IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 19, Issue 10 Ser.1 (October. 2020), PP 10-19
www.iosrjournals.org

Comparison of Subthreshold Micro Pulse Diode Laser (Yellow Laser, 577nm) and Combination of Anti Vascular Endothelial Growth Factors and Mild Macular Grid (MMG) Laser in the Treatment of Diabetic Macular Edema

Dr Viplav Goutham Reddy B[1], Dr A S Guruprasad[2]Dr Shrinivas M Joshi[3], Dr Apoorva Ayaachit[4]

[1](Resident,Department of Vitreo Retina, DR MM Joshi Eye Institute, India)
[2](HOD,Department of Vitreo Retina, DR MM Joshi Eye Institute, India)
[3](Senior Consultant,Department of Vitreo Retina, DR MM Joshi Eye Institute, India)
[4](Consultant, Department of Vitreo Retina, DR MM Joshi Eye Institute, India)

Abstract:
Background*: Diabetic retinopathy is the most frequent and severe ocular complication of diabetes mellitus and the leading cause of blindness in the working-age population in developed countries worldwide. DME is a major cause to vision loss and one of the main causes for decreased visual acuity in patients with diabetic retinopathy. The prevalence increases from 0 - 3% in individuals recently diagnosed with diabetes to 28-29% in those with diabetes duration of more than 20 years.(1) Untreated, patients with "clinically significant" DME' have a 32% 3-year risk of potentially disabling "moderate" visual loss. In addition to individual disability, the social and economic costs of the global diabetes pandemic and thus DME can hardly be overestimated.*
Materials and Methods*: 62 eyes of 62patients were randomized to 2 groups using simple randomization.Group 1 received Bevacizumab 1.25mg/0.05ml intravitreal injections monthly. After central macularthickness came down to less than 350µm or the edema became non foveal,patients were treated with Mild Macular Grid (conventional Laser). Group 2 received Bevacizumab 1.25mg/0.05ml intravitreal injections monthly. After central macularthickness came down to less than 350µm or the edema became non foveal,patients were treated with Sub Threshold Micro Pulse Diode Laser with a577nm Yellow Laser.*
Results*: Mean age of presentation was 60.75 years. Most common complaint was diminution of vision for distance followed by near vision difficulty and metamorphopsia. The mean duration of diabetes was 10.53 years in MMG group and 11.15 years in MPLT group. The mean duration of loss of vision in MMG group was 2.66 years and 2.93 years in MPLT group. In MPLT group there was gradual improvement of BCVA from 4th to 6th month and in MMG group gradual improvement of vision was noted from 3rd to 6th month. In MPLT group there was a statistically significant increase in CMT over a 6month period an in MMG group there was increase in CMT over a period of 6 months. In MPLT group there was decrease in SFCT noted from 4th month, but, the change in SFCT over 6 months was not statistically not significant and in MMG group there was gradual decrease in SFCT from 2nd month to 6 month. In MPLT group there was gradual decrease in macular volume from 3rd month to 6th month, the change in macular volume was not statistically significant and in MMG group there was gradual decrease upto 3rd month, there was gradual increase from 4th to 6th month. There was gradual increase in MMT over a period of 6 months in MPLT group, but the change in MMT was not statistically significant and there was a statistically significant drop in MMT in 2nd and 3rd month and then it increased gradually upto 6th month. The percentage of patients requiring rescue injections in the both the groups were almost the same.*
Conclusion: *In patients with moderate diabetic macular edema, both sub threshold micropulse diode yellow laser and Mild Macular Grid laser were equally effective in maintaining the visual acuity, macular volume, sub foveal choroidal thickness and maximum macular thickness. Whereas, mild macular grid laser was comparatively more effective in maintaining the central macular thickness.*
Key Word*: Laser ; Macular edema ; Retinopathy ; Vision*

