

FREQUENCY DOUBLED ND:YAG LASER FOR ADNEXAL LESIONS

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ABSTRACT**BACKGROUND**

LASER (Light Amplification by Stimulated Emission of Radiation) can be used for treatment of lid, adnexa, conjunctiva & ocular pathologies like I & D of hordeolum internum/ externum/small lid abscess, conjunctival papillae/cyst, cauterization of blood vessels of primary pterygium/corneal pathology/graft failure, wart (filiform), molluscum, skin tag, colloid milium, syringoma, melanocytic nevus, capillary haemangioma etc. We wanted to study the use of Nd:YAG laser in the treatment of ocular pathologies and its outcome.

METHODS

This is a retrospective study. Case records of 970 patients treated with slit-lamp mounted 532 nm frequency doubled Nd:YAG LASER under local/surface anaesthesia were studied. They were followed up at an interval of 1-week post laser, 1 month and after 6 months.

RESULTS

Age varied from 14- to 72-yrs (average 38 yrs.). Females were 62% and males were 38%. Out of 970 eyes, 96 eyes with no proper follow-up were excluded from analysis. The case distribution was: pterygium 22%, wart 18%, molluscum 16%, papillae/cyst 8%, others 36%. Patients' tolerance to the procedure was good & no serious complications occurred.

CONCLUSION

Nd:YAG laser can be used as a safe alternative for surgeries as laser surgical knife. Using slit lamp delivery system and high magnification lens, aids in precise and accurate treatment with minimal complications. It can be performed as a day care procedure. Numerous studies have been conducted on its usefulness in skin lesions, but its effectiveness in treating lesions over eyelids has not been studied very widely, thereby making this study unique.

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BACKGROUND

The first medical specialty to adopt lasers for the past 50 years right from their invention is Ophthalmology. LASER enables novel applications with utmost safety and challenging precision, which in turn continue the advancement in laser technologies.¹ Among medical professionals, Ophthalmologists were the first to study the therapeutic and biological effects of laser beams.² In ophthalmology, lasers are used to photocoagulate, cut, remove, shrink, and stretch ocular tissues. Laser is an acronym for Light Amplification by Stimulated Emission of Radiation. Laser emits photons which is amplified to produce

monochromatic high intensity polarized light. Power of the beam is measured by altering the energy or time ($P = E/t$). Q-switching and mode-locking mode can be used to increase the power of laser beam. It is achieved by using shutters that synchronize the light

A solid-state laser that uses crystal made up of Neodymium-doped Yttrium-Aluminium-Garnet as the lasing medium, which emits infrared light of a frequency of 1064 nm. There are two modes pulsed mode or continuous mode. Pulsed YAG lasers are typically Q-switched to achieve high-intensity pulses, which can be frequency doubled to emit an infra-red light 532 nm frequency. Q switching of pulsed mode is an effective technique for generating pulses of large energies.³

Nd:YAG laser has numerous applications in ophthalmology which includes YAG capsulotomy for posterior capsular opacification after cataract surgery⁴ and to create a peripheral iridotomy in patients with narrow angles or angle-closure glaucoma.

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Aim of The Study

To study the use of Nd:YAG laser in the treatment of ocular pathologies and its outcome.

METHODS

A retrospective case study of 970 patients who attended ophthalmology OPD at Jubilee Medical College from December 2016 to June 2017 was included in the study. All patients who presented with ocular pathology were included in the study.

Inclusion Criteria

All patients in the age group of 14 to 75 years who attended ophthalmology OPD at Jubilee Medical College from December 2016 to June 2017 were included in the study. Patient was followed up for a period of 6 months with weekly visit in the first one month and thereafter monthly review for the next 6 months.

Exclusion Criteria

Patients who required repeat laser or showed no follow-up was excluded from the study.

Procedure

All patients attending the ophthalmology OPD was subjected to detailed evaluation including visual acuity, slit lamp evaluation, intraocular pressure recording and fundus evaluation.

