

The efficacy of intense pulse light among patients with skin type III-IV in acute facial acne: The Malaysian experience

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ABSTRACT

Twenty-seven adult patients, skin type III -V with mild to moderate acne, were recruited. IPL at wavelengths range of 420 - 600nm with triple pulses was administered every two weeks for a total of 3 sessions. Assessment of acne severity and improvement of treatment was based on Global Acne Grading System (GAGS), scoring before and after treatment for each session and patient satisfaction's using a 5-item Likert scale range at the end of session three.

Results: Of the 27 patients, 77.8% were female. Their ages group ranged from 18 to 35 years, and all patients had skin type III or IV. There were 14 mild acne patients and 13 moderate ones. There was a statistically significant improvement in mean acne severity score from 18.1 ± 4.3 at baseline to 14.3 ± 4.6 after two weeks post-IPL and 12.3 ± 4.9 after four weeks post-IPL. The result on satisfaction level of patients showed 'satisfied' in 3 patients, "very satisfied" in 5 patients; and, half of the patients (11) answered "fair" at the end of the study. Most patients tolerated well the procedure, and only 5 patients developed either post-inflammatory hyperpigmentation or skin hyperpigmentation.

Conclusion: The IPL of wavelength of 400-600nm offers effective, safe, and well-tolerated treatment of mild to moderate acne lesions in Malaysians with skin types III-IV. The majority of subjects had a fair score on treatment satisfaction. It is recommended that reasonable expectations for clinical results be addressed with patients before hands to prevent over-expectation.

KEYWORDS:

Intense pulse light; acne; Malaysian, Fitzpatrick skin type III-IV

INTRODUCTION

Acne is a well-known inflammatory disease of the pilosebaceous units that affect adolescents more often than adults. The two acne lesions are non-inflammatory acne lesions (closed comedones, open comedones) and inflammatory acne lesions (papules, pustules, nodules, and cysts). The disease predominantly affects the areas of skin with a large number of sebaceous glands, including the face, neck, chest, and back. Acne pathogenesis is now thought to

be triggered by inflammatory pathways caused by factors such as genetic predisposition, diet, sebaceous gland involvement, inflammatory mediators, and their target receptors, as well as Propionibacterium acnes proliferation.¹⁻² Depending on its severity, different methods of treatments have been suggested, and one of the methods is to use treatment with intense pulsed light therapy (IPL).

When a chromophore (melanin, red blood cells, and water) on our skin is exposed to the light of a specific wavelength or colour, it absorbs the energy and self-destructs, resulting from the enormous heat produced by the absorbed energy.³ IPL is a light source with polychromatic (all visible colour or all visible wavelength from 400nm to 700nm), non-coherent, and non-collimated light waves that spread out as they pass. IPL (400–1200 nm) is thought to disrupt sebaceous gland function by causing direct phototoxic and thermal damages⁴ and bactericidal effects on P. acnes by inducing reactive free radicals.^{4,5} Porphyrins such as coproporphyrin III and protoporphyrin IX formed by P. acnes within sebaceous follicles absorb light wavelengths between 400 and 700nm, with the 415nm wavelength in the blue light spectrum being most effectively absorbed.^{5,7} Blue light, on the other hand, has inadequate penetration depth into the skin. Red light, which is longer wavelengths such as 660nm, can, in addition to its deeper penetration, have anti-inflammatory properties by influencing cytokines released from macrophages.⁸ IPL was also effective in treating inflammatory acne in darker-skinned patients as a monotherapy, with reduced side effects and better patient compliance.⁹ There are currently no proven guidelines for the number of sessions necessary for IPL acne treatment, and the majority of studies used three treatment sessions at two-week intervals.^{10,11} Though IPL is effective in treating acne in people in other countries, no research has yet been done in Malaysia on its effects. As a result, this research was aimed to establish the efficacy of IPL as a monotherapy in treating acne in Malaysians.

MATERIALS AND METHODS

Study design and population

This prospective open-label study was conducted from September 2020 to October 2020. The study obtained ethical approval from the Research Ethics Committee of MAHSA

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University (code: RMC/EC36/2020). All participants were recruited through convenient sampling from MAHSA Avenue Clinic, Petaling Jaya, Malaysia. This clinic provides medical services to all its students, staff, and community nearby, consisting of a multi-ethnic population. Adolescent and middle-aged women are the main populations who come to this clinic for getting treatment, especially skin conditions.