Date of Submission: 20-09-2020 Date of Acceptance: 04-10-2020

I. Introduction

Diabetic retinopathy is the most frequent and severe ocular complication of diabetes mellitus and the leading cause of blindness in the working-age population in developed countries worldwide. (1) Diabetic

retinopathy may begin to appear in people with type I Diabetes Mellitus within 3 – 5 years of onset. By 10 years, between 14 – 25% of patients will have Diabetic Macular Edema(DME). DME is a major cause to vision loss and one of the main causes for decreased visual acuity in patients with diabetic retinopathy. The prevalence increases from 0 - 3% in individuals recently diagnosed with diabetes to 28-29% in those with diabetes duration of more than 20 years.[(1)] Untreated, patients with "clinically significant" DME' have a 32% 3-year risk of potentially disabling "moderate" visual loss. In addition to individual disability, the social and economic costs of the global diabetes pandemic and thus DME can hardly be overestimated. [(2,3)]

Quantification of macular edema is precisely made with the optical coherence tomography and treatment options include retinal laser, intravitreal antivascular endothelial growth factors (VEGF), and implantable dexamethasone. [(4)] Subthreshold photocoagulation[(5)] threshold-level treatment[(6)] minimally intensive laser photocoagulation[(5)] and mild macular grid laser photocoagulation[(7)] with a conventional continuous laser have all been reported as less invasive procedures. Currently, a short or ultrashort pulse duration is used to reduce laser energy and avoid collateral damage. Selective photocoagulation of the retinal pigment epithelium (RPE) by the subthreshold micropulse diode laser photocoagulation method was first reported in 1997 by Friberg and Karatza, [(8)] Compared with conventional laser, subthreshold micropulse diode laser is considered as a less invasive treatment. [(9)]

Mild Macular Grid (MMG) laser photocoagulation is the application of mild, widely spaced burns throughout the macula (avoiding the fovea). The widespread application also might lead to improved oxygenation thereby development of healthier retinal pigment epithelium and overall physiological improvement of the entire macula[(7).] The present was conducted to evaluate the outcomes in terms of anatomical andfunctional efficacy of subthreshold micropulse diode laser (577nm-yellow laser)and Mild Macular Grid laser followed by Anti Vascular Endothelial growth factorin the treatment of DMEand to compare the results of the above two procedures interms of anatomical and functional outcomes.

II. Material And Methods

Prospective randomized study was carried out on the patients attending Vitreo-Retina in the department of MM Joshi Eye Institute between September 2016 toNovember 2017.

Study Design: Prospective randomized controlled trial

Study Location: This was a tertiary care teaching hospital based study done in Department of Opthalmology, MM Joshi Eye Institute, Gokul Road, Hubli,Karnataka.

Study Duration: November 2014 to November 2015.

Sample size: 62 eyes of 62patients were randomized to 2 groups using simple randomization.

Subjects & selection method: Group 1 received Bevacizumab (Avastin, Genentech Inc., South San Francisco,CA) 1.25mg/0.05ml intravitreal injections monthly. After central macularthickness came down to less than 350µm or the edema became non foveal,patients were treated with Mild Macular Grid (conventional Laser). Group 2 received Bevacizumab (Avastin, Genentech Inc., South San Francisco,CA) 1.25mg/0.05ml intravitreal injections monthly. After central macularthickness came down to less than 350µm or the edema became non foveal,patients were treated with Sub Threshold Micro Pulse Diode Laser with a577nm Yellow Laser (Iridex IQ 577; Laser System Iridex Corp, CA).

Group MMG: 30 Eyes

Group MPLT: 32 Eyes

Inclusion criteria:

1. Men or women with type 1 or type 2 diabetes mellitus (HbA1C not morethan 10%)
2. Previously untreated macular oedema
3. Pre laser retinal thickness not more than 350 microns (confirmed withspectral domain optical coherence tomography)

Exclusion criteria:

1. Previous macular laser photocoagulation
2. Previous history of vitrectomy
3. Previous history of intra vitreal steroid injections
4. Any intra ocular surgery at least 6 months before treatment
5. Ischaemic or tractional maculopathy
6. Significant media opacities that precluded fundus imaging
7. Patients with systemic causes of macular oedema such as severe anaemia and established nephropathy
8. Diabetic macular oedema in proliferative diabetic retinopathy
9. Hard exudate plaque