Patients with ocular pathology is given local infiltration of lignocaine and seated in front of slit lamp. Using slit lamp 532 nm double frequency enhanced Nd:YAG laser is applied to the lesion. Lesions over eyelid are cleaned with povidone iodine prior to the procedure. Pterygium cases are given post laser topical steroid and antibiotic for a period of 1 week. Setting on the machine (spot size, exposure time & power) is based on the size of the lesion and tissue response to the laser burn. For common lesions like pterygium the following will be the machine setting parameters (exposure time 130-210 ms, power 110-220 Mw & spot size 100/200). The laser beam will be applied to the feeder vessels of the pterygium.

Sample Size

A total of 970 eyes were studied out of which 96 were excluded from the study as they required repeat laser or no follow-up (this is a retrospective ongoing study aiming at single sitting results)

Statistics

Statistical data was entered using SPSS software. Analysis was done using independent two sample t test for the parametric variables and Mann Whitney U test for non-parametric variables. To test the mean variables, Wilcoxon signed rank test was used.

RESULTS

Retrospective analysis of 970 eyes with ocular pathology was studied out of which 96 were excluded as they required repeat laser.

The study included 152 eyes with wart over eyelid which was successfully treated with laser.

135 eyes with molluscum contagiosum was treated with Nd:YAG laser. Youngest patient was aged 14 years. A single treatment showed no recurrence of lesion when followed up for period of 6 months.

68 eyes with papillae and cysts were applied Nd:YAG laser and was successfully treated with no recurrence.

ND:YAG laser was applied to 186 eyes with pterygium and patients were followed up for a period of 6 months and no incidence of recurrence was noted.

305 eyes with miscellaneous conditions like feeder vessels, hypopigmented scars etc were successfully treated with Nd:YAG laser.

1. Age Distribution

Age distribution showed maximum incidence in the age group of 31 to 40 years. The occurrence of ocular pathology showed a relative higher incidence among the middle age group. The incidence was quite low among children below 20yrs (Figure 1).

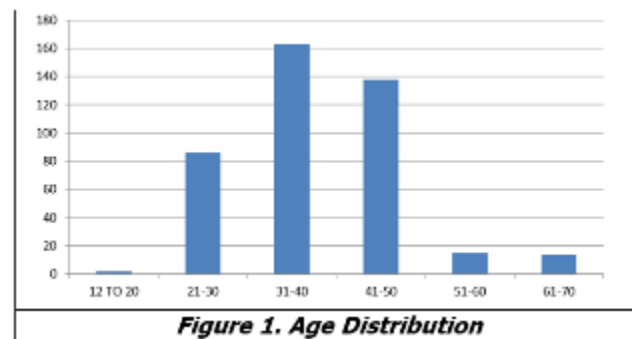


Figure 1. Age Distribution

2. Sex Distribution

Sex distribution showed more incidence of conjunctival, lid and orbital lesions among females giving a suspicion of hormonal influence. The occurrence of ocular pathology was found to be higher among middle aged females (Figure 2).

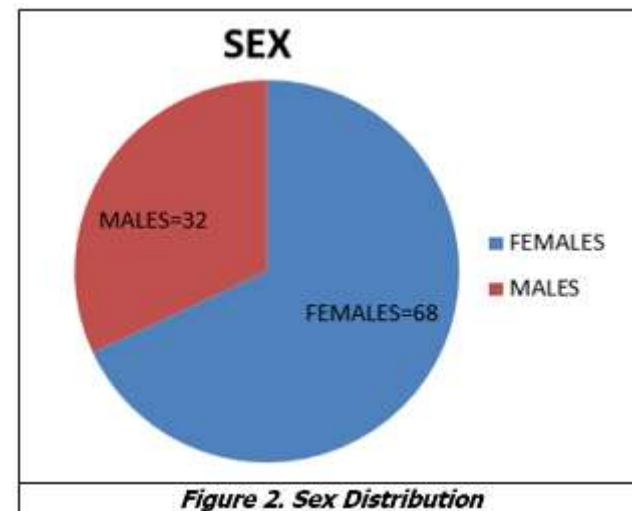


Figure 2. Sex Distribution

3. Disease Distribution

Nd:YAG laser was attempted for warts, pterygium, molluscum, papillae and cysts. They formed the majority of ocular pathology presenting to ophthalmology OPD (Figure 3).

