Received: 15 April 2020 | Revised: 1 May 2020 | Accepted: 6 May 2020

DOI: 10.1111/jocd.13480

ORIGINAL CONTRIBUTION

JCD Journal of Cosmetic Dermatology | WILEY

650 usec 1064nm Nd:YAG laser treatment of acne: A double-blind randomized control study

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Funding information
Skin Laser and Surgery Specialists of NY & NJ received funding from Aerolase for this study.

Abstract

Background: A variety of energy-based devices have been used to treat acne. However, all studies have been subjective and have not involved double-blind and randomized controlled studies.

Aims: We undertook a randomized controlled study evaluating the use of a 650 usec 1064 nm Nd:YAG laser compared with a sham in the treatment of acne.

Patients/Methods: A total of 20 subjects with moderate-to-severe acne were randomized to receive either 650 usec 1064nm Nd:YAG laser or sham treatment. All subjects received 3 treatments, two weeks apart, plus an additional session undertaken 4 weeks after the 3rd treatment. Subjects were evaluated for investigator global improvement, improvement in inflammatory lesions, improvement in comedonal lesions, total porphyrin score, and total sebum score.

Results: The laser-treated group showed an Investigator's Global Assessment Scale (IGA) improvement of 26% compared with 7% for the sham group (a 271% improvement over sham treatment group). The treatment group also showed a decrease in the number of inflammatory lesions of 42% compared with 26% in the sham group (a 62% improvement over sham). The laser-treated cohort also experienced a reduction in total number of comedones similar to that seen with inflammatory lesions and a decrease in total porphyrin score. There was also an 18% reduction in sebum production in the treated group, compared with 9% in the sham group (a 100% improvement).

Conclusion: This is the first study that has compared laser treatment of acne compared with a sham treatment. A 650 usec 1064nm Nd:YAG laser can effectively treat acne.

KEYWORDS
acne, laser, Nd:YAG

1 | INTRODUCTION

Acne vulgaris is one of the most common conditions treated by dermatologists.[1] The pathogenesis of acne is multifactorial. Epidermal hyperproliferation and excess sebum production result in blockage of the pilosebaceous units. This is followed by increased proliferation and activity of commensal skin bacteria *Propionibacterium acnes*, resulting in subsequent inflammation.[2,3] Moderate acne is traditionally treated with topical cleansers, retinoids, and antibiotics. Moderate-to-severe acne may sometimes require additional treatment with systemic antibiotics or retinoids.[4] Treatments can often be irritating, unsatisfactory, and the chronic exacerbations and remissions throughout adolescence and adulthood can have a major impact on patient quality of life.[5,6] Devices and lasers are often employed as an adjunctive treatment for acne and acne scarring. Common treatments include chemical peels, nonablative radiofrequency,

and microneedling with radiofrequency.[7-11] Studies have reported some efficacy of laser treatment.[12-16] Laser therapy can be successful in diminishing acne vulgaris lesions by halting overactive sebaceous gland activity and alleviating the effects of inflammation. The mechanism of action is thought to be by activation of porphyrins produced by *Propionibacterium acnes*, resulting in destruction of cell membranes of these bacteria. Lasers with a 1064 nm wavelength have been studied for acne. One study done by Ballin and Ubelhoer treated one patient with 10 sessions of a laser with 1064-nm Nd:YAG and resulted in almost 100% clearance of lesions.[17] Another study compared intense-pulsed light with 1064-nm Nd:YAG and found no significant difference in the treatment of acne.[18]

Typical Nd:YAG 1064nm lasers operate with longer pulse durations anywhere from 3 to 30 milliseconds. The laser used in this study has a 650 microsecond pulse duration. This is a new technology where all necessary power settings from 4 J/cm^2 to 255 J/cm^2 can be delivered within a 650-microsecond pulse in a variety of spot sizes and at a fast repetition rate of up to 2.0 Hz. A total of 650 microseconds is below the thermal relaxation time of the skin tissue, so the skin has time to cool itself between pulses, thus