Methodology

All the cases in both groups were followed up at monthly for a period of 6 months. All cases underwent routine ophthalmic evaluation including best corrected visual acuity using Snellen's chart. Visual acuity was converted into Log MAR unit for study purpose, Corrected near visual acuity at 25cm in a good illuminated environment using near vision chart, IOP by Goldmann applanation tonometer, Slit lamp examination, Dilated fundus examination using biomicroscopy and Spectral Domain Optical Coherence Tomography.

Criteria for Laser (MMG/MPLT)

1. Central Macular thickness less than 350 microns.
2. Non foveal edema

CMT was measured as the distance between ILM (Internal limiting membrane)and RPE (Retinal pigment epithelium)

All the eyes with CMT greater than 350 microns and foveal edema received1.25mg/0.05ml Intravitreal Bevacizumab (Avastin, Genentech Inc., South SanFrancisco, CA) injection. Post injection, they received topicalantibioticsteroid eye drops (Gatifloxacin 0.30% w/v + Prednisolone acetate IP 1% w/v)for one week (6 hourly) and followed up on day 1 and at 3 weeks.

Patients were advised self-assessment of vision to rule out untoward adverseeffects up to 3 weeks after injection. If criteria for laser were not satisfiedduring the third week follow up, the patient was asked to come after 1 weekand Intra Vitreal Bevacizumab (IVB) was repeated. Post injection, Followup schedule was followed as after 1st injection. If criteria for laser were notmet, PRN Avastin was be given until laser could be performed as per setcriteria Once the criteria for laser were met,the patients were randomised togroup 1 or group 2.

Treatment Protocol for Group 1

Mild Macular Grid was performed as per DRCR.netrecommendationsusing PASCAL Laser system and Mainsterstandard contact lens.

1. Area considered for grid treatment:

a.500-3000 microns superiorly, nasally, and inferiorly from the centerof macula.

b.500-3500 microns temporally from the macular center. Noburns are placed within 500 microns of the disc.

2. Burn size – 50 microns.
3. Burn duration – 0.05 to 0.1 second.
4. Burn intensity – barely visible (light grey).
5. Burn separation – 200-300 total burns evenly distributed over thetreatment area outlined above. (approximately 2-3 burn widths apart)
6. Wave length –Yellow wavelength

Treatment Protocol for Group 2

Group 2 patients are treated with micro pulse diode laser (Iridex IQ 577; LaserSystem Iridex Corp, CA) with the following parameters:100microns spot size on slit lamp (105microns spot size on retina),5% Duty Cycle of 0.2 seconds,Power of micropulse laser was decided as follows. A test burn with conventional laser was given outside thevascular arcades withincreasing power until a visible burn is seen, then the machine is switched tomicropulse mode and power is quadrupled.

Number of spots depend on extent of edema

The patients were followed up monthly for 6 months

At each follow up following investigations are done:

1. Best Corrected Visual Acuity (BCVA) was done with snellens chartconverted to logMAR.
2. Spectral Domain Optical Coherence Tomography (SDOCT)

a.Central Macular Thickness (CMT)was automaticallycalculated in the 9 ETDRS areas (consisting in a centralcircular zone with a 1-mm diameter, representing thefoveal area, and inner and outer rings of 3 and 6 mmdiameter, respectively). The inner and the outer rings aredivided into four quadrants: superior, nasal, Inferior, and temporal.The thickness recorded in central 1mm zoneof 9 ETDRS is recorded as Central Macular Thickness.

a. Macular Volume (MV)Macular volume was defined as the sum of allvolumes of all nine sections.

b. Sub Foveal choroidal Thickness (SFCT)was measured manually as perpendiculardistance from the posterior edge of the RPE to thechoroid/sclera junction

c. Maximum Macular Thickness (MMT) is the highest value recordedwithin 3 mm ring of the 9 ETDRS areas on SD OCT