Using the reported IPL effectiveness by Patidar MV et al. (2016) and Faul F et al. (2007) as a reference, the largest sample size required to detect a difference between matched sample population (level of significance (α) of 0.01, power of 95% with mean + standard deviation of 24.1 and 20.5), was 15. Considering a 50% possible dropout rate, a total of 31 adult patients aged 18 – 45 years with mild to moderate acne skin type III -V (Fitzpatrick classification) were invited to participate in the study. Patients were excluded from the study if they had severe acne, pregnant, taking oral isotretinoin, immunocompromised patients, receiving light & laser therapies within the last three months, or any acne & cosmetic treatments within the previous six months. During the recruitment, patients were given explanation about the study and their rights. Patients were informed that they would receive the intervention at no cost. Upon agreement to participate, they were asked to sign the informed consent form to allow their demographic information and photos to be used in this study.

Measuring tools

The Global Acne Grading System (GAGS) was used in this study as a subjective tool for assessing the severity of acne based on the presence or absence of inflammation and the degree of involvement.¹² The GAGS, a reliable¹³ tool of assessment, considers six areas of the face and chest/upper back with a factor at each area based on the surface area, distribution, and density of pilosebaceous units (Figure 1). The hairline, jawline, and ears define the boundaries of the face. The six areas were graded separately depending on the type of lesion as the following: no lesion =0, one comedone = 1, papule=2, one pustule = 3, one nodule = 4. The lesion score then was multiplied by the factors area, which performs as the weightage score to produce the local scores for each face area. The sum of local scores gives the global score of between 0 and 52 (Table I).

Two well-trained researchers, AI and SK evaluated the severity of acne lesions, who received a 2-hour training on acne assessment and GAGS scoring in all sessions. Both researchers scored the acne lesions independently and gave a global scoring. If the acne severity global score between two researchers had a difference of more than 10%, a consensus was achieved through a discussion. Facial photos of the acne area were taken upon consented by the patients (five angles) at the baseline (week 0) and final follow-up (week 4).

The patient satisfaction throughout the IPL treatment was conducted using a self-administered survey. At the end of the session, patients were asked to score their satisfaction with the treatment provided using a 5-item Likert scale ranging between very disappointed to very satisfied.

The IPL procedure

All patients in this study received three sessions of IPL at baseline (week 0), week 2 and week 4. The three sessions of the two-week interval were utilized in this study following the procedure reported in previous studies.^{14,15} The same intervention procedures were provided in all three sessions. During the intervention, appropriate goggles were worn by both the patients and clinicians. A cut-off filter of 420-600nm was used. Test shots were performed on the forearm of patients, and the maximum tolerated dose was selected. The procedure was continued when there was no adverse effect, such as erythema observed after 3-5 minutes. According to the skin type of patients, a range of fluence 10 to 15J/cm² with triple pulses was used, in which higher fluence was used for fairer skin type III to IV. Lower fluence was used for darker skin type V. Treatment areas were applied with clear ultrasound gel (approximately 1-2 mm thickness). Two overlap shots of IPL were administered once over each acne lesion. To avoid treating the unwanted area, a wooden spatula was used to cover part of the IPL handpiece tip. The immediate endpoint was observed as mild erythema. Post-procedure, the patient was advised to protect from the sun and to never pick scabs, if they appear. Moisturiser was applied over the treated site immediately after the procedure in all patients, followed by sunscreen (>SPF 35). Post-procedure side effects such as erythema, blistering, scarring, hypopigmentation, or hyperpigmentation were noted and treated with topical steroid-antibiotic cream. Patients received the same procedure in the second and third sessions with a degree of improvement, assessed using GAGS, were conducted for every session.

Data Analysis

The demographic characteristics of the patients, such as age, gender, ethnicity, and satisfaction towards the treatment, were analyzed and presented as a number, percentage, mean and standard deviation where appropriate. The scoring for pre and post-treatment of IPL was done using the Global Acne Grading System (GAGS) and analyzed using paired t-test. A p-value of < 0.05 was considered significant. Satisfaction of patients towards the treatment was assessed using patient subjective responses at the end of the follow-up visit using questionnaires that rated satisfaction.

RESULTS

A total of 31 patients were recruited, with 27 agreeing to take part in the study. The mean age \pm standard deviation (SD) of patients is 20.5 \pm 3.6 (range between 18 and 35). There were a total of 19 Malay and 12 Indian patients in this study. The majority of the respondents were females (n=21, 77.8%) and had Fitzpatrick's skin type III (n=16) followed by type IV (n = 11).