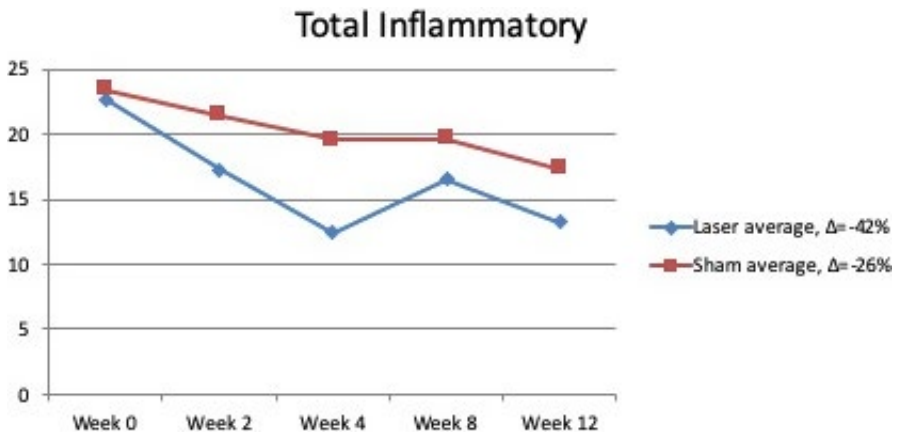


FIGURE 1 Total inflammatory lesion count

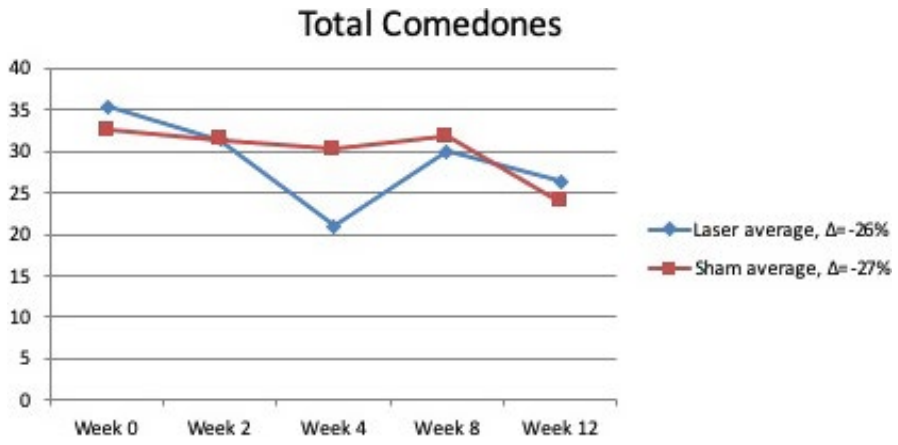


FIGURE 2 Total comedone lesion count

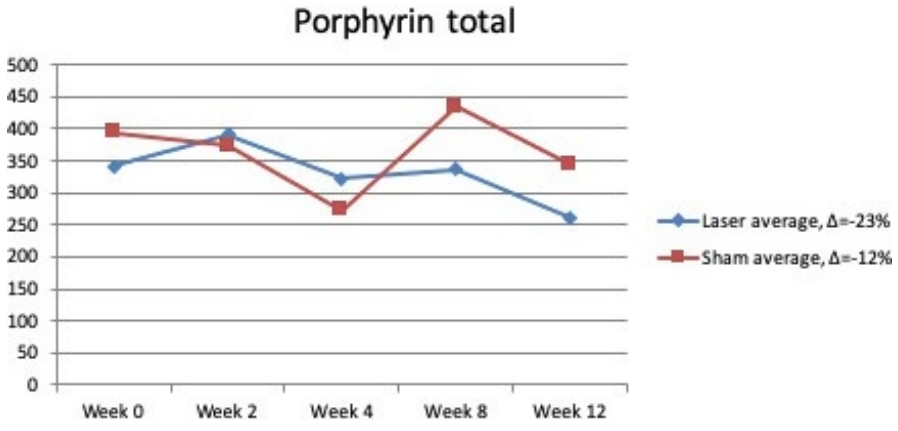


FIGURE 3 Total porphyrins

FIGURE 4 Sebometer readings

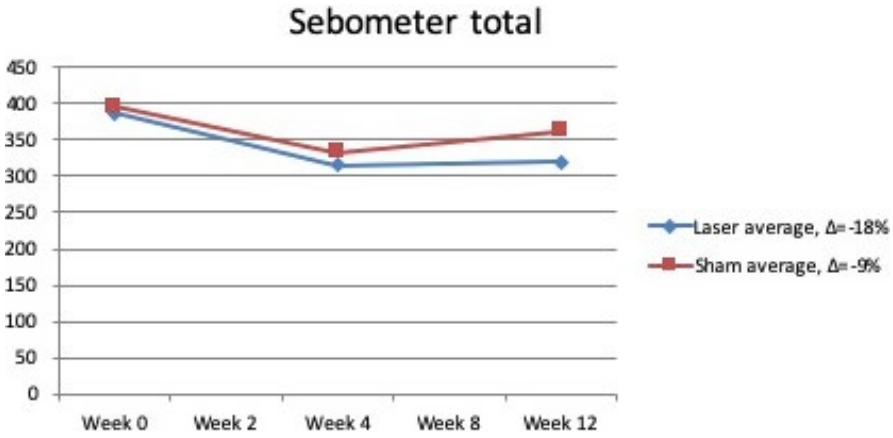


FIGURE 5 Investigator's Global Assessment Scale scores

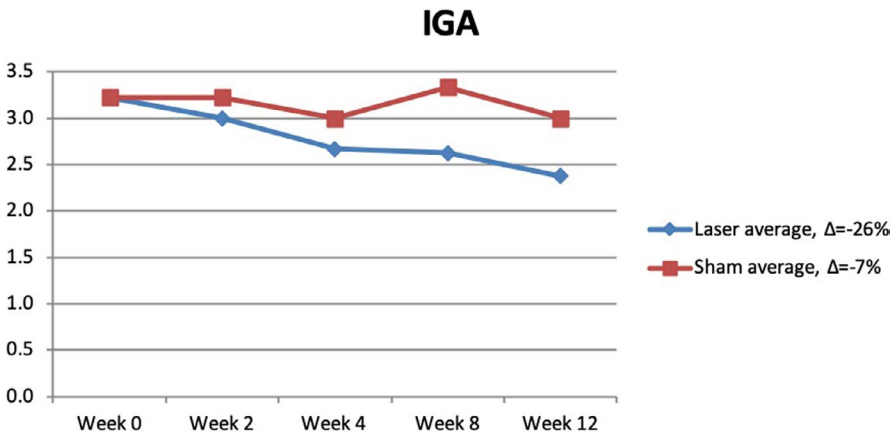
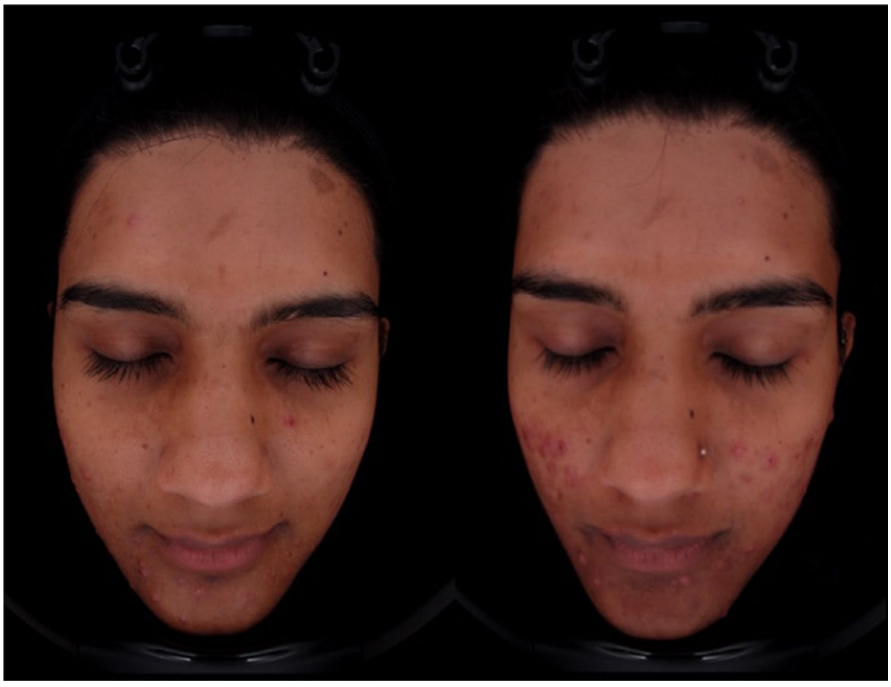


FIGURE 6 Sham treatment patient at the beginning (left) and end (right) of the study



confining the heat in the selectively absorbed target for higher clinical efficacy and safety to the surrounding skin.[19] The high-energy pulse is delivered into the target in such a short-pulse duration. The targeted structure has less time to lose heat, through conduction, to the surrounding skin, so the target reaches a higher temperature. A higher temperature in the targeted tissue translates into greater target tissue destruction for higher efficacy. We undertook a randomized controlled study evaluating the use of 650 usec 1064 nm Nd:YAG laser compared with a sham in the treatment of moderate-to-severe acne.

