

0.1 Second versus 0.2 Second pulse duration of Frequency Doubled Nd: YAG Laser in treatment of Clinically Significant Diabetic Maculopathy.

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Summary

Background: clinically significant macular edema (CSME) is the commonest cause of visual loss in patients with diabetes mellitus and laser focal photocoagulation is the golden standard for treating it.

Patients and Methods: A frequency doubled Nd: YAG laser was used to treat all eyes included in this study with diabetic maculopathy. Thirty eyes of three insulin dependent and twenty six non insulin dependent diabetic Iraqi patients were included. The study involved twenty six males, three females and followed for one year. Their ages were ranging between 36- 59 years, all of them from patients attending ophthalmic out-patient department in the medical city in the period between January 2005 and June 2006. Eyes divided in to two groups (fifteen eyes in each group) and the disease severity was taken into account. The first group treated with 0.1 second and second group with 0.2 second pulse duration.

Results: In group (1) improvement of V.A occurred in 19.99% (Statistically significant) and 60% (Statistically significant) in group (2). There was stabilization 80% (Statistically insignificant) in group (1) and 33.33% Stabilization (Statistically significant) in group (2), while worsening only in group (2) 6.67% (Statistically insignificant).

Conclusion: The frequency – doubled Nd:YAG laser is effective in controlling diabetic macular oedema when applied in focal treatment. The setting of 100 μ m \times 0.2sec., pulse exposure time show more improvement in V.A. than 100 μ m \times 0.1sec.

Keywords: Laser, Focal, Photocoagulation.

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Introduction:

Diabetes mellitus is one of the leading causes of visual loss in the industrial world. The farmost cause of visual loss in diabetic retinopathy is diabetic maculopathy. Previous studies of Argon, Krypton, or Diode laser for diabetic macular edema have employed visible moderate intensity laser burns with good results¹.

Photocoagulation was first performed by Meyer-Schwickerath² and still remains the most effective treatment for diabetic retinopathy³. The beneficial effects of pan-retinal photocoagulation (PRP) for diabetic retinopathy and its effectiveness in decreasing the incidence of blindness were established almost 20 years ago by a multicentric study and the Diabetic Retinopathy Study⁴ (DRS). Both DRS and the Early Treatment Diabetic Retinopathy Study (ETDRS) provided data to establish the guidelines for detection and effective treatment of proliferative diabetic retinopathy (PDR) and diabetic macular oedema⁵. While the DRS findings demonstrated that PRP reduces the risk of severe visual loss in patients with high-risk PDR by 50-60%,⁶

ETDRS reported the effectiveness of using photocoagulation to treat diabetic macular edema and recommended that documented pan-retinal photocoagulation should be initiated early to be most effective in the management of proliferative diabetic retinopathy⁷⁻⁸.

Patients and Methods:

The study included 30 eyes of 29 patients with type I and type II diabetes mellitus having clinically significant macular edema (CSME) presented to us between January 2005 and June 2006 in the Medical City Teaching Complex, Specialized Surgeries, Iraq. The cases were divided into two groups, 15 eyes in each. We included only those eyes related to patients with CSME that have: best corrected visual acuity (snellen's test), slit lamp biomicroscopical examination of the anterior segment, goldmann applanation tonometry to measure the intraocular pressure and examination of the vitreous and retina with slit lamp biomicroscopy using non contact condensing lens (+ 90 and +78) and Goldmann triple mirror contact lens.

Treatment Technique:

The pupil was dilated with combination of Tropicamide 1% and phenylephrine 10% eye drops. The eye was anesthetized with Tetracain 0.4% eye drop.

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Insertion of fundus contact lens (Mainster lens) using coupling viscous fluid (methylcellulose 2% eye drop) to establish clear fundal view and identify landmarks. Mainster lens burn size on the retina is approximately 1.05 times larger than spot size setting on the control panel of the laser system 9. Focusing the aiming beam, tilting the contact lens as necessary to produce a round (not elliptical) spot. Frequency doubled Nd- YAG laser was restricted to microaneurysms and focal sites of leakage at the centers of exudates arcs or circles. Lesions closer than 500 μm to center of macula were avoided during initial treatment. In eyes requiring re-treatment due to persistent macular edema, treatment was extended as close as 300 μm to the center of the macula 9.

Results:

The study sample consisted of 26 males (89.65%) and 3 females (10.34%). their ages ranged between 36-59 years (average 54.13) and duration of diabetes ranged between 2-25 years (average 9.72), three patients were insulin dependent and 26 were non-insulin dependent.

The data of the effect on V.A. for the 2 groups are presented as the mean change in visual acuity (in lines) plus or minus the standard deviation. Comparison between the two groups was made. The statistical significance was checked using paired student's t- test. Changed were considered statistically significant if P- value was ≤ 0.05.

Group 1 (0.1 sec × 100μm)

This group included 15 eyes, at the end of the one year follow up period the result were as shown in table 1 and fig 1.

Table 1: Visual acuity changes after treatment in group 1. Statistically significant if P- value ≤ 0.05.