Criteria for re treatment with laser:

At 3 months follow up of first laser if;

1. Fall in visual acuity by one line of Snellens visual acuity chart
2. Less than 50 micron reduction in Central Macular Thickness (CMT)from BaselinePatient were followed up monthly for 6monthsThe same retreatment protocol was followed if any patient had any of the above mentioned retreatment criteria

Criteria for rescue injection
At any follow up if
• CMT increased by 100 microns
• One line reduction in Snellens visual acuity
• Foveal edema

Statistical analysis

The data was collected, coded and fed in the Microsoft Excel Sheet. The statistical analysis was done using the SPSS (IBM Version 23), Armonk, NY, USA. The descriptive statistics included the mean, standard deviation, frequency and percentage. Within group comparison was conducted using One way ANOVA. Between groups comparison was conducted using Independents t test. The level of significance was set at 0.05 at 95% of Confidence Interval.

III. Result

Total number of patients were 30 and 32 eyes in MMG and MPLT group respectively. The mean age at presentation 59.6 years and 61.8 years in MMG and MPLT groups respectively. In MMG group there were equal number of males and females whereas in MPLT group females (53.1%) were more than males (46.9%). The most common presenting complaint was diminution of Vision followed by Near Vision difficulty and Metamorphopsia in both MMG and MPLT groups respectively. All patients were on Oral Hypoglycaemic agents on presentation. All patients were diabetic and on treatment. Hypertension was the second most common associated risk factor followed by dyslipidemia. 65.50% had a positive family history. Hypertension was the second most common risk factor followed by dyslipidemia. Mean duration of loss of vision in MMG group was 2.66 years. Mean duration of loss of vision in MPLT group was 2.93 years. Average duration of diabetes in MMG group was 10.53 years. Average duration of diabetes in MPLT group was 11.15 years. Duration of diabetes was 10.53 years and 11.15 years in MMG and MPLT groups respectively. Duration of loss of vision was 2.93years and 2.55 years in MPLT and MMG groups respectively.

WITHIN GROUP COMPARISON (MPLT)

Table 1. Follow up BCVA at Baseline pre-laser treatment and post laser 1st, 2nd, 3rd, 4th, 5th and 6th month respectively in MPLT group.

MPLT		Mean (logMAR)	SD	F	Sig.
BCVA	Pre Laser treatment	0.287	0.202	0.370	0.919 (N.S)
	1st month	0.268	0.175		
	2nd month	0.301	0.203		
	3rd month	0.316	0.254		
	4th month	0.340	0.297		
	5th month	0.310	0.223		
	6th month	0.282	0.222		

Table 2: Baseline CMT pre-laser treatment and post laser monthly follow up respectively in MPLT group.

MPLT		Mean (microns)	SD	F	Sig.
CMT	Pre Laser treatment	291.875	35.303	2.074	0.047(S)
	1st month	300.250	35.868		
	2nd month	318.031	89.559		
	3rd month	331.812	91.061		
	4th month	334.000	89.905		
	5th month	321.718	87.451		
	6th month	324.437	92.157		

Table 3. Baseline SFCT pre-laser treatment and post laser monthly follow up respectively in MPLT group.

MPLT		Mean (microns)	SD	F	Sig.
SFCT	Pre Laser treatment	171.000	7.886	0.305	0.951 (N.S)
	1st month	169.906	5.855		
	2nd month	170.468	6.430		
	3rd month	170.968	6.640		
	4th month	170.312	5.670		
	5th month	168.812	12.619		
	6th month	170.906	6.432		

Table 4. Baseline Macular Volume pre-laser treatment and post laser monthly follow up in MPLT group

MPLT		Mean (mm3)	SD	F	Sig.
MV	Pre Laser treatment	8.701	0.988	0.169	0.991(N.S)
	1st month	8.666	0.966		
	2nd month	8.731	1.246		
	3rd month	8.882	1.176		
	4th month	8.800	1.172		
	5th month	8.763	1.239		
	6th month	8.796	1.321		