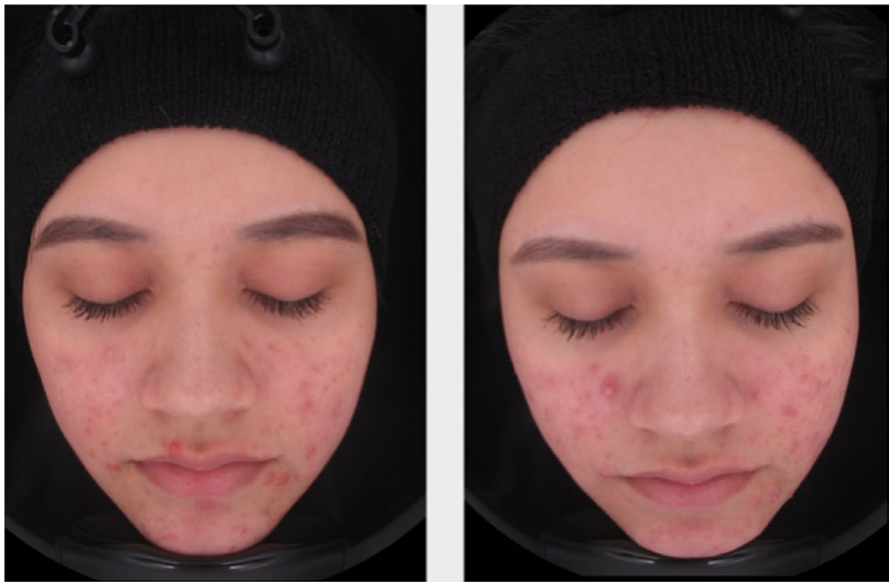


FIGURE 7 Sham treatment patient at the beginning (left) and end (right) of the study

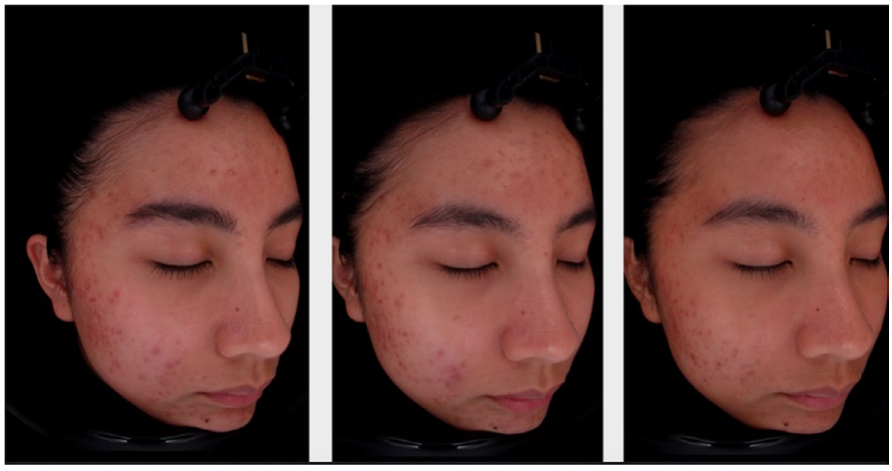


FIGURE 8 Subject in the active treatment group at the beginning (left) of the study, 4 weeks into the study (middle), and at the end (right)

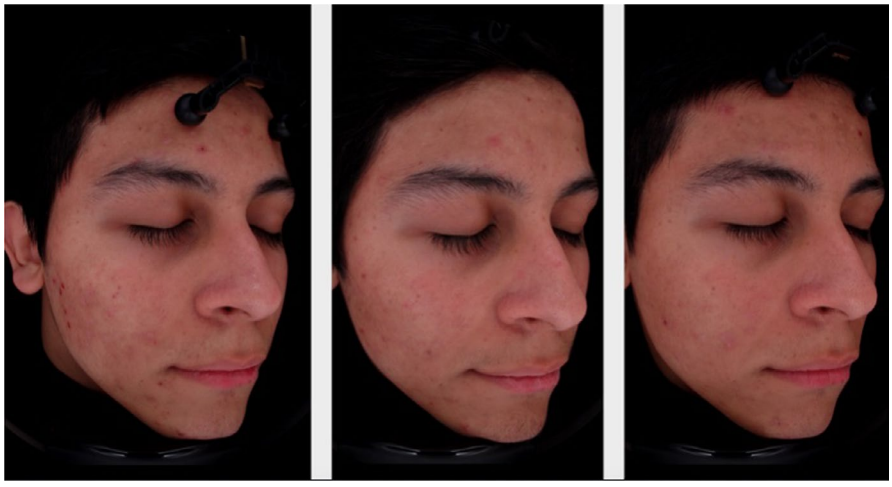


FIGURE 9 Subject in the active treatment group at the beginning (left) of the study, 4 weeks into the study (middle), and at the end (right)

