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**Original Article**

# Comparison of single versus burst-pulse mode in IPL in patients with acne vulgaris

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## Abstract

***Background*** Acne vulgaris is a very frequently occurring disease in adolescence and adulthood. The coalescence of adverse impacts of systemic and topical anti acne treatments, antimicrobial resistance and inclination for high tech strategies has led to a new interest in light based acne treatment. Intense pulsed light (IPL) has been utilized to treat facial acne. Data on local population is not available that compares single versus burst-pulse mode in IPL in acne vulgaris patients.

***Objective*** To compare the outcomes of single versus burst-pulse mode in IPL in patients having acne vulgaris.

***Methods*** A Randomized controlled trail was conducted at the Department of dermatology, Sir Ganga Ram Hospital Lahore. 300 Patients were randomly split up into two groups (150 each). In group-A burst-pulse mode was used to treat the patients, and in group-B the patients were managed with single-pulse mode. Forearm was selected to apply the test dose with IPL, and the most endurable dosage was chosen. Acne global severity scale was calculated at baseline and after completion of four sessions. Percentage improvement in acne global severity scale was calculated.

***Results*** The mean age of cases was 29.86±9.62 years. Overall there were 72(24%) male and 228(76%) female cases. The mean Acne global severity scale at baseline was 3.10±0.83 in Single pulse mode and 3.07±0.87 in Burst-pulse mode with no significant difference. The mean Acne global severity scale at 4th week was 1.58±0.50 and 1.39±0.75 with significantly lower score and Burst-Pulse mode, p-value < 0.05. The mean percentage improvement in single pulse mode was 49.56±16.41% and in Burst-Pulse mode was 63±18.98 %. The mean percentage improvement in Burst –pulse mode was significantly higher than single pulse mode, p-value < 0.001.

***Conclusion*** As per findings of the study, it is concluded that at 4th week percentage improvement was significantly higher in burst-pulse mode in IPL as compared to single-pulse mode in patients with acne vulgaris. So, using Burst-pulse mode can achieve early recovery and can reduce the severity of the disease. Combining IPL with systemic and topical medications can improve the effectiveness of this treatment.

***Key words***
Acne vulgaris, Intense pulsed light, single-pulse mode, burst-pulse mode, Acne global severity scale, percentage improvement.

## Introduction

Androgen-induced elevated production of sebum, changed keratinisation, inflammation, and bacterial colonisation of hair follicles on the neck, face, chest, and back by *Propionibacterium acnes* results in acne vulgaris, a chronic inflammatory disease of the pilosebaceous unit.[1] The prevalence of acne

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vulgaris stays 85%[2,3] of adolescents and often continuing into later adulthood.[2,4] Aside from financial impacts, there are also psychological effects that can influence the sufferers' self-esteem and social isolation.[3,5,6] This composite disease is caused by the inflammatory and non-inflammatory components, which include blackheads, whiteheads, cysts, papules and nodules.[5,7,8]

Mixed results are reported by conventional treatments with antimicrobial agents and retinoids and can be perplexed by antimicrobial resistance and unfavorable treatment plans.[2] Thus, latest therapeutic techniques like light-based therapy have been introduced to cater the demand for acne treatment.[2,9] A range of narrowband light derivations, intense pulsed light, lasers, and photodynamic therapy (PDT) have been developed.[10] Management with aforementioned light sources may result in betterments in inflammatory acne and scarring caused by acne, with increased finite advantages for non-inflammatory acne.[2,10]

We are seeing more and more patients who are responding well to the latest advances in acne treatment.[11] Management for acne vulgaris is becoming more dependent on lasers and light sources.[10] In addition, the effectiveness of these gadgets might have been improved with the utilization of intense pulsed light.[12] There are two different modes for IPL functioning i.e. single- and burst-pulse modes. The fluence is administered in a one time go in the single-pulse mode, whereas fluence is split up and applied into rounds of pulses with a gap betwixt the pulses in burst-pulse mode.[11] A study in 2010 revealed that mean severity score at baseline was 22.4 and 27 while after 4 weeks it was 13.4 and 11.7 in single and burst pulse mode, respectively. Mean percentage improvement in curtailment of acne severity score was 40.17% in single pulse mode while 56.66% in burst pulse mode.[11] An Indian study reported that there was 49.19% curtailment in the mean total Michelsons acne severity index after four sessions of IPL. Better results were observed in the burst-pulse mode treated side.[13]

The rationale of this study was to compare the single- and burst-pulse mode in IPL in patients with acne vulgaris, as no local study is available and international data is also limited on this comparison. Acne vulgaris is very common in our population and despite different traditional therapeutic plans readily obtainable, a lot of sufferers are not able to have good control on acne. In this study, facial acne was treated with IPL using single and burst mode. This study helped us to know which mode is better so that in future it would be easy to choose the best mode to gain early recovery and to reduce the severity of the disease.

