetic dermatology practice.

2. Materials & Methods

This prospective, single-arm, open-label interventional study evaluated the effectiveness and safety of standardised intradermal injections of botulinum toxin type A (BoNT-A) microinjections for reducing sebum levels and improving acne in adults with acne vulgaris and seborrhoea. The methodological framework was designed to ensure scientific rigor, reproducibility, and clinically relevant outcomes while addressing shortcomings in the existing literature, including the lack of a homogeneous injection technique and non-homogeneous measurements of effectiveness. All methods were performed according to Good Clinical Practice (GCP) Guidelines, the Declaration of Helsinki (as revised in 2013), and all local regulatory requirements.

2.1. Study Design

A prospective, single-centre, single-arm, open-label design using a within-subjects comparison method was employed. This design was chosen to provide clinically relevant results on the effectiveness of the tested procedure while ensuring that each participant served as his or her own control. The single-arm design was justified for this interventional experiment because it minimised the risk of confounding factors and allowed in-depth analysis of temporal changes in participants' status. The study involved one screening visit, one treatment visit at week

0, and three follow-up visits at weeks 4 (peak of effect), 8, and 12.

2.2. Study Setting and Participants

The study was conducted at a specialised aesthetic dermatology clinic in the United Kingdom between March 2025 and December 2025. This setting provided access to standardised photographic equipment in a controlled clinical environment as well as calibrated measuring devices.

Participants were recruited via advertisements posted in the clinic and through patient referrals. Based on effect sizes estimated from previous studies, a minimum required sample size of 42 participants was calculated to achieve 80% power for detecting a 30% reduction in sebum production with $\alpha = 0.05$, while accounting for possible attrition rates of up to 15%.

2.3. Inclusion and Exclusion Criteria

Strict eligibility criteria were applied to ensure participant safety, population homogeneity, and applicability of findings to the target aesthetic dermatology population (Table 1).

Table 1. Inclusion and exclusion criteria.

Criteria Category	Inclusion Criteria	Exclusion Criteria
Demographic	Adults 18 - 45 years; both sexes	Age < 18 or >45 years
Clinical	Mild-to-moderate acne (IGA 2 - 3); facial seborrhea	Severe acne (IGA $\geq$ 4); nodulocystic acne; active infection
Medical History	Willing to discontinue topical acne treatments 2 weeks prior	Isotretinoin use within 6 months; neuromuscular disorders; pregnancy/lactation
Treatment History	No facial BoNT-A within 6 months	Known hypersensitivity to BoNT-A; concurrent systemic acne therapies
Other	Able to provide informed consent; available for follow-up	Significant facial asymmetry; prior facial surgery; inability to comply

All participants underwent comprehensive medical screening, including detailed dermatological examination, medical history review, and assessment of contraindications to BoNT-A.

2.4. Intervention Protocol

BoNT-A (onabotulinumtoxin A) was reconstituted according to manufacturer guidelines at a concentration of 4 units/0.1 mL (100 units diluted in 2.5 mL preservative-free sterile saline). Each microdroplet injection delivered approximately 0.05 - 0.1 mL (2 - 4 units) using a 30 - 32 G needle. The total dose for each participant (within the 40 - 60 units range) was selected according to facial surface area and baseline sebum distribution: participants with smaller facial surface area or milder seborrhoea received 40 - 45 units; those with larger facial surface area or

higher baseline sebum received 50 - 60 units. Dose selection was performed by the treating clinician at the treatment visit using a pre-defined anatomical grid. Injections were performed by a board-certified aesthetic practitioner with extensive experience in neuromodulator techniques under direct supervision.

A total dose of 40 to 60 units per participant was distributed across the forehead, cheeks, and chin using a uniform micro-droplet grid pattern of 2 - 4 units per 2 cm². Superficial intradermal injections were administered at a 30° - 45° angle using 30 - 32 G needles to minimise diffusion to underlying musculature. Precise anatomical mapping was performed to avoid high-risk zones associated with complications such as ptosis or asymmetry (**Table 2**).

Table 2. Injection protocol summary.