2 | MATERIALS AND METHODS

We present a double-blinded randomized study with 20 subjects 12-40 years of age that present with moderate-to-severe acne vulgaris (Investigator's Global Assessment Scale [IGA] score of 3 or 4). This study was approved by an Institutional Review Board and complies with the Declaration of Helsinki. Written informed consent was obtained from all subjects. Subjects were randomized to receive a treatment as part of either an active treatment cohort or a control treatment cohort. No other acne treatments were

allowed during the study. The washout period was 2 weeks for topical antibiotics, 1 month for topical retinoids and oral antibiotics, and 6 months for oral isotretinoin. An active treatment group of 10 subjects were treated with 4 sessions of 650 microsecond Nd:YAG laser (Aerolase LightPod Neo®) therapy throughout the period of the study (Week 0, 2, 4, and 8). For Fitzpatrick skin types I-III for the first pass a 6-mm lens was used with a 0.65 msec pulse width and 21 J/cm^2. The second pass for Fitzpatrick skin types I-III was a 2-mm lens, 0.65 msec pulse width and 64 J/cm^2. For Fitzpatrick skin type IV, a 6-mm lens with 0.65 msec pulse width and 18 J/cm^2 was used for both passes. Fitzpatrick skin type V patients received treatment with a 6-mm lens with 0.65 msec pulse width and 14 J/cm^2 was used for both passes. Fitzpatrick skin type VI patients had a 6-mm lens with 0.65 msec pulse width and 11 J/cm^2 for both passes. A control treatment group of 10 subjects were given a sham treatment throughout the period of the study at the same intervals. The same device was used for the sham treatments, but no laser energy was emitted from the device. Subjects attended 6 in-office visits consisting of the following: Screening (Visit 1), Baseline Visit 2 (Week 0), Visit 3 (Week 2), Visit 4 (Week 4), Visit 5 (Week 8), and Visit 6 (Week 12). The visits took place throughout a 12-week period. Subjects were asked to have their photographs taken as well as complete self-evaluations at every visit. Porphyrin counts were taken using the VISIA™ Skin Analysis to quantify the amount of bacteria present at each visit over the 12-week study period. Sebum was measured with the Sebumeter® SM 815, assessed by investigator and subject assessments at every visit during the study. Separate study staff were assigned to either perform treatments or conduct evaluations. Safety and adverse event monitoring were performed at every visit.

3 | RESULTS

The treatment group also showed a decrease in the number of inflammatory lesions of 42% compared with 26% in the sham group (a 62% improvement over sham). Total inflammatory lesion count and total comedone count trended toward significance during the 12-week study period (*P*-values of .099 and .71, respectively) (Figure 1). The laser-treated cohort also experienced a reduction in total number of comedones similar to that seen with inflammatory lesions and a decrease in total porphyrin score (Figure 2). Similar findings for porphyrin count and sebometer value over the course of the study (p-values of 0.34 and 0.48, respectively)(Figures 3 and 4). There was also an 18% reduction in sebum production in the treated group, compared with 9% in the sham group (a 100% improvement) (Figure 4). Decrease in IGA by 26% in laser-treated group and 7% in sham group (ANOVA, *P*-value = .049) (Figure 5). This is a 271% improvement over sham treatment group. This finding is consistent with what we appreciated clinically which is an overall improvement in the acne of the treated group (Figures 6,7,8 and 9). No adverse events were reported during this study.

4 | CONCLUSION

The 1064nm, 650 usec Nd:YAG laser treatment is a safe and effective treatment for moderate-to-severe acne vulgaris. There was a high patient satisfaction of subjects in the active group compared with the control group. This is a novel laser with a short-pulse duration and the ability to deliver high energy within this short time. There is a plethora of options for acne treatment for patients, and patients may want to avoid oral and/or topical medications due to their side effects. This noninvasive and safe laser is an excellent choice for patients with moderate-to-severe acne.