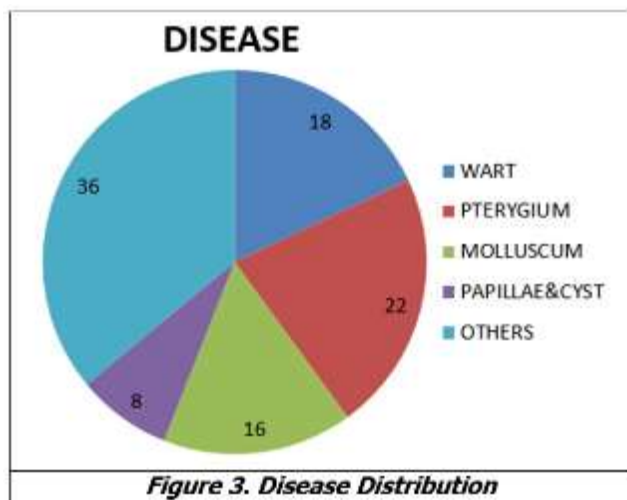


Figure 3. Disease Distribution

Lesions	Number
Wart	152
Pterygium	135
Molluscum	186
Papillae & cyst	69
Others	304
No response to laser	28

Table 1. Disease Distribution

4. Complications

Patients with pterygium developed redness in the immediate post-operative period. They were started on topical antibiotic, steroid and followed up for a week. Patients were symptomatically better, and redness disappeared after 1 week. All patients were evaluated weekly for the first month and thereafter monthly for the next 6 months. 96 eyes showed recurrence and thereby excluded from study All patients continue to be under monitoring with relative low incidence of complications and good follow up (Figure 4).

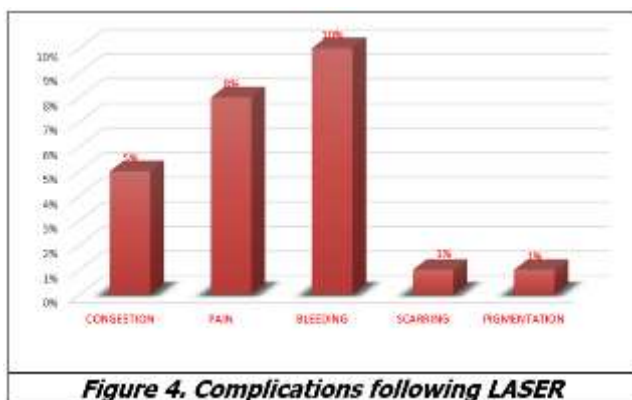


Figure 4. Complications following LASER

DISCUSSION

This present study is to evaluate the use of Nd:YAG laser for ocular adnexal pathologies and its outcome. Yttrium Aluminium Garnet (YAG= Y3 Al5 O12) with 1.5% trivalent neodymium ions (Nd³⁺) present as impurities in host medium. Nd³⁺ ions occupy the lattice sites of yttrium ions as substitutional impurities thereby providing energy for pumping and lasing transitions. Depending on the power of the laser, length and diameter of the laser rod ranges from 5 cm to 10 cm and 6 to 9 mm respectively. Laser transition takes place at 1.06 μm. Xenon flash lamps are used for pulsed output. For optical pumping, Nd:YAG laser can be operated with tungsten-halide incandescent lamp.

Nd:YAG laser emit light with a wavelength of 1064 nm, in the infrared region.⁵ In Q-switching mode, output power is 250 MW with a pulse durations of 10 to 25 nanoseconds⁶ The high-intensity pulses are efficiently frequency doubled to generate laser light at 532 nm.

Other common host medium for Neodymium include YLF (yttrium lithium fluoride of 1047 and 1053 nm) and YVO₄ (yttrium orthovanadate, 1064 nm).⁷ It is absorbed by endogenous melanin less efficiently thereby resulting in lesser adverse effects on skin.