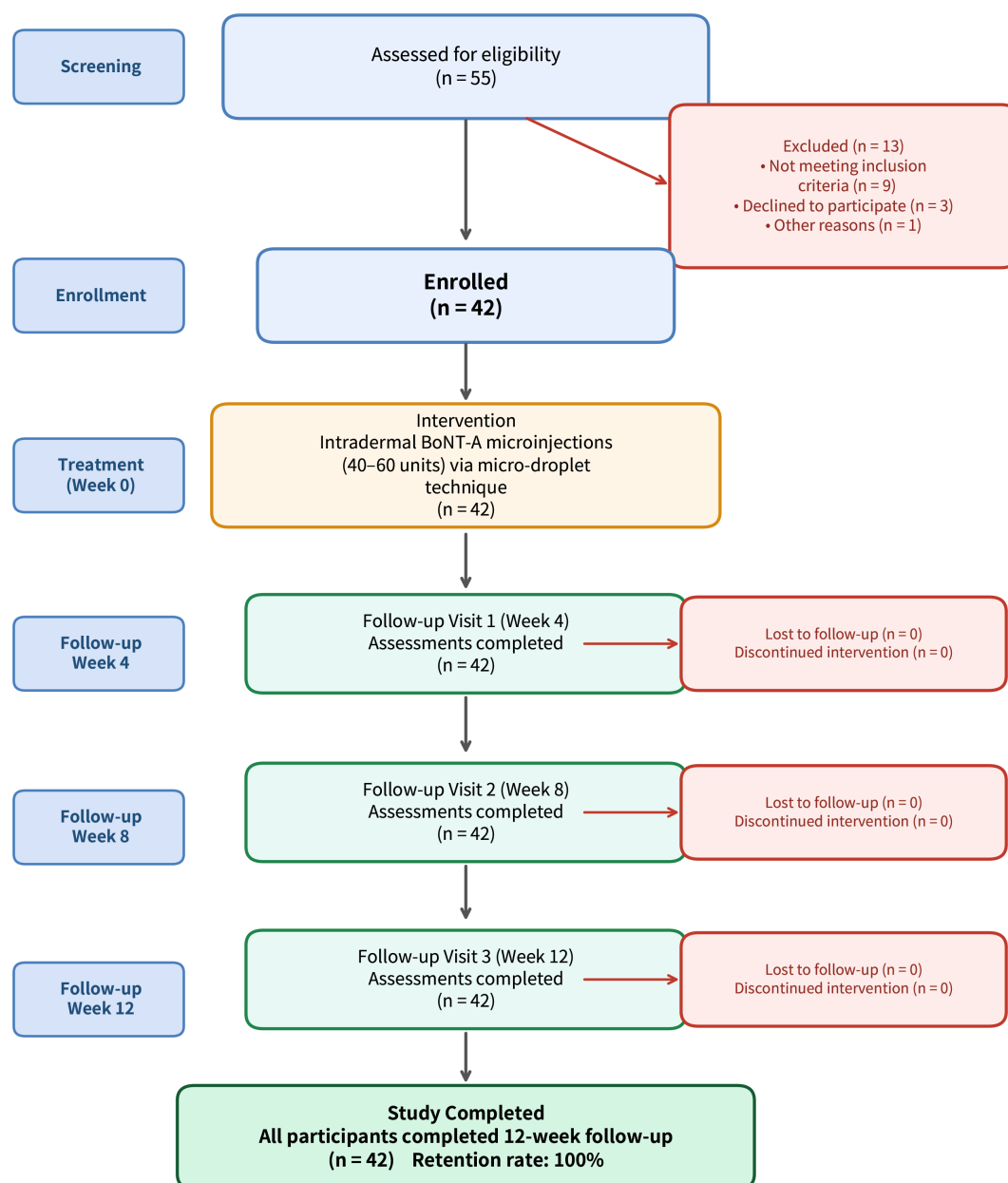
Facial Region	Units per 2 cm ²	Approx. Total Units	Injection Depth	Rationale
Forehead	2 - 3	12 - 18	Intradermal	High sebum density [4]
Cheeks	3 - 4	18 - 24	Superficial dermal	Prominent pore and seborrhoea area [12]
Chin	2 - 3	8 - 12	Intradermal	Targeted sebaceous control

No routine topical anaesthesia was required, although ice packs were offered for patient comfort. Post-treatment instructions included avoidance of strenuous exercise, heat exposure, facial massage, and alcohol consumption for 24 hours (**Figure 1**).

