

Efficacy of Q-Switched Nd: Yag Laser in Hyperpigmentation

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Abstract ;

Background; Hyperpigmentary skin disorders affecting the exposed part of the body, particularly face, produce a severe cosmetic defect, becomes a source of considerable mental stress. In spite of tremendous advances in the field of basic concepts of melanin pigmentation, a regularly effective, predictable and safe treatment for hyperpigmentary skin disorders is yet to be developed. It is decided to find out the effect of Q-switched Nd : YAG laser in the treatment of hyperpigmentary disorders.

Aims And Objectives Of The Study: To assess the effect of Q-Switched Nd:YAG laser in hyperpigmentary disorders, to observe the side effects of Q-Switched Nd:YAG laser during and after treatment.

Materials & Methods: A prospective analytical study was conducted in the department of dermatology, Government Stanley Medical College and Hospital, Chennai, Tamil Nadu for a period of 18 months. Cases with epidermal hyperpigmentation ,Dermal or mixed Hyperpigmentation.

Results: In our study, Q - switched Nd : YAG (1064 nm) gave excellent results in tattoos. Very good results were noted in freckles. Becker's nevus, nevus of Ota and Café -au -lait macules yielded variable results with high risk of recurrence. Poor response was noted in melasma and lentiginos.

Conclusion: Q- switched Nd:YAG laser is a well tolerated and good modality of treatment for tattoos and freckles without compromising the cosmetic aspects .

Keywords: Q switched Nd YAG laser, Tattoo removal, freckles, melasma, Nevus of Ota

I. Introduction

Hyperpigmentary skin disorders affecting the exposed part of the body, particularly face, produce a severe cosmetic defect, becomes a source of considerable mental stress. It is decided to find out the effect of Q-switched Nd : YAG laser in the treatment of hyperpigmentary disorders.

Q-switched Nd:YAG Laser ¹

Nd: YAG (Neodymium - doped yttrium aluminium garnet Nd:Y₃Al₅O₁₂) is a crystal used as a lasing medium. The dopant, triply ionized neodymium, typically replaces yttrium in the crystal structure of yttrium aluminium garnet, since they are similar size. The crystalline host is doped with around 1% neodymium by weight. This laser system emits light at two wavelengths 1064 nm and 532 nm. The long 1064 nm wavelength has the least absorption by melanin and the deepest penetration. It is the most effective for treating black ink tattoos, especially darker skin types. By modifying the system with Q-switching, selective photothermolysis of exogenous blue black pigment can be achieved.

Treatment Algorithm

1. Anaesthesia

In these cases treatment is generally well tolerated after application of topical anaesthetic such as EMLA under plastic wrap occlusion for 1 hour prior to therapy.

2. **Eye protection** Q-switched laser light can cause permanent retinal damage and vision loss. All persons present in the room during laser treatment must wear appropriate eye protection.

3. **Determine treatment parameters** With the aid of a test spot. The test spot should be evaluated 4 - 8 wks after having been performed

4. **Position the laser hand piece** at an angle of 90 degree perpendicular to the skin surface.

5. Ensure that the hand piece is held at the appropriate distance from the patient. Holding the laser too close or too far from the patient or using the wrong styles can result in an improper energy fluence being delivered to the skin and can cause unwanted thermal injury and scarring.

6. Repeatedly delivering multiple pulses to the same area can result in an unwanted thermal injury and scarring.

7. Post operative care :

Apply a layer of petrolatum or bacitracin beneath a dressing of nonstick gauze and paper tape. Instruct the patient to change the dressing twice daily after gently cleansing the area with soap and water.

- 8. Follow up and additional treatments :** Treatments should be at least 6 - 8 weeks apart. At subsequent treatments, the energy fluence (J/cm^2) can be increased by small increments of 1 - 2 joules to a maximum that will vary according to the laser and the nature of the patient's lesion.