During the baseline visit, a total of 14 patients had mild acne condition of score between 1-18 and 13 had moderate acne condition of score between 19-30. The mean baseline acne severity score according to GAGS was 18.1 \pm 4.3. There was a significant difference in terms of acne severity score pre-intervention (mean = 18.1, SD 4.3) and two weeks post-intervention (mean = 14.3, SD = 4.6) with t-value (26) = 5.2, p < 0.0001. A significant difference was also noted between

Table I: The Global Acne Grading System (GAGS)

Area	Factor	Most severe lesion score*	Local score
Forehead	2		
Right cheek	2		
Left cheek	2		
Nose	1		
Chin	1		
Chest and upper back	3		
GLOBAL SCORE			

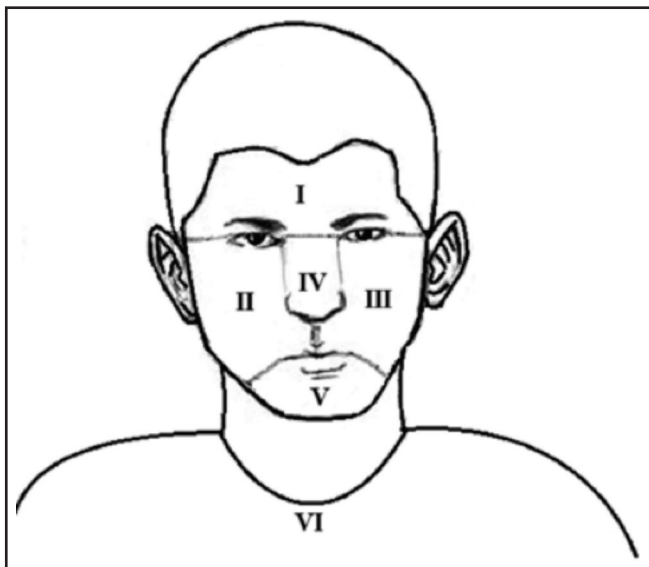


Fig. 1: Visual representation of GAGS scoring for acne.



Fig. 2: A 20-year-old male showing clearance of pustules following three sessions of IPL.

pre-intervention (mean = 18.1, SD 4.3) and four weeks post-intervention (mean = 12.3, SD 4.9) with t-value (22) = 6.8, $p < 0.0001$. For the acne score between week 2 (mean = 14.3, SD = 4.6) and week 4 post-intervention (mean = 12.3, SD 4.9) the results also showed to be significantly different with t-value (22) = 2.4, $p = 0.03$. According to our subgroup analysis, patients with mild acne improved significantly after four

weeks of treatment (pre-intervention: mean = 14.5, SD 2.7; post four weeks intervention: mean = 10.4, SD 3.9) with t-value (11) = 3.1, $p = 0.01$. Similarly, significant improvement was also observed among patients with moderate acne post 4 weeks of the intervention (pre-intervention: mean = 21.5, SD 2.7; post four weeks intervention: mean = 14.2, SD 4.9) with t-value (12) = 7.07, $p < 0.01$. When the effectiveness of IPL was

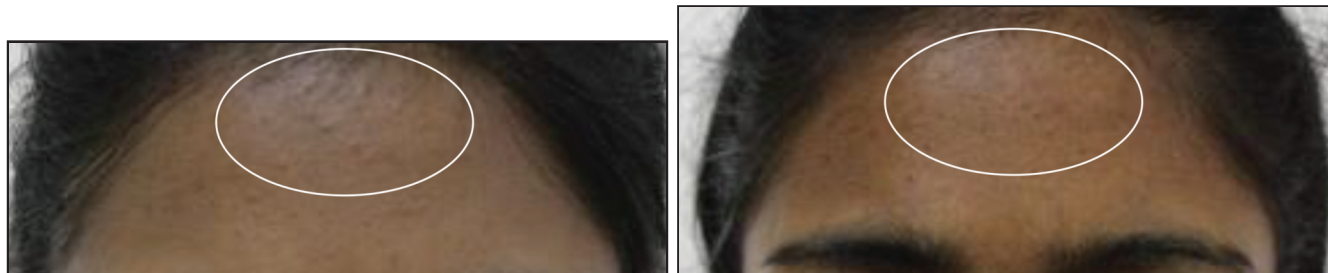


Fig. 3: A 21-year-old female showing a reducing number of papules following three sessions of IPL.



Fig. 4: A 22-year-old female showing post-inflammatory hyperpigmentation following IPL.