## Materials and Methods

A randomized controlled trial was conducted at Department of dermatology, Sir Ganga Ram Hospital Lahore. A total of 300 patients (150 in each single-pulse and burst-pulse mode groups) meeting the inclusion criteria were taken in this study. The sample size was calculated using percentage improvement in terms of reduction in single pulse mode as 40.17% and 56.66% in burst pulse mode.[11] The study included patients aged 18-60 years of either gender having acne vulgaris of grade 1 to 4. Patients who were pregnant, breastfeeding, taking oral or topical anti-acne treatment, who have likelihood to have scarring, and with previous history of sensitivity to light were not included in the study. An informed consent was taken and patients were split up in two groups in random way using lottery method. In group A, burst-pulse mode patients were treated with burst-pulse mode, and in group B, the patients were treated with single-pulse mode. To avoid bias, whole procedure was

conducted by a single dermatologist with experience of more than 5 years after post-graduation. Forearm was selected to apply the test dose with IPL, and the most endurable dosage was chosen. 1J was the starting dose which was under the most endurable dose and differed from patient to patient. The least fluence used for the management on the face was 15J, while 21J was the highest utilized fluence. Cutoff filters of 420nm were utilized in the current study. The procedure was administered once every week for four consecutive weeks. The fluence was gradually raised in every sitting. Acne global severity scale was calculated at baseline and after four sessions. Digital photographs was captured before the start of the treatment and after completion of four sessions for differentiation. Percentage improvement acne global severity scale was calculated.

Quantitative data was described using Mean and standard deviation and qualitative data using Frequency and percentage. Mean percentage reduction in acne severity score was compared using independent sample t-test. Data was stratified for age, gender, baseline severity score and duration of disease to rule out the effect modifiers. P-value less than 0.05 was taken as significant value after applying t-test to see difference among stratified groups and percentage improvements were calculated respectively.

## Results

A total of 300 patients were included in the study (150 in each group). The mean age of cases was 29.86±9.62 years. Overall there were 72(24%) male and 228(76%) female cases. The mean duration of disease in single and Burst-pulse mode was 4.59±2.90 and 5.35±3.26 months respectively. Baseline characteristics of study respondents in each group are given in **Table 1**.

Comparison between baseline and at 4$^{th}$ week mean Acne global severity scale is given in **Table 2**. Means of single Pulse mode and burst pulse mode were compared at baseline and there was not statistically significant difference in the mean Acne global severity scale at baseline. But comparison after 4 weeks resulted in significant variation in mean scores, $p<0.05$. The mean percentage improvement in single pulse mode was 49.56±16.41% and in Burst-Pulse mode was 63±18.98%. The mean percentage improvement in Burst –pulse mode was significantly higher than single pulse mode, p-value<0.001.

When data was stratified for age, gender, and duration was disease, mean percentage improvement was significantly higher in Burst-pulse mode in each stratum.

**Table 1** Baseline characteristics of study participants (N=300).

| *Parameters* | | *Single pulse mode (N=150)* | *Burst pulse mode (N=150)* |
|---|---|---|---|
| Age* (years) | | 29.19±9.33 | 30.53±9.89 |
| Gender* | Male | 35 (23.3%) | 37 (24.7%) |
| | Female | 115 (76.7%) | 113 (75.3%) |
| Duration of disease* (months) | | 4.59±2.90 | 5.35±3.26 |

* Continuous data is given as mean±standard deviation while discrete data as number and percentage.

**Table 2** Comparison between baseline and at 4$^{th}$ week mean acne global severity scale.

| *Parameters* | *Single-Pulse Mode* | *Burst-Pulse Mode* | *p-value* |
|---|---|---|---|
| Mean Acne Global Severity Scale at baseline | 3.10±0.83 | 3.07±0.87 | 0.760* |
| Mean Acne Global Severity Scale at 4$^{th}$ week | 1.58±0.50 | 1.39±0.75 | 0.013* |
| Mean Percentage Improvement | 49.56±16.41% | 63±18.98 % | < 0.001* |

* Independent sample t-test was used to calculate the result and p value<0.05 is considered statistically significant.