2.5. Outcome Measures

The primary outcome was change in facial sebum secretion, objectively measured using the calibrated Sebumeter SM 815 (Courage + Khazaka, Germany) in arbitrary units (AU) on three specified areas (forehead, right cheek, and left cheek). Prior to each visit, participants were instructed to avoid all topical skin products (including moisturisers, sunscreens and make-up) for at least 4 hours and to refrain from washing the face for at least 2 hours. Upon arrival, participants acclimatised for 20 minutes in a controlled environment (room temperature 20°C - 22°C, relative humidity 40% - 60%). Three consecutive readings were obtained at each of the three sites; the mean of the three readings per site was calculated, and the overall facial sebum value was defined as the arithmetic mean of the three site means. The primary prespecified comparison was the paired change from baseline to week 4 (the anticipated peak-effect time point).

Secondary outcomes included counting of inflammatory lesions (papules and pustules) and non-inflammatory lesions (open and closed comedones), performed manually under standard conditions and assisted by high-definition photographs. Patient-reported outcomes were assessed using a 10-point Visual Analogue Scale (VAS) for satisfaction and the Global Aesthetic Improvement Scale (GAIS). Clinician-based evaluation of skin appearance was performed through



BoNT-A: Botulinum toxin type A.

Figure 1. Study flow diagram.

assessment of photographs, blinded when possible.

Safety outcomes were actively queried and recorded, with specific attention to injection-related reactions, ptosis, asymmetry, bruising, erythema, and systemic manifestations.

2.6. Data Collection and Follow-Up Visits

Baseline measurements were obtained before treatment initiation at week 0. Follow-up examinations were conducted at weeks 4, 8, and 12. Data were collected using standardised electronic case report forms with automated validation and

double data entry.

2.7. Statistical Analysis

All data were statistically analysed using SPSS version 28.0 (IBM Corp., Armonk, NY). Summary measures (mean, standard deviation, frequencies, and percentages) characterised baseline parameters and endpoints. Changes from baseline were assessed using paired Student's t-test for normally distributed data and the paired Wilcoxon signed-rank test for non-parametric distributions. The primary analysis was the paired mean change in overall facial sebum (AU) from baseline to week 4, with a two-sided 95% confidence interval. Repeated-measures analysis of variance (or the Friedman test in cases of non-normal distribution) was employed to evaluate the effect of time on repeated measurements, followed by post-hoc Bonferroni correction. Possible effect modifiers (age, gender, baseline sebum content, and severity of acne) were examined through subgroup analysis. Statistical significance was defined as $p < 0.05$ (two-tailed).

2.8. Ethics Considerations and Approvals

The study was reviewed and approved by the ValMari Aesthetic Education Center Institutional Review Board (approval identifier: VMEC-IRB-2025-003, dated 12 February 2025). The study was conducted in accordance with the ethical principles of the Declaration of Helsinki (2013 revision) and applicable ethical standards for research involving human participants. All participants provided written informed consent before participation and were informed about the study procedures, the off-label use of botulinum toxin type A, potential risks and benefits, and their right to withdraw from the study at any time. Participant confidentiality and anonymity were maintained throughout the study, and study data were handled in accordance with applicable data-protection requirements.

3. Results

Overall, 42 patients participated, received treatment, and were followed up for 12 weeks, providing a 100% retention rate without any drop-outs or loss to follow-up. A high retention rate is a marker of very good adherence to the procedure among study subjects. Demographic and baseline clinical features of the study sample are presented in **Table 3**. The sample comprised 42 adults (female: 73.8%, $n = 31$; male: 26.2%, $n = 11$) with a mean age of 28.4 ± 6.2 years. The vast majority had Fitzpatrick skin types II–IV and Investigator's Global Assessment scores of 2 (mild) and 3 (moderate).

3.1. Primary Outcome: Facial Sebum Production

A rapid, statistically significant, and clinically meaningful reduction in facial sebum production was observed following intradermal BoNT-A microinjections, with effects sustained throughout the 12-week follow-up period. Mean sebum levels, objectively measured using the Sebumeter SM 815, decreased from a baseline

Table 3. Baseline demographic and clinical characteristics of study participants (n = 42).