Fig. 5: A 21-year-old female of Fitzpatrick skin type IV showing skin hyperpigmentation following IPL.

evaluated against the demographic information and ages of patient's there was no significant association with the changes of acne severity score pre-and post-intervention ($r_s = -0.06577$, $p\text{-value} = 0.77$). No significant difference in IPL effectiveness was found between males and females ($t = 0.56$, $p = 0.57$) and Malay and Indian patients ($t = -0.89$, $p = 0.38$). After three sessions of IPL therapy, 81% of patients showed improvement in acne lesions, as shown in Figures 2 and 3. Nonetheless, 2 weeks after IPL, 18% ($n = 5$) of patients had

side effects such as post-inflammatory hyperpigmentation (PIH) and hyperpigmentation, as seen in Figures 4 and 5. In those who developed PIH and hyperpigmentation following IPL, downtime varied from one to two weeks, although it usually took longer for complete resolution of the lesion.

The mean score of satisfaction of patients upon completion of the treatment is 3.4 ± 0.9 of the total score of 5. Three patients were very satisfied at the end of treatment; 5 were

satisfied, 11 were fair, one was disappointed and very disappointed with their treatment. Six patients did not fill in their satisfaction evaluation form at the end of the study.

DISCUSSION

In this study, the mean age of our patients was 20.5 + 3.6, and the majority of them were females. Most of our patients had Fitzpatrick skin type III, where half of them had mild acne and the other half have moderate acne. Based on demographic data, patient ages, and gender, there was no significant effect of IPL has been reported.

A few known methods like topical regimens and systemic acne therapies are scientifically proven and widely accepted as an effective treatment for acne. Nevertheless, their level of effectiveness and satisfaction with the treatment given are varied. IPL may be an alternative treatment option when topical or systemic therapies either had not been effective, were contraindicated, or are not preferred by the patients. The photothermal activity of IPL at wavelengths of 400-420nm helps minimize active acne lesions and new lesions by heating the sebaceous gland and photochemical inactivation.^{3,5} This mechanism supports our finding that IPL therapy showed better therapeutic effects for moderate acne patients than mild acne patients. Generally, mild acne is due to the formation of comedones (blackheads or whiteheads). At the same time, the growth of bacteria such as *P. acnes* remained relatively limited compared to the case of moderate acne. Hence, IPL therapy is more effective for moderate acne cases, which the prominent cause is the formation and growth of Cutibacterium colonies and inflammation.^{3,5} The study conducted by Mathew et al. also showed that IPL is an effective treatment for acne-induced post-inflammatory erythema (PIE) in Fitzpatrick's skin type III and type IV.¹⁶

IPL can be delivered by splitting the energy into two, three, or four pulses with different pulse delays, which allow the skin to be cooled between pulses, thus preventing adverse effects. Kumaresan et al. compared burst-pulse and single pulse mode of IPL and found that burst-pulse mode had a better result in clearing acne than the single-pulse mode.⁴ Patients with darker skin types are more likely to have hyperpigmentation and skin burning post-IPL.^{4,17} Our study used a range of fluence 10 to 15J/cm² with triple pulses to minimize the risk of skin burning, erythema, and PIH. However, five (18 percent) of our patients with Fitzpatrick skin type III-IV experienced skin burning and PIH despite using sub-pulses mode with longer pulse width and off-time between 20ms to > 30ms. Our results were consistent with the research conducted by Mathew et al. and Kawana et al., who noticed that Fitzpatrick skin type III - V was more likely to have an adverse effect.^{16,17} However, Patidar et al. found that both normal(35J/cm²) and subnormal fluence(20J/cm²) were equally effective in reducing side effects. None of their patients experienced hyperpigmentation and scarring following IPL.¹⁸

IPL for acne treatment is not without complications, and recent studies have shown that it induces more side effects and complications in patients with skin types III-V.^{17,16} According to our study, five patients with skin type IV

experienced side effects. This may be one reason why most of our patients were moderately satisfied with the free IPL treatment given. Other causes could include the differing perceptions of patients and/or higher expectations of clinical outcomes, resulting in a reasonable degree of satisfaction with the treatment. Six patients failed to turn up for their final assessment visit, by which time the survey was expected to be handed out. Patients may not have shown up for the last visit evaluation due to concerns about the COVID-19 disease outbreak, which hit countries near the end of the study.

CONCLUSION

The intense pulse light therapy of wavelength of 400-600nm offers effective, safe, and well-tolerated treatment of mild to moderate acne lesions with skin types III-IV. It may be an attractive option for treating acute facial acne, with a low risk of side effects in the Malaysian population. The majority of subjects responded noting a fair score on treatment satisfaction. In order to prevent over-expectation by patients, it is recommended that this be addressed with patients before hand.

LIMITATIONS

The main limitation of this study is a short-term follow-up period because of the COVID-19 outbreak. We should extend the study by six to twelve weeks to collect more data on the recurrence rate of facial acne and patient satisfaction.

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CONFLICTS OF INTEREST

The authors have nothing to disclose.

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