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Comedone Extraction and Electrodesiccation Added to Topical Adapalene for Comedonal Acne: A Quasi-Experimental Study

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Abstract

Background: Topical retinoids reduce the formation of microcomedones. The addition of procedural removal may speed up their resolution, but whether this provides an additional benefit in terms of safety and side effects has not been assessed.

Objective: To compare comedone extraction and electrodesiccation followed by adapalene 0.1% versus topical adapalene 0.1% alone for comedonal acne.

Methods: Eighty (80) patients aged 16 to 40 years with comedonal acne using a 2-arm, 8-week regimen were enrolled in the study. Forty participants were assigned to combined treatment and 40 to adapalene alone by nonrandom alternating allocation. The primary outcome was percentage reduction in total facial comedone density after 8 weeks. Secondary outcomes included Global Acne Grading System improvement, post-inflammatory hyperpigmentation, scarring, tolerability, and adherence.

Results: All 80 participants completed follow-up. Mean Week 8 reduction was 71.94% (SD=10.62) with combined treatment and 62.67% (SD=13.86) with adapalene alone, Welch t (73.06) = 3.36, p=.001; mean difference = 9.27 percentage points, 95% CI [3.77, 14.78], Hedges' g = 0.74. The treatment-by-time interaction favored combined treatment, F(1.15, 89.87) = 10.23, p=.001. Median GAGS improvement was 6.50 versus 4.00 points, p <.001. Week 8 post-inflammatory hyperpigmentation occurred in 17.5% versus 7.5% and scarring in 5.0% versus 0%; both comparisons were imprecise and nonsignificant.

Conclusion: Patients receiving in-office procedures in addition to topical treatment demonstrated greater improvement in comedonal lesions. However, due to the non-randomized design, safety estimates were imprecise and warrant confirmation in future randomized studies.

Keyword: acne vulgaris; Adapalene; Comedones; Comedone extraction; Electrodesiccation; Quasi-experimental study.

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Introduction

Acne vulgaris represents a chronic disorder of the pilosebaceous unit in which a complex interplay between hyperkeratinization of the follicular infundibulum, retention of sebum, dysbiosis of the bacterial flora, and inflammation plays an important role.[1-4] Microcomedones are precursor lesions to all forms of acne. However, unimpeded progression leads to comedones (open and closed), inflammation, and

subsequent postinflammatory pigmentation, textural changes, and scarring.[3-6] Therefore, adherence to treatment for early disease control along with prevention of lesion development is paramount.

Topical retinoids are cornerstone therapy because they normalize follicular keratinization and prevent microcomedone formation; adapalene is generally better tolerated than earlier topical retinoids.[7-10] Their clinical response is gradual, however, and early irritation can undermine adherence.[7,10]

Given these limitations, procedural treatment may provide more rapid lesion clearance. Manual extraction evacuates open comedones, whereas light electrodesiccation creates a superficial opening for persistent closed comedones. A randomized clinical trial found greater lesion-count reduction with extraction than with oral doxycycline in moderate acne.[11] Recent split-face trials found meaningful comedone reduction with procedural treatment,[12,13] while contemporary reviews emphasize the variable evidence base and transient local reactions associated with physical modalities.[14,15] No previous study has evaluated combined extraction and electrodesiccation alongside ongoing adapalene against adapalene alone in parallel patient groups.

The balance between faster clearance and procedural harm is especially important in darker skin phototypes, in which even modest trauma or inflammation may cause persistent post-inflammatory hyperpigmentation (PIH).[10,16-19] Preventing scarring and limiting avoidable procedural injury are also important early-treatment goals.[20,21] Accordingly, this prospective, assessor-blinded, two-group quasi-experimental study compared comedone extraction and light electrodesiccation added to adapalene 0.1% with adapalene 0.1% alone. We hypothesized that the combined regimen would produce a greater reduction in total facial comedones by Week 8. Secondary outcomes were changes in facial Global Acne Grading System (GAGS) score, PIH, scarring, tolerability, and adherence.