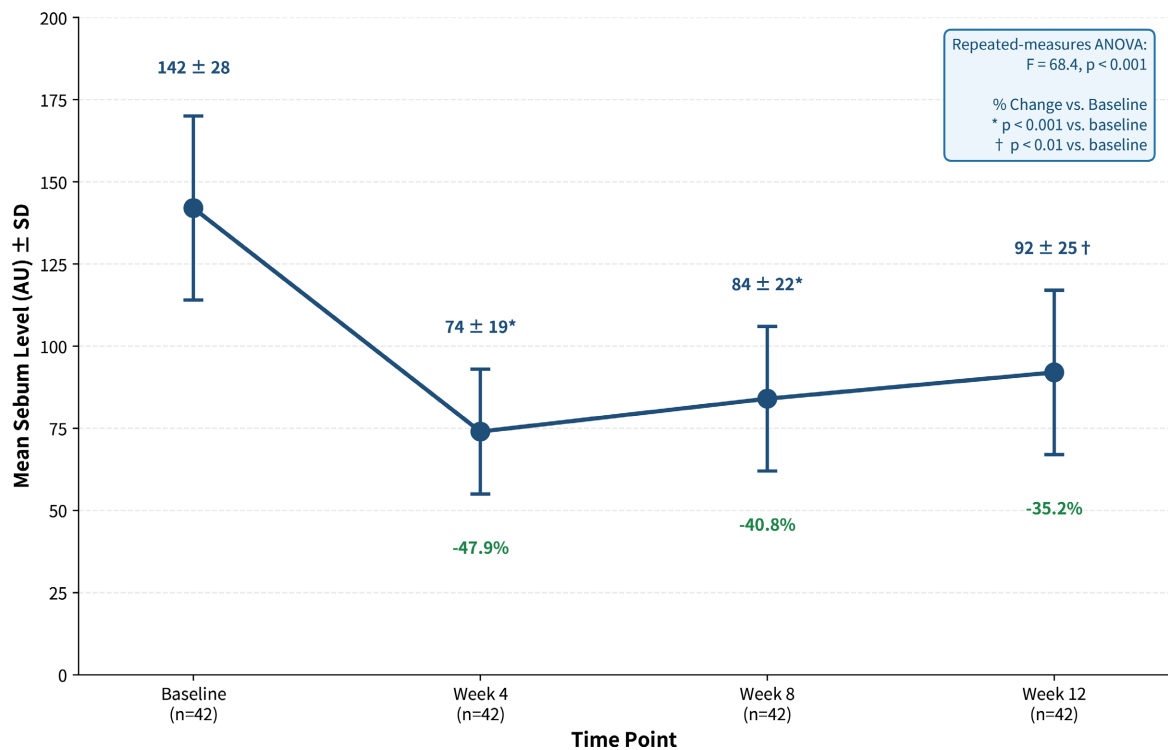
Characteristic	Value
Age (years), mean $\pm$ SD	28.4 $\pm$ 6.2
Sex—Female, n (%)	31 (73.8%)
Sex—Male, n (%)	11 (26.2%)
Fitzpatrick II, n (%)	12 (28.6%)
Fitzpatrick III, n (%)	21 (50.0%)
Fitzpatrick IV, n (%)	9 (21.4%)
IGA 2 (mild), n (%)	19 (45.2%)
IGA 3 (moderate), n (%)	23 (54.8%)
Baseline sebum level (AU), mean $\pm$ SD	142 $\pm$ 28
Inflammatory lesion count, mean $\pm$ SD	18.4 $\pm$ 7.2
Non-inflammatory lesion count, mean $\pm$ SD	24.6 $\pm$ 9.1
Previous topical retinoids, n (%)	28 (66.7%)
Previous benzoyl peroxide, n (%)	19 (45.2%)
Previous oral antibiotics, n (%)	11 (26.2%)

value of 142 ± 28 AU to 74 ± 19 AU at week 4, corresponding to a 47.9% reduction (mean paired change -68 AU, 95% CI -78 to -58 ; $p < 0.001$). Although a gradual partial rebound was noted thereafter, clinically relevant suppression persisted at later time points, with reductions of 40.8% at week 8 (84 ± 22 AU, $p < 0.001$) and 35.2% at week 12 (92 ± 25 AU, $p < 0.01$). Repeated-measures ANOVA demonstrated a highly significant effect of time ($F = 68.4$, $p < 0.001$), and post-hoc Bonferroni-adjusted analyses confirmed that all follow-up measurements differed significantly from baseline.