Table 5. Baseline MMT pre-laser treatment and post laser monthly follow up in MPLT group

MPLT		Mean(microns)	SD	F	Sig.
MM T	Pre Laser treatment	371.468	39.941	0.973	0.452(N.S)
	1st month	373.062	41.582		
	2nd month	379.843	57.159		
	3rd month	384.375	56.294		
	4th month	371.776	89.056		
	5th month	375.281	62.370		
	6th month	378.156	64.892		

WITHIN THE GROUP COMPARISON (MMG)

Table 6. Baseline BCVA pre-laser treatment and post laser monthly follow up in MMG group

MMG		Mean (logMAR)	SD	F	Sig.
BCVA	Pre Laser treatment	0.220	0.058	1.169	0.321(N.S)
	1st month	0.231	0.121		
	2nd month	0.277	0.176		
	3rd month	0.298	0.174		
	4th month	0.257	0.127		
	5th month	0.257	0.135		
	6th month	0.246	0.122		

Table 7. Baseline CMT pre-laser treatment and post laser monthly follow up in MMG group

MMG		Mean (microns)	SD	F	Sig.
CMT	Pre Laser treatment	320.133	38.157	1.696	0.111 (N.S)
	1st month	327.333	37.782		
	2nd month	326.200	35.854		
	3rd month	332.533	36.789		
	4th month	329.933	38.205		
	5th month	326.400	32.336		
	6th month	336.333	38.214		

Table 8. Baseline SFCT pre-laser treatment and post laser monthly follow up in MMG group

MMG		Mean(microns)	SD	F	Sig.
SFCT	Pre Laser treatment	73.800	7.457	2.992	0.005 (H.S)
	1st month	74.000	7.046		
	2nd month	71.333	2.720		
	3rd month	70.133	2.515		
	4th month	71.600	4.263		
	5th month	69.600	3.296		
	6th month	71.066	4.059		

Table 9. Baseline MV pre-laser treatment and post laser monthly follow up in MMG group

MMG		Mean(mm3)	SD	F	Sig.
MV	Pre Laser treatment	8.831	0.729	0.411	0.895(N.S)
	1st month	8.820	0.735		
	2nd month	8.780	0.727		
	3rd month	8.889	0.820		
	4th month	8.745	0.734		
	5th month	8.798	0.713		
	6th month	8.850	0.741		

Table 10. Baseline MMT pre-laser treatment and post laser monthly follow up in MMG group

MMG		Mean(microns)	SD	F	Sig.
MMT	Pre Laser treatment	367.733	26.294	3.335	0.002 (H.S)
	1st month	365.200	29.873		
	2nd month	336.216	93.314		
	3rd month	342.533	99.325		
	4th month	367.066	29.486		

5th month	364.466	30.458	
6th month	373.266	28.253	

Table 11. Comparison of baseline parameters in MPLT and MMG group

PRE-LASER TREATMENT		Mean	SD	T	Sig.
BCVA	MMG	0.220	0.058	2.672	0.000 (H.S)
	MPLT	0.287	0.202		
CMT	MMG	320.133	38.157	-2.362	0.021 (S)
	MPLT	291.875	35.303		
CSFT	MMG	73.800	7.457	-1.106	0.656 (N.S)
	MPLT	71.000	7.886		
MV	MMG	8.831	0.729	0.298	0.767 (N.S)
	MPLT	8.701	0.988		
MMT	MMG	367.733	26.294	0.902	0.004 (H.S)
	MPLT	371.468	39.941		

In MMT group, 9.4 % patients required rescue injections in 1st month. 28.1 % patients required rescue injections in 2nd month. 28.2 % patients required rescue injections in third month. 40.6% patients required rescue injections in fourth month. 28.1% patients required rescue injections in fifth month.31.3% patients required rescue injections in 6th month. The number of rescue injections required in each month was over 6 months was not statistically significant. In MMG group, 20% patients in MMG group required rescue injections in 1st month. 26.7 % required rescue injections in 2nd month. 33.3% patients required rescue injections in 3 month.