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Methods

This prospective, single-center, assessor-blinded, two-group quasi-experimental study was conducted in the dermatology outpatient department of CIMS, Bahawalpur, Pakistan. Consecutive patients were enrolled from January 6 to April 29, 2026; Week 8 follow-up ended June 24, 2026.

Patients aged 16–40 years of any sex were eligible if they had predominantly comedonal facial acne, defined as at least 20 open or closed facial comedones, no nodules or cysts, and no more than 10 inflammatory papules or pustules. They also agreed to avoid other acne treatments and attend the Week 4 and Week 8 visits.

Exclusion criteria were inflammatory, nodulocystic, conglobate, drug-induced, or occupational acne; active facial infection or dermatitis; scarring that impaired lesion counting; recent isotretinoin, antibiotics, topical acne treatment, or facial procedures; pregnancy, lactation, or planned pregnancy; keloidal tendency, bleeding risk, an implanted pacemaker or defibrillator, immunosuppression, uncontrolled diabetes, delayed wound healing, relevant hypersensitivity, or inability to complete follow-up.

Consecutive eligible participants were enrolled until the sample reached 80 and were assigned nonrandomly by alternating allocation to combined treatment or adapalene alone (40 per group). Participants and the treating dermatologist were unmasked; a blinded assessor completed follow-up lesion counts and facial GAGS assessments from coded records.

At baseline and Week 4, the combined-treatment group underwent extraction of accessible open comedones and light electrodessication of resistant closed

comedones after topical lidocaine/prilocaine anesthesia and antiseptic preparation. A sterile extractor was used for open lesions, and a fine electrode (Hyfrecator 2000, low mode, 2.0 W) was applied briefly to create a superficial opening. One dermatologist performed all procedures. Adapalene 0.1% gel began 48 hours after each procedure and was applied nightly through Week 8, except on procedure nights.

The comparator group applied adapalene 0.1% gel nightly for 8 weeks. Both groups received the same advice on gentle cleansing, moisturizer, and broad-spectrum sunscreen. Application frequency could be reduced temporarily for clinically important irritation; other acne treatments and manual lesion manipulation were prohibited. Adherence was assessed using diaries, structured interviews, and returned tubes.

At baseline, a trained assessor mapped the forehead, cheeks, and chin bilaterally. Open and closed comedones were counted separately through a transparent 1-cm² grid; total density was their sum divided by the mapped area. The same area was evaluated at each visit, and frontal and oblique photographs were obtained under standardized conditions.

The primary outcome was the percentage reduction in total facial comedone density from baseline to Week 8: [(baseline density − Week 8 density)/baseline density] × 100. Secondary efficacy outcomes were density at Weeks 4 and 8 and change in facial GAGS score.

Safety outcomes included graded redness, burning, dryness or scaling, and crusting; treatment-related infection; new PIH; and new scarring. Adapalene-frequency reduction and adherence were prespecified tolerability and implementation outcomes.

A sample of 80 (40 per group) provided approximately 80% power in G*Power 3.1 for a two-sided independent-group test at α=.05 to detect a standardized mean difference of 0.64. This conservative effect was selected because no study had evaluated the complete regimen.

Continuous variables were summarized as mean (SD) or median (IQR), and categorical variables as n (%). Baseline characteristics were described without significance testing. The primary endpoint was compared using Welch's independent-samples *t* test because variances were unequal; results were reported as the mean difference, 95% CI, and Hedges' g. A Mann–Whitney test assessed robustness. A repeated-measures model assessed group, time, and group-by-time effects on density, with Greenhouse–Geisser correction when required. An exploratory ANCOVA assessed whether the Week 8 group difference varied with baseline density.