Moskalik et al studied the efficacy of facial skin cancer treatment with high-energy pulsed neodymium and Nd:YAG lasers and found it to be effective method with acceptable cosmetic results to treat facial skin cancer of stages T (1-2) N (0) M(0)⁸

Our study included 152 eyes with wart over eyelid which was successfully treated with laser. Frequency-doubled Nd:YAG green lasers of 532 nm wavelength are used for pan-retinal photocoagulation in patients with diabetic retinopathy. It is used extensively in the field of cosmetic medicine for laser hair removal and in the treatment of minor vascular defects such as spider veins on the face and legs. Recently used in dermatology for dissecting cellulitis of the scalp.⁵

Omi T et al studied the outcome of recalcitrant molluscum contagiosum treated with Nd:YAG laser wherein they applied a single shot from a 585 nm pulsed dye laser to each lesion (3 mm, 300 ms, 8.0 J/cm²). Study subjects included 15 children, 11 boys and 4 girls, between the age group of 3-5 years of (mean 4.2 yr) with recalcitrant molluscum contagiosum. They were followed up, at 1 week and 3 months post-treatment. A single treatment of simple and recalcitrant lesions were treated successfully with the pulsed dye laser, it also reported no recurrence or complications on follow up. It was well tolerated even by the young subjects.⁹

In our study 135 eyes with molluscum contagiosum was treated with Nd:YAG laser. Youngest patient was aged 14 years. A single treatment showed no recurrence of lesion when followed up for a period of 6 months.

Nakamura k et al studied the usefulness of Er: YAG laser for pterygium. The removal of pterygium was done under topical anaesthesia with 50 to 100 laser shots. Complications such as corneal erosion or thinning of the sclera were not reported. However, the 3 retreatment cases reported. The

study was concluded that Er: YAG laser system may be a clinically useful tool as a laser surgical knife for ocular tissue.¹⁰

In our study we applied Nd:YAG laser to 186 eyes with pterygium and patients were followed up for a period of 6 months and no incidence of recurrence was noted. This was based on the coagulative property of Nd:YAG laser.

Amir Hossein Siadat et al studied the incidence of colloid milium caused by exposure to intense sunlight and treated it successfully with Er-YAG laser.¹¹

Kilmer et al studied the effect of frequency-doubled Q-switched Nd:YAG laser in the treatment of epidermal pigmented lesions. A single treatment for benign epidermal pigmented lesions was done with Q-switched mode of Nd:YAG laser (532 nm, 2.0-mm spot size, 10 nanoseconds) on 49 patients. They were followed up at 1- and 3-month intervals. The study was concluded frequency-doubled Nd:YAG laser of 532 nm frequency, as safe and effective in treatment of benign epidermal pigmented lesions.¹²

Levy JL et al conducted a similar study on the treatment of individual café au lait macules with the Q-switched Nd:YAG¹³ Grossman et al also conducted similar study on the effect of Nd:YAG laser in the treatment of cafe au lait spots and found it to be effective in its management.¹⁴

Nd:YAG laser is able to create a coagulation effect at a depth of 5-6 mm thereby useful in treating moderately deep large calibre vessels and feeding reticular veins 3- and 5-mm spot sizes are suitable for superficial lesions and larger 5 and 7 mm spot size for thicker or deeper ones. Pulse duration should be based on vessel size of each lesion¹⁵ 304 eyes with miscellaneous conditions like feeder vessels, hyper pigmented scars etc., were successfully treated with Nd:YAG laser.

This is an ongoing study where all the 846 eyes are being monitored monthly for recurrence and complications. Till now patient tolerance was good and no recurrence is being reported. 124 eyes required repeat laser due to poor regression and was thereby excluded from the study.