Fig 1: Monthly comparison of BCVA in MPLT and MMG group

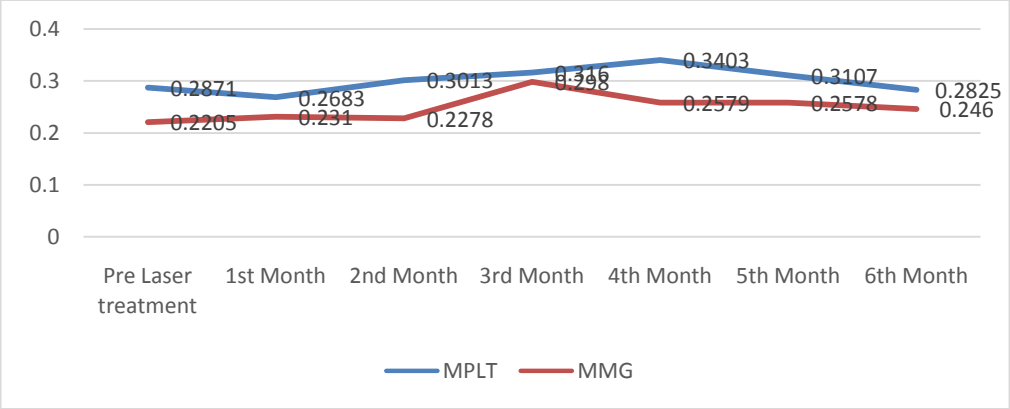


Fig 2: Comparison of baseline pre-laser CMT and follow up CMT between MPLT and MMG groups respectively

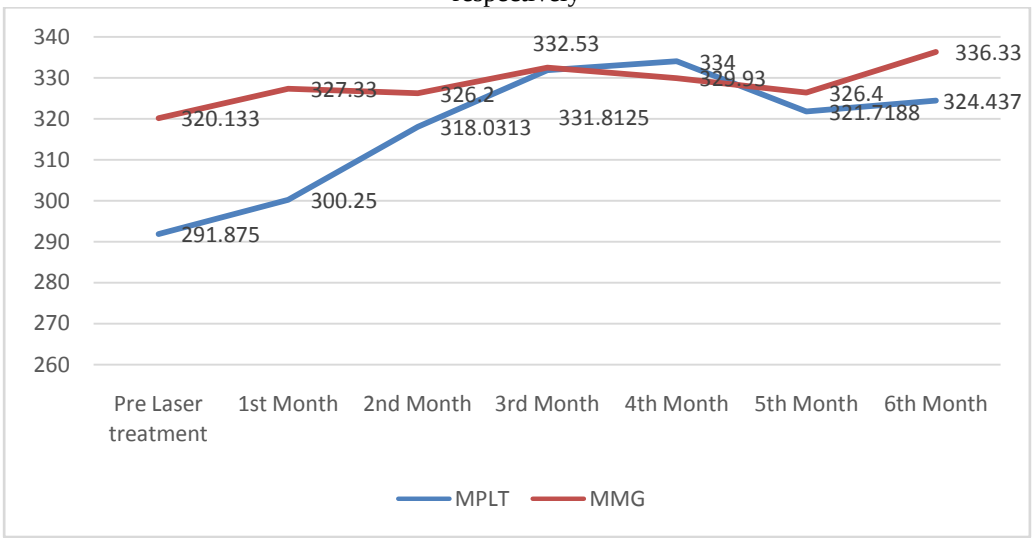


Fig 3: Comparison of baseline pre-laser SFCT and follow up SFCT between MPLT and MMG groups respectively