GAGS change and ordinal tolerability scores were compared using Mann–Whitney tests, binary outcomes using Fisher's exact tests and risk ratios, and adherence using Welch's *t* test. Tests were two-sided (α=.05); exploratory secondary analyses were not adjusted for multiplicity. All 80 participants had complete outcomes and were analyzed. Because assignment was nonrandom, estimates were interpreted as associations. Analyses were performed in Python 3.12.

The protocol was approved by the Department of Dermatology, CIMS Bahawalpur. Adults provided written informed consent; minors provided assent with parental or guardian consent. Coded identifiers were used for analysis, and separate written consent was obtained for publication of de-identified clinical photographs.

Results

All 80 consecutively enrolled participants entered their assigned group (40 per group), received treatment, and completed Week 8. No outcome data were missing.

The groups were broadly similar at baseline **(Table 1)**. Median age was 26.0 years (IQR = 20.0–30.0) with combined treatment and 22.5 years (IQR = 20.0–28.0) with adapalene alone. Mean comedone density was 3.28 (SD=0.67) and 3.44 (SD=1.05) comedones/cm², respectively; median facial GAGS score was 10.0 in

Table 1 Baseline Characteristics by Treatment Group

Characteristic	*Combined + adapalene; (n = 40)*	*Adapalene only (n = 40)*
Age, years	26.00 [20.00, 30.00]	22.50 [20.00, 28.00]
Female sex	23 (57.5%)	26 (65.0%)
Male sex	15 (37.5%)	14 (35.0%)
Other sex category	2 (5.0%)	0 (0.0%)
Urban residence	27 (67.5%)	23 (57.5%)
Acne duration, months	22.68 (11.15)	23.52 (11.36)
Previous acne treatment	24 (60.0%)	26 (65.0%)
Fitzpatrick type III	7 (17.5%)	7 (17.5%)
Fitzpatrick type IV	20 (50.0%)	13 (32.5%)
Fitzpatrick type V	11 (27.5%)	19 (47.5%)
Fitzpatrick type VI	2 (5.0%)	1 (2.5%)
Assessed facial area, cm²	20.00 [20.00, 25.00]	20.00 [20.00, 25.00]
Open comedones, count	25.20 (7.29)	24.52 (6.71)
Closed comedones, count	41.42 (6.38)	44.42 (10.17)
Total comedones, count	66.62 (10.20)	68.95 (13.93)
Total density, comedones/cm²	3.28 (0.67)	3.44 (1.05)
Facial GAGS subtotal	10.00 [10.00, 12.00]	10.00 [9.00, 11.00]

Note. Values are mean (SD), median [Q1, Q3], or n (%). GAGS = Global Acne Grading System. Baseline significance tests are intentionally omitted; clinical balance should be judged from the distributions.

both groups. Sixty-six participants (82.5%) had Fitzpatrick skin types IV–VI.

At Week 8, mean comedone-density reduction was 71.94% (SD=10.62) with combined treatment and 62.67% (SD=13.86) with adapalene alone **(Table 2; Figure 1)**. The mean difference was 9.27 percentage points (95% CI, 3.77–14.78), Welch t (73.06) = 3.36, p=.001; Hedges' g=0.74. The Mann–Whitney sensitivity analysis was concordant (p = .004).

Comedone density decreased in both groups **(Table 3)**, from 3.28 at baseline to 0.91 at Week 8 with combined treatment and from 3.44 to 1.33 with adapalene alone. The group-by-time interaction favored combined treatment, F(1.15, 89.87) = 10.23, p = .001.