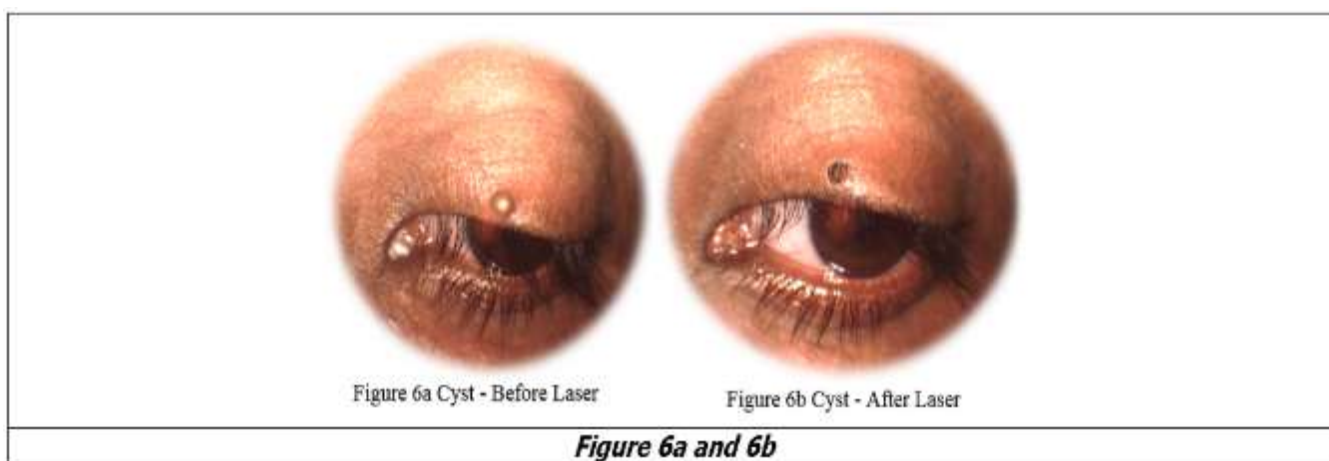




Figure 7a. Cyst-Before Laser Figure 7b. Cystwall Exposed Figure 7c. Cyst-Post Laser

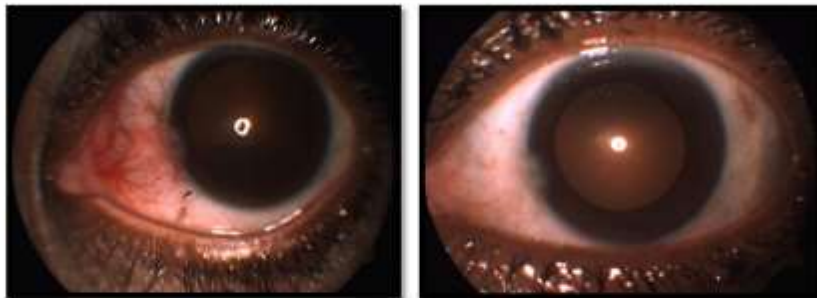


Figure 8a. Pterygium pre- laser Figure 8b. Pterygium post- laser

Figure 8a and 8b

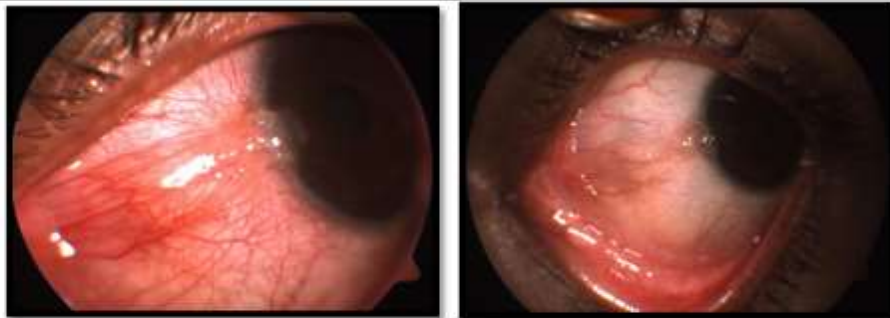


Figure 9a. Pterygium Pre- laser Figure 9b. Pterygium Post- laser

Figure 9a and 9b



Figure 10a. Chalazion pre- laser Figure 10b. Chalazion post- laser

Figure 10a and 10b

Patient with ocular pathology subjected to Nd:YAG laser and thereby followed up after 1 month showed complete resolution of the lesion. Patient was assessed monthly for the next 6 months and it showed no recurrence.

Limitations

Since it's an ongoing study, more data is required to conclude whether its comparable to the surgical procedure.

CONCLUSIONS

Our retrospective study on the use of Nd:YAG laser in pterygium, lid and ocular pathologies has revealed it to be a safe alternative for surgeries as well as its efficacy as a laser surgical knife. Using slit lamp delivery system, Nd:YAG delivery for aesthetic purpose can be performed as a day care procedure. Use of high magnification lens in laser delivery aids in precise and accurate excision with minimal complications. Numerous studies have been conducted on its usefulness in skin lesions but its effectiveness in treating lesion over eyelid and pterygium has not been studied earlier to the best of our knowledge, thereby making this study unique.

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