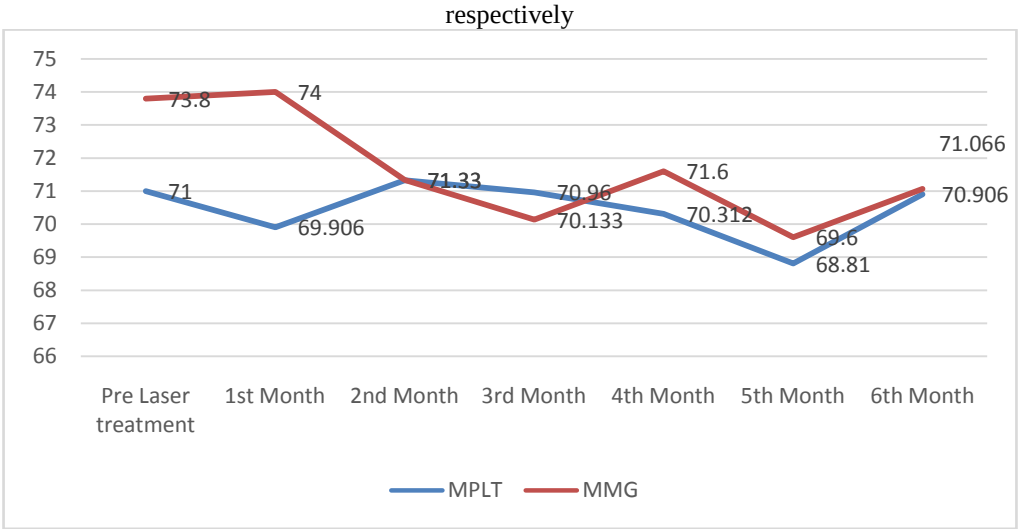


Fig 4: Comparison of baseline pre-laser MV and follow up MV between MPLT and MMG groups respectively

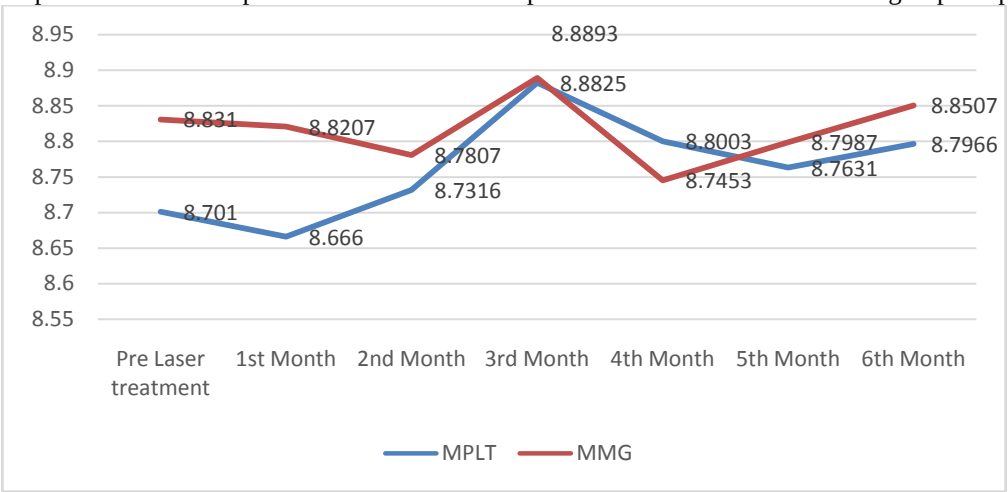
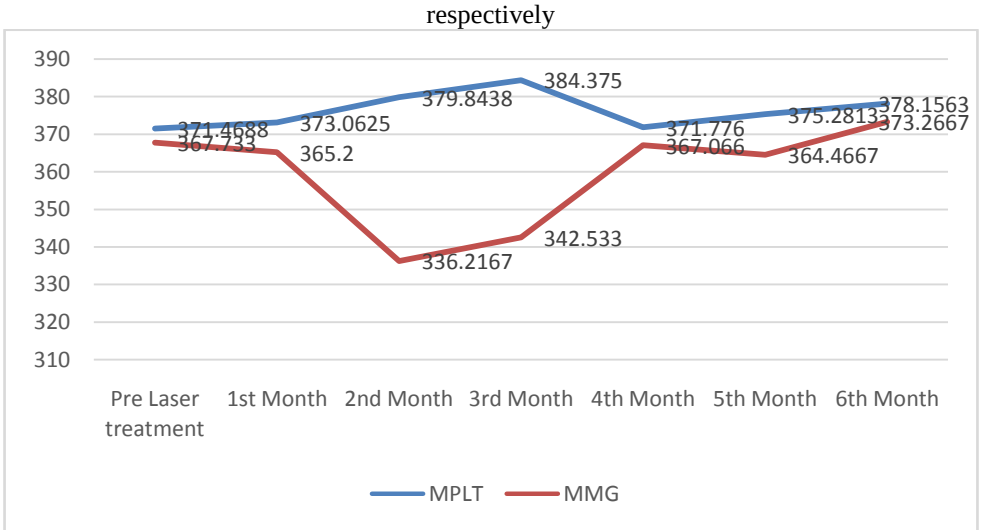