The exploratory ANCOVA showed a baseline-density-by-group interaction (p=.010): the estimated Week 8

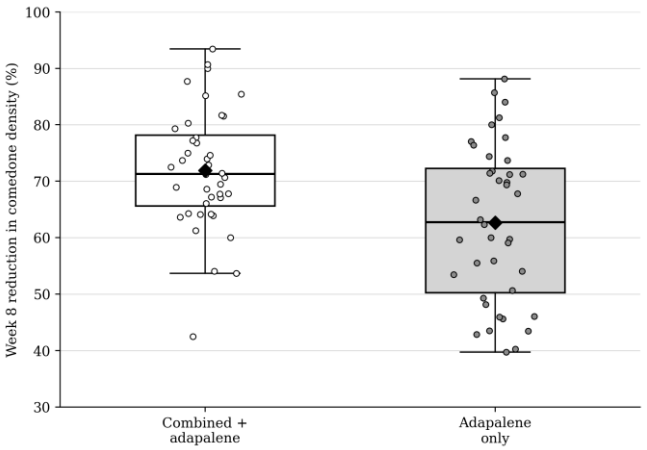

Figure 1 Distribution of Week 8 Percentage Reduction in Comedone Density.

group difference was larger at higher baseline density. This finding was not prespecified and was interpreted cautiously.

Facial GAGS improvement was greater with combined treatment (median, 6.50; IQR, 5.75–7.00) than with adapalene alone (median, 4.00; IQR, 3.75–5.00), U = 1387.00, p < .001 **(Table 2)**.

At Week 8, new PIH occurred in 7 of 40 combined-treatment participants (17.5%) and 3 of 40 adapalene

Table 2 Primary and Secondary Efficacy Outcomes at Week 8.

Outcome	*Combined + adapalene*	*Adapalene only*	*Between-group effect [95% CI]*	*P Value*
Week 8 density reduction, %	71.94 (10.62)	62.67 (13.86)	MD = 9.27 [3.77, 14.78]	.001
Week 8 density, comedones/cm²	0.91 (0.39)	1.33 (0.75)	Descriptive; ANCOVA interaction present	-
Facial GAGS improvement	6.50 [5.75, 7.00]	4.00 [3.75, 5.00]	U = 1387.00; rrb = .734	< .001
Overall adherence, %	92.64 (3.73)	89.86 (5.31)	MD = 2.77 [0.73, 4.82]	.009

Note. Values are mean (SD) or median [Q1, Q3]. The primary analysis used Welch's t test. Hedges' g for the primary endpoint was 0.74, 95% bootstrap CI [0.33, 1.24]. The common-slope ANCOVA estimate for Week 8 density was not interpreted because the baseline-density-by-group interaction was significant. MD = mean difference; GAGS = Global Acne Grading System; rrb = rank-biserial correlation; em dash = not applicable.

Table 3 Total Facial Comedone Density Across Study Visits

Treatment group	*Visit*	*Mean (SD), comedones/cm²*	*95% CI for mean*
Combined + adapalene	Baseline	3.277 (0.666)	[3.064, 3.490]
	Week 4	1.639 (0.432)	[1.501, 1.778]
	Week 8	0.914 (0.390)	[0.790, 1.039]
Adapalene only	Baseline	3.438 (1.052)	[3.101, 3.774]
	Week 4	2.283 (0.910)	[1.992, 2.574]
	Week 8	1.331 (0.752)	[1.090, 1.571]

Note. Greenhouse–Geisser-corrected repeated-measures results: time, $F(1.15, 89.87) = 891.26$, $p < .001$, partial $\eta^2 = .920$; group × time, $F(1.15, 89.87) = 10.23$, $p = .001$, partial $\eta^2 = .116$; group, $F(1, 78) = 7.03$, $p = .010$, partial $\eta^2 = .083$.

only participants (7.5%); RR = 2.33 (95% CI, 0.65–8.39), p=.311 **(Table 4)**. Two participants in the combined group developed small atrophic scars, compared with none in the adapalene-only group (p=.494). Two mild localized infections after combined treatment at Week 4 resolved with antiseptic care.

At Week 4, burning (p=.009) and crusting (p<.001) were greater with combined treatment; other tolerability comparisons are shown in **Table 5**. Mean adherence was 92.64% (SD = 3.73) versus 89.86% (SD=5.31), a difference of 2.77 percentage points (95% CI, 0.73–4.82; p = .009). Temporary adapalene-frequency reduction occurred in 17.5% versus 42.5% (RR = 0.41; 95% CI, 0.19–0.88; p=.027).