II. Materials & Methods

A prospective analytical study was conducted in the department of dermatology, Government Stanley Medical College and Hospital, Chennai, Tamil Nadu for a period of 18 months. Cases with epidermal hyperpigmentation (Freckles, Lentigines, Café-au-lait macules, Becker's nevus)

Dermal or mixed lesions(Nevus of Ota, Melasma, Tattoos) were serially selected from the. This includes approximately 20% of failure expected either in the response to treatment and followup. Selected cases were included after fulfilling the criteria, serially numbered, written consent obtained, proforma filled and filed. They were subjected to laser treatment, the power the frequency and the time of laser application calculated depending on the type and depth of lesion, site of involvement. Procedures were repeated at variable intervals depending upon the response and the results were analysed accordingly.

Conditions Included In Our Study

I. Epidermal Lesions

1. Freckles
2. Lentigines
3. Café-au-lait macules
4. Becker's nevus

II. Dermal or mixed lesions

1. Nevus of Ota
2. Melasma
3. Tattoo removal

III. Results

Freckles

In our study 7 patients were treated with 532nm, 550 watts, frequency 4 Hz. 1 week later the patients showed erosion and crusting. At an interval of one month 3 patients shown mild hyper pigmentation. One patient developed hypo pigmentation. 2nd sitting were given with voltage of 600 watts with frequency of 4 Hz. After 2 months of 2nd sitting there was 90% decrease in pigmentation in 4 patients and 100% clearance in pigmentation in 3 patients. Mild erythema, hypopigmentation and hyperpigmentation were noted in several patients but it disappears after 2 - 3 months of therapy. No relapse occurs after one year of follow up.

Lentigines

According to Liyt, Yang Ko et al.⁸ noted mean clearance of 76 - 95% for Q-switched Nd; YAG laser. In Tse, Y, A Shinoff R et al(9) tried a switched Nd; YAG laser in 20 patients. They were treated once. 100% of patients had >30% lightening.

In our study 5 patients between 22 - 35 years of age with lentigines were chosen. In the 1st sitting lentigines are treated with 532 nm in all patients with 550 watts and 4 Hz. In the first week all patients had erosion and crusting. Procedure repeated after one month. At the end of 2nd month 2 patients developed hypo pigmentation with mild scarring 3 patients developed hyperpigmentation. At the end of 6 months 2 patients noted 75% decrease in the pigmentation, In 3 patients relapse occurs. At the end of one year relapse occurs in 4 patients, one patient showed 25% reduction in pigmentation.

Becker's Nevus

In a comparative study done by TRELLES M.A. et al.¹⁰ Becker's nevus treated with Q-S Nd YAG laser and erbium : YAG laser. Numerous Sessions are necessary to get an acceptable clinical clearance rate. None of the patients who received 3 treatments with the Nd:YAG laser system cleared completely. We have tried Q-switched Nd:YAG (532nm) laser in 8 patients. After completion of 2 sittings 3 patients showed hypopigmentation, mild scarring. 6 patients showed relative hyperpigmentation. Voltage increased in subsequent sittings. After completion of 4 sittings one patient showed 50% clearance and one patient showed 95% clearance of pigmentation. One patient showed 25% clearance at the end of one year. All other patients showed relapse.

Café-Au-Lait Macules

We tried 532 nm Q-switched Nd:YAG volt of 550 - 600 watts with frequency of 4 - 5 Hz in 9 patients. There was 25% reduction, hypopigmentation, and mild scarring after single sitting in 4 patients. Hyperpigmentation noted in 5 patients at the end of 3rd month. After completion of 3 sittings 95% clearance in one patient and 50% clearance of pigmentation noted in 2 patients. Others showed recurrence and hyperpigmentation. 50% of clearance remains clear for up to one year in 2 patients and recurrence noted following sun exposure or spontaneously.