Regional analysis indicated consistent sebosuppressive effects across all measured facial zones (forehead, right cheek, left cheek), with the most pronounced reduction observed in the cheeks (52% at week 4), followed by the forehead (46%). Chin sebum was also assessed clinically as part of the injection protocol but was not included in the primary Sebumeter composite; exploratory chin readings showed an approximate 38% reduction at week 4, consistent with the overall pattern. This pattern suggests a robust response of sebaceous gland-rich areas to the standardized micro-droplet injection protocol (**Figure 2**).

3.2. Secondary Outcomes: Acne Lesion Counts

Treatment with intradermal BoNT-A was also associated with marked improvements in both inflammatory and non-inflammatory acne lesions. Inflammatory lesion counts (papules and pustules) decreased from a baseline mean of 18.4 ± 7.2 to 13.2 ± 6.1 at week 4 (-28.3% , $p < 0.05$), reaching a maximal reduction of 41.8% at week 8 (10.7 ± 5.1 , $p < 0.01$). At week 12, inflammatory lesions remained



AU = Arbitrary Units (Sebumeter SM 815). Values are mean + standard deviation. * $p < 0.001$ vs. baseline; † $p < 0.01$ vs. baseline (Bonferroni-corrected post-hoc analysis).

Figure 2. Mean facial sebum production over time following intradermal BoNT-A Microinjections.

significantly reduced at 37.5% below baseline (11.5 ± 5.4 , $p < 0.01$), indicating sustained clinical benefit.

Non-inflammatory lesions (open and closed comedones) showed a slower but consistent improvement, with reductions of 19.5% at week 4 (19.8 ± 8.4), 31.3% at week 8 (16.9 ± 7.8 , $p < 0.05$), and 28.0% at week 12 (17.7 ± 8.2) (Table 4).

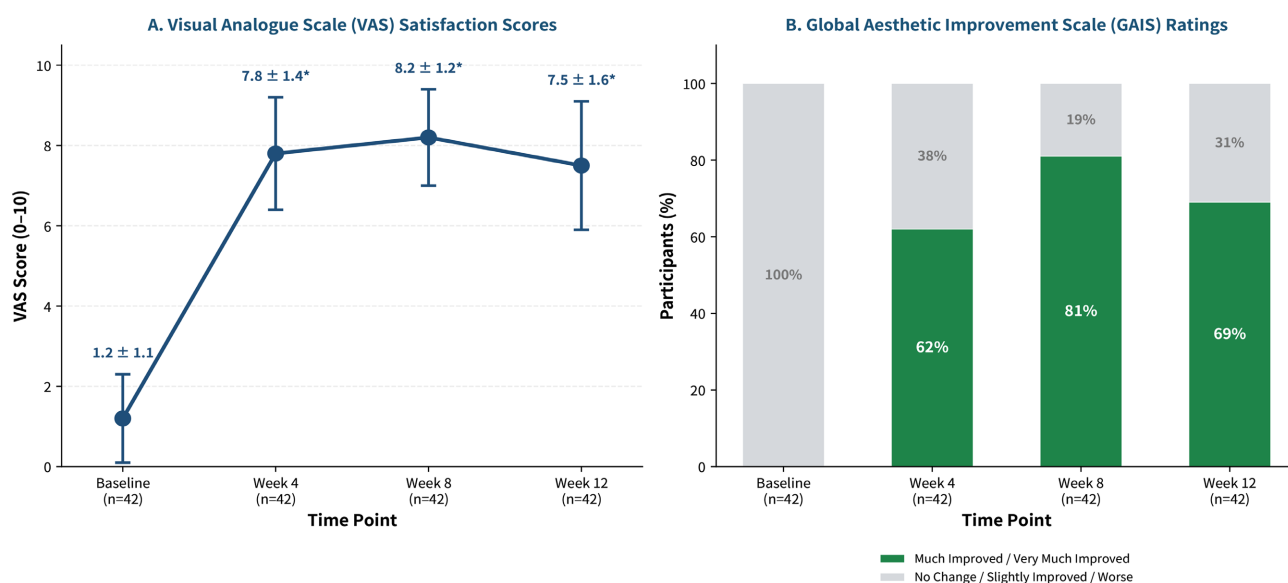
Table 4. Changes in acne lesion counts from baseline.