Discussion

Adding comedone extraction and light electrodesiccation to adapalene 0.1% was associated with a 9.27-percentage-point greater reduction in facial comedone density at 8 weeks than adapalene alone. The longitudinal interaction and greater GAGS improvement supported the same direction of association. Because allocation was nonrandom and predictable, however, the observed difference cannot be attributed solely to the procedures.

The clinical pattern is plausible because the treatments address different components of comedone persistence. Adapalene normalizes follicular keratinization and limits microcomedone formation,[7-10] whereas extraction removes open lesions and superficial electrodesiccation facilitates evacuation of resistant closed lesions.[11-14] Current acne guidance strongly supports topical retinoids,[7-10] but the present findings do not establish pharmacologic–procedural synergy.

Table 4 Binary Safety and Treatment-Modification Outcomes.

Outcome	*Combined + adapalene*	*Adapalene only*	*Risk ratio [95% CI]*	*Fisher p*
New PIH at Week 8	7/40 (17.5%)	3/40 (7.5%)	2.33 [0.65, 8.39]	.311
New scar at Week 8	2/40 (5.0%)	0/40 (0.0%)	5.00 [0.25, 100.97]	.494
Localized infection at Week 4	2/40 (5.0%)	0/40 (0.0%)	5.00 [0.25, 100.97]	.494
Infection at Week 8	0/40 (0.0%)	0/40 (0.0%)	Not estimable	1.000
Adapalene frequency reduced at Week 8	7/40 (17.5%)	17/40 (42.5%)	0.41 [0.19, 0.88]	.027

Note. PIH = post-inflammatory hyperpigmentation. A 0.5 continuity correction was used only to display risk ratios when a zero cell was present; Fisher exact p values are uncorrected. The two Week 4 infections were mild, treated with antiseptic care, and resolved before Week 8.

Table 5 Local Tolerability Scores by Visit.

Visit	*Symptom*	*Combined + adapalene*	*Adapalene only*	*U*	*P value*
Week 4	Redness	1.00 [1.00, 2.00]	1.00 [0.00, 1.00]	918.5	.208
	Burning	1.00 [1.00, 1.00]	0.50 [0.00, 1.00]	1040.0	.009
	Dryness/scaling	1.00 [0.00, 1.00]	1.00 [1.00, 1.00]	717.0	.368
	Crusting	1.00 [0.00, 1.00]	0.00 [0.00, 0.25]	1205.0	< .001
Week 8	Redness	1.00 [0.00, 1.00]	0.00 [0.00, 1.00]	933.0	.149
	Burning	0.00 [0.00, 1.00]	1.00 [0.00, 1.00]	620.5	.047
	Dryness/scaling	1.00 [0.00, 1.00]	1.00 [0.00, 1.00]	674.5	.195
	Crusting	0.00 [0.00, 0.00]	0.00 [0.00, 0.00]	900.0	.134

Note. Values are median [Q1, Q3]. Severity scale: 0 = none, 1 = mild, 2 = moderate, 3 = severe. Comparisons are exploratory and were not adjusted for multiplicity.

The results are consistent with, but not directly equivalent to, earlier procedural studies. Sitohang *et al*.[11] reported greater lesion-count reduction with extraction than with oral doxycycline in moderate acne; however, their inflammatory-acne population and active comparator differ from those in the present study. Yang *et al*.[13] reported a 46.36% reduction after four extraction sessions in a randomized split-face trial, whereas the combined-treatment arm in the present study achieved a 71.94% reduction at 8 weeks. The difference in magnitude may reflect concomitant adapalene, lesion distribution, treatment schedule, or study design and should not be interpreted as evidence of superiority across studies.

Bencharattanaphakhi *et al*.[12] likewise demonstrated comedone improvement in a split-face procedural trial while specifically addressing post-extraction erythema with pulsed-dye laser. Their safety focus is relevant to the transient increase in burning and crusting observed after the Week 4 procedure in our study.[15] Together, these studies support procedural activity against comedones while showing that early local reactions remain an important clinical tradeoff.