Before Treatment



After Treatment

Melasma

Study done by Polnikor N. et al. in 2 patients of Melasma treated by Q switched Nd:YAG laser in combination with 7% alpha arbutin showed greater than 80% reduction in hyperpigmentation. We tried Q-S Nd : YAG laser 532 nm, 550 - 600 watts of 4 - 5 Hz frequency in 12 patients. At the end of 1 week after 1st sitting ulceration, erythema, pain was noted almost all patients. At the end of one month of treatment 9 patients showed relative hyperpigmentation. No change in 3 patients. 50% clearance was noted at the end of 3rd month in 3 patients. Hypopigmentation and mild scarring noted in 6 patients. At the end of 6 months of treatment after 3 sittings 2 patients showed 75% clearance. One patients showed 25% clearance. 4 patients showed relative hyperpigmentation. At the end of one year one patient showed 50% clearance. All other patients showed relapse following sun exposure and spontaneously.

Nevus Of Ota

Comparative study was done by Chan HH et al.,¹¹ with Q-Switched 1064 nm Nd: YAG and Q switched 955 nm alexandrite laser in the treatment of Nevus of Ota. He found that Q-Switched Nd:YAG (1064nm) was found to be more effective than Q-Switched alexandrite. We tried Q-Switched Nd:YAG laser 1064 nm 550 - 750 watts, 4 - 5 Hz frequency in 9 patients. Pain, erosions, crusting was noted at the end of 1st week. At the end of 2 months 2 patients showed 20% reduction in the pigmentation. All other 7 patients showed

no difference. After completion of 8 sittings 2 patients showed 75% clearance with mild scarring. 3 patients showed relative hyperpigmentation and 4 patients showed no difference. At the end of one year one patient showed 50% clearance, one patient showed 25% clearance. All other 7 patients showed recurrence. Patients should be followed up over a long period to watch for any recurrence at the same site.

Tattoo Removal

In a study done by Kilmer et al.¹² 15 patients were treated for tattoo removal used 1064 nm Q S Nd:YAG Laser 10 - 12 J /Cm². He noted >75% clearance occurred in 77% of lesions, >95% clearance was achieved in 28% of lesions.

In our study 7 patients are treated with Q-switched Nd:YAG laser (1064nm), 600 - 700watts, frequency of 4 - 5 Hz. Among 7 patients one patient was treated for professional tattoo over the cheek. After one week of 1st sitting all patients showed erosion and crusting. At the end of one month 50% clearance was noted in professional tattoo. 25% clearance was noted in 3 patients. 95% clearance noted at the end of 3rd month. 50% clearance was noted in 3 patients at the end of 4 sittings. Mild scarring, depigmentation, erythema noted in all 6 patients. After completion of 6 sittings 3 patients showed 90% clearance with mild scarring and hypopigmentation. After completion of 8 sittings two patients showed 95% clearance. One patient showed 65% reduction. 3 patients showed 50% clearance with mild scarring and hypopigmentation. At the end of one year one patient (Professional Tattoo) showed 100% clearance with no textural alteration. All other patients showed mild scarring at the treatment site.



Before Treatment



After Treatment

IV. Conclusion

We studied the efficacy of Q - switched Nd : YAG laser in 60 cases. In our study, Q - switched Nd : YAG (1064 nm) gave excellent results in tattoos. Very good results were noted in freckles. Becker's nevus, nevus of Ota and Café -au -lait macules yielded variable results with high risk of recurrence. Poor response was noted in melasma and lentiginos. Mean no of sittings needed for tattoo removal was 6. Mean number of sitting

needed for freckle was 2. No relapse was noted after one year of follow up. Immediate side effect noted was mild transient erythema and edema and punctuate bleeding points. Delayed side effects noted are hypopigmentation and mild scarring and it is more often observed after multiple sessions. All side effects are transient and resolved over a period of time. Q-switched Nd:YAG laser is a well tolerated and good modality of treatment for tattoos and freckles without compromising the cosmetic aspects.

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