Time Point	Inflammatory (mean ± SD)	% Change	Non-Inflammatory (mean ± SD)	% Change	p*
Baseline	18.4 ± 7.2	—	24.6 ± 9.1	—	—
Week 4	13.2 ± 6.1	-28.3%	19.8 ± 8.4	-19.5%	<0.05
Week 8	10.7 ± 5.1	-41.8%	16.9 ± 7.8	-31.3%	<0.01/<0.05
Week 12	11.5 ± 5.4	-37.5%	17.7 ± 8.2	-28.0%	<0.01

3.3. Patient-Reported Outcomes and Global Aesthetic Improvement

Satisfaction with the treatment remained high throughout the study period. Mean VAS scores increased to 7.8 ± 1.4 at week 4, reached a maximum of 8.2 ± 1.2 at week 8, and remained elevated at 7.5 ± 1.6 at week 12. On the GAIS, 81% ($n = 34$) of participants reported their skin as “much improved” or “very much improved”

at week 8, with 69% (n = 29) still reporting this level of improvement at week 12. Patient feedback commonly described reduced facial shine, smaller-looking pores, smoother skin texture, and an overall healthier appearance finding that were consistent with the objective improvements in sebum levels and acne lesion counts (Figure 3).



*p < 0.001 vs. baseline (paired t-test with Bonferroni correction). GAIS categories: Very Much Improved/Much Improved/Slightly Improved/No Change/Slightly Improved/Worse/Worse.

Figure 3. Patient satisfaction (VAS) and global aesthetic improvement (GAIS) over time.

3.4. Safety Profile and Adverse Events

The procedure demonstrated an excellent safety and tolerability profile. No serious adverse events occurred during the study. All reported side effects were mild, transient, and resolved spontaneously without treatment. Mild injection-site erythema occurred in 11.9% (n = 5) of participants, minor bruising in 7.1% (n = 3), and temporary forehead tightness in 2.4% (n = 1). All events resolved spontaneously within 3 - 7 days. No cases of ptosis, facial asymmetry, muscle weakness, or systemic complications were observed (0%, n = 0) (Table 5).

Table 5. Summary of adverse events.

Adverse Event	n (%)	Severity	Duration	Resolution
Mild erythema	5 (11.9%)	Mild	1 - 3 days	Spontaneous
Minor bruising	3 (7.1%)	Mild	3 - 7 days	Spontaneous
Forehead tightness	1 (2.4%)	Mild	5 days	Spontaneous
Serious adverse events	0 (0%)	—	—	—

3.5. Subgroup Analyses

Exploratory subgroup analyses indicated a trend toward greater sebum reduction

in participants with higher baseline sebum output (>150 AU) and in female participants compared with males; however, these differences did not achieve statistical significance within the current sample size. Improvements were broadly consistent across Fitzpatrick skin phototypes, age categories, and baseline acne severity (IGA 2 versus IGA 3), suggesting that improvements were observed across the subgroups represented in this study.

Overall, the findings demonstrate that a single session of standardised intradermal BoNT-A microinjections was associated with rapid, marked, and sustained reductions in sebum production and acne lesion counts. These objective improvements were accompanied by high levels of patient satisfaction and a favourable safety profile, with minimal and transient adverse effects in adults presenting with mild-to-moderate acne and facial seborrhoea.

4. Discussion

This single-centre prospective interventional study provides objective evidence that standardised intradermal micro-droplet injections of botulinum toxin type A (BoNT-A) are associated with clinically meaningful and statistically significant reductions in facial sebum production and acne lesion counts in adults with mild-to-moderate acne vulgaris and concomitant seborrhoea. The primary outcome demonstrated a rapid 47.9% reduction in sebum levels at week 4, with sustained suppression of 35.2% at week 12 ($p < 0.01$). These improvements were accompanied by marked reductions in inflammatory lesions (41.8% at week 8) and non-inflammatory lesions (31.3% at week 8), alongside high patient satisfaction (peak mean VAS 8.2/10) and an excellent safety profile characterised only by mild, transient adverse events and no serious complications.