Possible delayed harm also deserves attention. PIH and scarring were numerically more frequent with combined treatment, and two localized infections followed procedures. These findings are especially relevant because 82.5% of participants had Fitzpatrick skin types IV–VI, in whom inflammation may produce persistent dyspigmentation.[10,16-19] The small number of events and wide confidence intervals mean that nonsignificant comparisons do not demonstrate equivalent safety.

The findings therefore support selective rather than routine procedural augmentation. Conservative technique, sterile practice, careful lesion selection, barrier support, sunscreen, and counseling about PIH and scarring are essential.[7,16,19,20] The exploratory ANCOVA suggested a larger association at higher baseline density, but that interaction was not prespecified and should not be used to select patients until it is confirmed prospectively.

Strengths included prospective collection, consecutive recruitment, blinded assessment, standardized mapped-area counting, uniform skin-care advice, and complete follow-up. Limitations included nonrandom alternating allocation, a single center, a small sample, 8-week follow-up, absence of a screening log and sham procedure, lack of independent photographic grading, and inadequate power for uncommon harms. Pain, satisfaction, quality of life, cost, and recurrence were not measured. A multicenter randomized trial with concealed allocation, standardized photography, patient-reported outcomes, and 6–12 months of follow-up is needed to determine whether faster clearance outweighs procedural harm.

Results

In this quasi-experimental comparison, comedone extraction and light electrodesiccation added to topical adapalene 0.1% were associated with greater 8-week reductions in facial comedone density and facial GAGS than adapalene alone. The comparative signal was consistent across primary, longitudinal, and rank-based analyses.

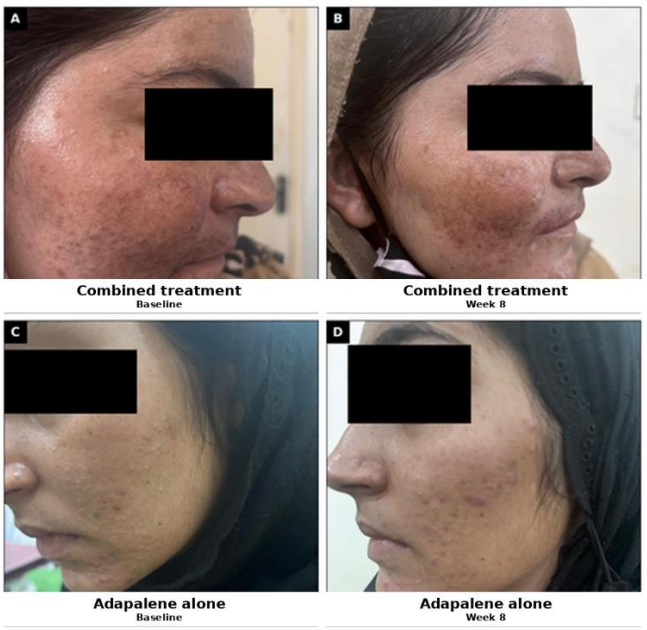

Figure 2 Representative clinical photographs showing a marked reduction in comedonal lesions from baseline (A) to Week 8 (B) with combined treatment, compared with slight or no visible reduction from baseline (C) to Week 8 (D) with adapalene alone.