CONFLICT OF INTEREST

Katarina Kesty, MD, MBA, and David J. Goldberg, MD, JD, have no financial disclosures.

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REFERENCES

1. Dreno B, Daniel F, Allaert FA, Aube I. Acne: evolution of the clinical practice and therapeutic management of acne between 1996 and 2000. *Eur J Dermatol*. 2003;13(2):166-170.
2. Kircik LH. Advances in the understanding of the pathogenesis of inflammatory acne. *J Drugs Dermatol*. 2016;15(1 suppl 1):s7-10.
3. Knutsen-Larson S, Dawson AL, Dunnick CA, Dellavalle RP. Acne vulgaris: pathogenesis, treatment, and needs assessment. *Dermatol Clin*. 2012;30(1):99-106.
4. Simonart T. Newer approaches to the treatment of acne vulgaris. *Am J Clin Dermatol*. 2012;13(6):357-364.
5. Hosthota A, Bondade S, Basavaraja V. Impact of acne vulgaris on quality of life and self-esteem. *Cutis*. 2016;98(2):121-124.
6. Dreno B, Bordet C, Seite S, Taieb C. 'Registre Acné' Dermatologists. Acne relapses: impact on quality of life and productivity. *J Eur Acad Dermatol Venereol*. 2019;33(5):937-943.
7. Chen X, Wang S, Yang M, Li L. Chemical peels for acne vulgaris: a systematic review of randomised controlled trials. *BMJ Open*. 2018;8(4):e019607.
8. Kontochristopoulos G, Platsidaki E. Chemical peels in active acne and acne scars. *Clin Dermatol*. 2017;35(2):179-182.
9. Elawar A, Dahan S. Non-insulated fractional microneedle radiofrequency treatment with smooth motor insertion for reduction of depressed acne scars, pore size, and skin texture improvement: a preliminary study. *J Clin Aesthet Dermatol*. 2018;11(8):41-44.
10. Simmons BJ, Bray FN, Falto-Aizpurua LA, Nouri K. The use of radiofrequency in combination with lasers for acne scars. *Int J Dermatol*. 2016;55(5):e312-e315.
11. Katz BE. The fate of active acne and acne scars following treatment with fractional radiofrequency. *J Drugs Dermatol*. 2019;18(12):1268-1272.
12. Alexiades M. Laser and light-based treatments of acne and acne scarring. *Clin Dermatol*. 2017;35(2):183-189.
13. Politi Y, Levi A, Snast I, Ad-EL D, Lapidoth M. Integrated cooling-vacuum-assisted non-fractional 1540-nm erbium: glass laser: a new modality for the simultaneous effective treatment of acne lesions and scars. *J Drugs Dermatol*. 2018;17(11):1173-1176.
14. Barbieri JS, Spaccarelli N, Margolis DJ, James WD. Approaches to limit systemic antibiotic use in acne: systemic alternatives, emerging

topical therapies, dietary modification, and laser and light-based treatments. *J Am Acad Dermatol*. 2019;80(2):538-549.
15. Bakus AD, Yaghmai D, Massa MC, Garden BC, Garden JM. Sustained benefit after treatment of acne vulgaris using only a novel combination of long-pulsed and Q-switched 1064-nm Nd: YAG lasers. *Dermatol Surg*. 2018;44(11):1402-1410.
16. Xia J, Hu G, Hu D, Geng S, Zeng W. Concomitant Use of 1,550-nm nonablative fractional laser with low-dose isotretinoin for the treatment of acne vulgaris in Asian patients: a randomized split-face controlled study. *Dermatol Surg*. 2018;44(9):1201-1208.
17. Ballin JS, Uebelhoer NS. The use of the low-fluence 1064 nm Nd:YAG laser in a female with contraindications to systemic anti-acne therapy. *J Drugs Dermatol*. 2009;8(11):1025-1026.
18. Mohamed EE, Tawfik K, Elsaie M. Intense pulsed light versus 1,064 long-pulsed neodymium: yttrium-aluminum- garnet laser in the treatment of facial acne vulgaris. *J Clin Diagn Res*. 2016;10(7):1-3.
19. Herd RM, Dover JS, Arndt KA. Basic laser principles. *Dermatol Clin*. 1997;15(3):355-372.

How to cite this article: Kesty K, Goldberg DJ. 650 usec 1064nm Nd:YAG laser treatment of acne: A double-blind randomized control study. *J Cosmet Dermatol*. 2020;00:1–6. https://doi.org/10.1111/jocd.13480