Change in V.A	No. of eyes	Percentage	Statistical significant	
Improvement	≥4 lines	2	13.33	significant
	3 lines	1	6.66	insignificant
	Total	3	19.99	significant
Stabilization	12	80	significant	

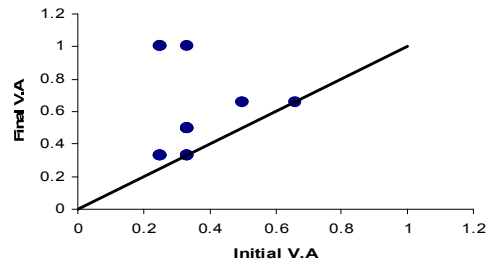


Fig1: Comparison between initial and final visual acuity (V.A.) for group 1. Symbols to the left of the diagonal line indicate V.A. improvement and symbols to the right indicate visual deterioration. Symbols on the line indicate stabilization.

Group 2 (0.2 sec × 100μm)

This group included 15 eyes. At the end of the one year follow up period, the results were as shown in table 2 and fig2.

Table 2: Visual acuity changes after treatment in group 2. statistically significant if P- value ≤ 0.05.

Changes in V.A	No. of eyes	Percentage	Statistical significant	
Improvement	≥ 4 lines	3	20	significant
	3 lines	6	40	
	Total	9	60	
Stabilization	5	33.33	significant	
Worsening	1	6.67	insignificant	

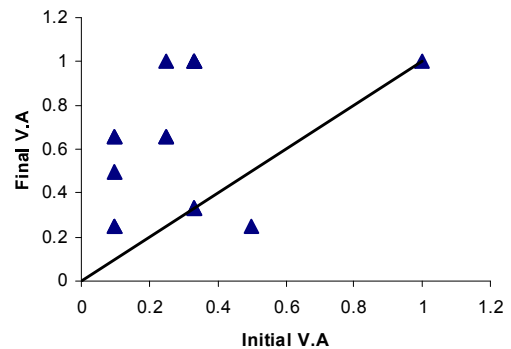


Fig 2: Comparison between initial and final visual acuity (V.A.) for group 2. Symbols to the left of the diagonal line indicate V.A. improvement and symbols to the right indicate visual deterioration. Symbols on the line indicate stabilization.

Discussion:

Diabetic macular edema is defined as retinal thickening of two or more contiguous disc areas and involving some portion of the foveal a vascular zone (FAZ) 10.

Laser photocoagulation can reduce macular oedema through its effect on the outer blood- retinal barrier

(retinal pigment epithelium RPE) causes the elaboration of a chemical or a substances that causes mitosis of retinal vessels. The revitalized vessels may then leak less or absorb more, thus reducing macular oedema. It may also be that the laser treatment destroys some of the photoreceptors and RPE which are the layers that using most (up to 75%) of the oxygen needed by the retina. Post treatment scarring also causes retinal thinning allowing for better diffusion of oxygen from choroid 11. Laser treatment thus reduces the need for oxygen in the retina and increases its supply from the choroid. Retinal capillaries especially in patients with severe macular oedema are dilated, possibly in response to retinal ischaemia and they become narrower after treatment with laser, this reduces the intravascular hydrostatic pressure, the vessels leak and oedema 12.

Different exposure times are necessary for proper treatment. Longer laser exposure duration is necessary for those patients with sever CSMO in which the retina is extremely thick to be treated. This may necessitate the longer need for power delivery to induce the proper gentle burn. This is a consequence of the fact that the treatment of those patients depends on the temperature rise as it is the important physical factor for that matter. This, in turn, depends on the rate of heat delivery to the lesion, the rate of heat dissipation and dispersion, which depend on the lesion size, thickness, and blood supply. Consequently if the heat accumulation is high we use short treatment duration and vice versa.

In the present work, it is found that treatment with 0.2 second gave higher improvement (60%) compared with (19.99%) for the treatment duration of 0.1second. Such improvement has also been observed by *Gupla et al.2001*, *Massin and Coscan.1994* who reported an improvement of vision in 28.8% of their 71 cases treated with Nd:YAG laser (grid + focal treatment). At the same time they compared the effect of argon green (514nm), krypton red (647nm), Nd:YAG (532nm) and diode (810nm) lasers in reducing/ eliminating clinically significant macular oedema (CSMO) they reached a conclusion that frequency doubled Nd:YAG laser has the best treatment results. However, Nd:YAG may have the advantage of requiring fewer retreatments. As for stabilization and worsening, the results of the present work show more stabilization in group 1 (80%) than in group 2 (33.33%) but these results are not significant because of the low patients number.

In an earlier use of frequency-Doubled Nd:YAG laser dose not show the same rate of success, in 2005 by *Bandello F and Isola M* has used the same type of laser but their results was lower (43%) of 14 eyes than that reported in this work

In general, we may not be able to get a clear idea about which treatment duration is better. This is

because different durations may be used for different disease severity and the high success rate may be attributed to the less severity rather than the effect of treatment duration. However, results show an improvement in visual acuity in both treatment durations.

Conclusion:

The frequency – doubled Nd:YAG laser is effective in controlling diabetic macular oedema when applied in focal treatment. The setting of $100\mu\text{m} \times 0.2\text{sec.}$, pulse exposure time show more improvement in V.A. than $100\mu\text{m} \times 0.1\text{ sec.}$, but the setting of $100\mu\text{m} \times 0.1\text{ sec.}$, is more efficient in achieving stabilization of vision. The improvement and stabilization are more noticeable in eyes that have better visual acuity before treatment than those with poor vision initially.

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