The magnitude and durability of sebum suppression observed are consistent with, and in some respects exceed, findings from earlier studies. Previous randomised and split-face trials have reported significant improvements in acne severity and reductions in seborrhoea and pore size following BoNT-A treatment. The sustained 12-week effect observed here aligns with the known pharmacodynamic profile of onabotulinumtoxinA and supports clinical observations described in earlier work. The standardised micro-droplet technique (40 - 60 units delivered in a uniform grid pattern) likely contributed to consistent regional efficacy, particularly the pronounced reduction in sebaceous activity observed in the cheeks, a region of high gland density.

Mechanistically, these findings support cholinergic modulation of sebaceous gland activity as a key pathway of action. By inhibiting acetylcholine release, BoNT-A appears to downregulate sebaceous hyperactivity, addressing an upstream driver of acne pathogenesis that is not fully targeted by conventional therapies. This mechanism plausibly explains the concurrent improvements in both objective lesion counts and subjective skin quality outcomes such as reduced oiliness, smaller-appearing pores, and smoother texture—features that are often of high importance in aesthetic dermatology. High levels of patient satisfaction further reinforce the

clinical relevance of these cosmetic benefits: 81% ($n = 34$) of participants rated their improvement as “much improved” or “very much improved” on the GAIS at week 8.

The safety findings were highly favourable. No cases of ptosis, facial asymmetry, muscle weakness, or systemic effects were observed (0%, $n = 0$). Mild adverse events such as erythema (11.9%, $n = 5$) and bruising (7.1%, $n = 3$) were infrequent and self-limiting, supporting the importance of superficial intradermal delivery and precise anatomical mapping in minimising risk.

4.1. Strengths and Limitations

This study's strengths include its prospective design, objective primary outcome (Sebumeter measurements), standardised injection protocol, comprehensive assessment combining clinical, instrumental, and patient-reported outcomes, and complete 100% ($n = 42$) follow-up over 12 weeks. However, the absence of a concurrent control group limits causal inference; observed reductions are therefore described as occurring after treatment rather than as established treatment effects. The modest sample size ($n = 42$) and relatively short follow-up restrict conclusions regarding long-term durability, optimal retreatment intervals, and cumulative effects. In addition, the single-centre cohort may limit generalisability to broader populations, including different ethnic groups and more severe acne phenotypes.

4.2. Clinical Implications

These findings support intradermal BoNT-A as a useful adjunctive option for patients seeking rapid improvement in seborrhoea, acne lesions, and overall skin quality, particularly when conventional treatments are insufficient or poorly tolerated. However, it should be viewed as part of a multimodal approach rather than a standalone therapy, given its limited effect on microbial colonisation and deeper inflammatory pathways.

4.3. Future Research Directions

Further large-scale, multicentre, double-blind randomised controlled trials are needed to confirm these findings, optimise dosing and retreatment schedules, and evaluate long-term efficacy and cost-effectiveness. Comparative studies against standard acne therapies, as well as combination protocols and mechanistic investigations using imaging or histology, would further clarify its role in sebaceous gland modulation. Broader population studies across diverse skin types and hormonal acne subgroups are also warranted.

In conclusion, this study provides prospective evidence that standardised intradermal BoNT-A microinjections are associated with safe, effective, and well-tolerated reductions in sebum production and improvements in acne outcomes in adults with mild-to-moderate disease. The findings meaningfully expand the evidence base for neuromodulatory approaches in aesthetic dermatology and sup-

port further rigorous investigation to define their optimal clinical role.

5. Conclusions

Standardised intradermal micro-droplet injections of botulinum toxin type A were followed by meaningful reductions in facial sebum production and acne lesion counts in adults with mild-to-moderate disease and concurrent seborrhoea. The procedure was well tolerated, with only mild and transient adverse effects and no serious complications. High levels of patient satisfaction were observed. Because of the single-arm design, these changes are reported as observations after treatment rather than as definitive causal effects. These findings support the use of intradermal botulinum toxin type A as a useful adjunctive option within a multimodal aesthetic dermatology approach. Larger multicentre randomised controlled trials with longer follow-up are warranted to confirm durability, optimal retreatment intervals, and cost-effectiveness.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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