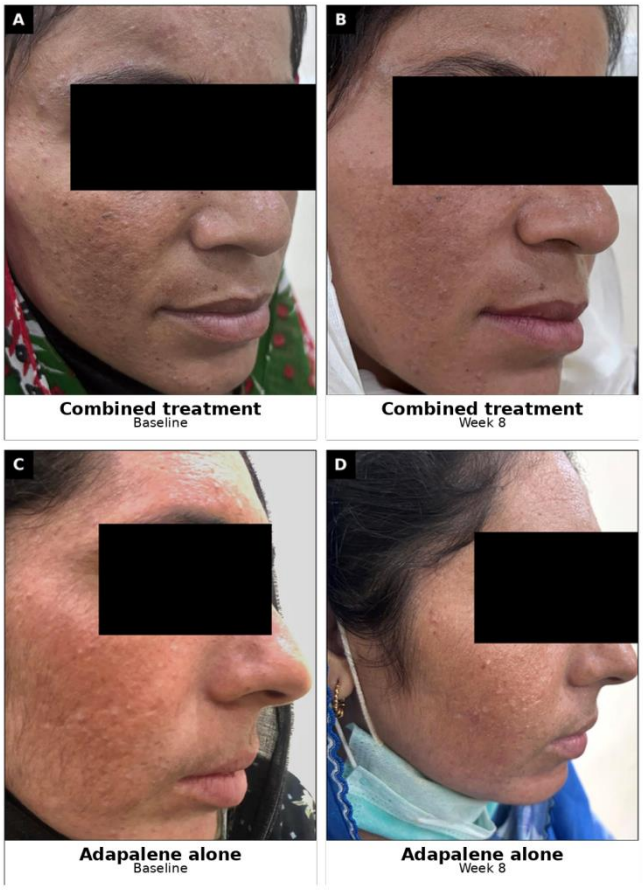

Figure 3 Additional clinical photographs showing a marked reduction in comedonal lesions from baseline (A) to Week 8 (B) with combined treatment, compared with slight or no visible reduction from baseline (C) to Week 8 (D) with adapalene alone.

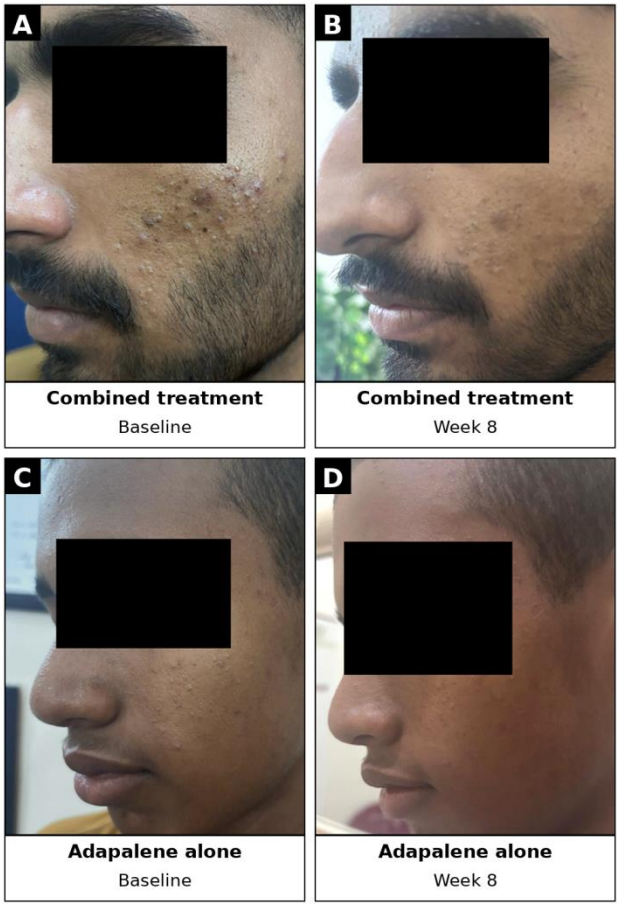

Figure 4 Additional clinical photographs showing a marked reduction in comedonal lesions from baseline (A) to Week 8 (B) with combined treatment, compared with slight or no visible reduction from baseline (C) to Week 8 (D) with adapalene alone.

However, nonrandom group assignment limits causal inference, and the numerically higher frequencies of PIH and scarring in the combined group were estimated imprecisely. The regimen warrants rigorous randomized evaluation before its comparative safety or routine clinical role can be established.

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