**Table 3** Comparison of mean percentage improvement at 4th weeks in both groups with respect to age groups, gender, duration of disease, and acne global severity scale.

| *Parameters* | | *Single-pulse mode* | *Burst-pulse mode* | *p-value* |
|---|---|---|---|---|
| Age (years) | 18-40 | 49.30±16.70 | 62.40±18.64 | <0.001* |
| | 41-60 | 51.32±14.50 | 65.52±20.50 | 0.012* |
| Gender | Male | 49.76±17.44 | 64.86±20.98 | 0.001* |
| | Female | 49.49±16.16 | 62.39±18.34 | <0.001* |
| Duration of disease (months) | 1-6 | 48.92±16.39 | 61.17±19.12 | <0.001* |
| | >6 | 52.47±16.48 | 67.02±18.22 | 0.001* |
| Acne global severity scale (baseline) | 1-2 | 55.56±15.94 | 58.89±19.33 | 0.408* |
| | 3-4 | 47.66±16.16 | 64.76±18.64 | <0.001* |

* Independent sample t-test was used to calculate the result and p Value <0.05 is considered statistically significant.

But when data was stratified for baseline acne global severity scale the mean percentage improvement was statically same in cases that had score 1-2 but percentage improvement was significantly higher in Burst-pulse mode in 3-4 baseline acne global severity scale, as shown in **Table 3**.

## Discussion

There are many options for treatments of acne vulgaris either medical or interventional.[8,14] Medical management of acne vulgaris encompasses systemic and topical antimicrobial agents in particular doxycyclines and erythromycin, topical retinoic acid, systemic isotretinoin, and systemic antiandrogen drugs.[15] Topical retinoids, topical antimicrobial drugs and systemic antibiotics are still the first line of treatment for acne vulgaris. At least a 6-month course of medical therapy should be considered before change to another line of therapy. Many interventional options for treatment of acne are also readily available such as chemical peeling, crystals micro-peeling, IPL, laser therapy and others.[15,16]

Acne vulgaris is being treated with IPL in different countries of Asia with favourable outcomes.[17,18] Technology of IPL includes implementation of filtered flash lamp source administered to the skin.[19] IPL utilizes blue light that is absorbed by the P. acnesporphyrins causing their photoexcitation. This results in the formation of Reactive Oxygen Species within the bacteria itself, which results in turn in its selective demolition.[20]

A study conducted by Elman *et al*. reported that 85% of the individuals treated with IPL had more than 50% betterment in their acne vulgaris disease after having therapy twice a week for four consecutive weeks.[21] A study in 2010 revealed that mean severity score at baseline was 22.4 and 27 while after 4 weeks it was 13.4 and 11.7 in single and burst pulse mode, respectively. Mean percentage improvement in curtailment of acne severity score was 40.17% in single pulse mode while 56.66% in burst pulse mode.[20] In current study the mean percentage improvement in single pulse mode was 49.56±16.41% and in Burst-Pulse mode was 63±18.98%. The mean percentage improvement in Burst –pulse mode was significantly higher than single pulse mode, p-value<0.001.

Another study reported that statistically significant curtailments in the inflammatory and non-inflammatory abrasions count were noticed (p=0.0024), for both single and burst-pulse therapies. There was no significant variation observed in the effectiveness of these two different methods in decreasing the inflammatory and non-inflammatory abrasions quantity from the starting point of the treatment to the 5th week (p=0.76 and p=0.61, respectively). Also, there was no significant difference observed in the acuteness of acne of

the two methods at 5th week visit on the basis of acne global severity scale (p=0.26).[22] This finding is not in agreement to the statistics of the current study.

Furthermore as a result of a comparative study, conducted to compare single-pulse and burst-pulse mode in the management of acne, it was reported that monotherapy with IPL was done in 10 patients with facial acne. Michelsons acne severity index was used for grading of acne at baseline; however, separate scoring was done for both sides of the face and a composite score was also calculated. A total of four sessions of IPL were conducted, once every week. Burst-pulse mode was administered on the right side, and single-pulse mode on the left side of the face. At the end of the treatment, Severity score was analyzed. The main result of the study has revealed that all patients showed a decrease in the amount and severity of acne for both modes. At baseline, the average composite score was 49.4 and demonstrated a total of 49.19% curtailment after four sessions of IPL. Better results were observed in the burst-pulse mode treated side. Hence it can be concluded that beneficial effects were obtained by using IPL as a single therapy in facial acne's management.[20]

## Conclusion

As per findings of the study, it is concluded that at 4th week percentage improvement was significantly higher in burst-pulse mode in IPL as compared to single-pulse mode in patients with acne vulgaris. Using Burst-pulse mode can attain early and fast recovery and can reduce the severity of the disease. Integrating IPL with systemic and topical medications can improve the effectiveness of this treatment.

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