Fig 5: Comparison of baseline pre-laser MMT and follow up MMT between MPLT and MMG groups respectively



IV. Discussion

In this study we included both treatment naïve DME and macular edema treated with anti-VEGF, whereas Guohai et al[10] have studied only treatment naïve DME . The mean age at presentation in MMG group is 59.6 years and MPLT was 61.8 years, whereas Vujosevic et al [11] showed a mean age of the patients was 63.9 ± 9.2 years and Lavinsky D [12] showed a mean (SD) age of 61.9 years.

The duration of loss of vision in MMG group was 2.67±0.48 years whereas in MPLT group 2.93± 0.245years respectively. Duration of diabetes in patients in MMG group is 10.53±4 years and in MPLT group is 11.15±5.94 years respectively. Duration of diabetes in Squirell et al[13] study was 16 years. In this study it was around 11 years. The mean pre treatment HbA1c in Squirrell et al study was 8.0% where as in this study it was 6.5 % or less. The duration of diabetes and baseline severity of the disease may have altered the progression disease in this study.

The baseline BCVA in MPLT is 0.287 logMAR and 0.220 logMAR in MMG group. Vujosevic et al [11] showed a Mean BCVA at baseline was 0.10 ± 0.12 logMAR in the Y-MPL group. There was no significant change in BCVA following Y-MPL at 1, 3 and 6 months follow up. In this study also there was no statistically significant change in BCVA in MPLT group. In MMG group gradual worsening of vision was noted till 3rd month and there was gradual improvement from 3rd to 6th month but the change was not statistically significant. The confounding factor in this study was the use of rescue injections which may have altered the normal course of BCVA with only laser.

Ohkoshi et al[9] showed post MPLT that visual acuity remained unchanged in majority of patients when followed up over 12 months. The laser used in this study was 810 nm where as in this study we used 577nm yellow laser. In this study we could not follow patients upto 1 year as done in this study due time constraints.

Mean baseline CMT in Vujosevic et al[11] yellow laser group was 340.1 ± 35.7 microns whereas In this study it was 291.87 µ. The difference in baseline may have altered the final outcome.

Vujosevic et al[11] studied comparision between 810 nm and 577 nm yellow laser over 6months they noticed that there was drop in CMT in both the groups. In this study, we compared yellow laser with the MMG laser and we did not include treatment naïve DME cases unlike Vujosevic et al which may have altered our final outcome. In this study there was increase in mean CMT noted in both MPLT and MMG groups at 6 month follow up inspite of rescue injections.

Siclair et al[6] observed that if baseline CMT was less than 300 microns there was decrease in CMT when followed over 7 months whereas baseline CMT more than 300 microns there was no change in CMT over 7 months. This study was conducted by 811 nm laser unlike ours, where, we used 577 nm yellow laser and all patients baseline CMT was below 350 microns.

Elisa bottega et al[14] studied comparison of ETDRS laser and MPLT laser 810 nm over a period of one year and noted that there was no significant difference BCVA or CMT between the two groups. In this study we studied yellow laser over a period of 6 months. Mean CMT studied in Japanese eyes treated with MPLT decreased over 12 months[9]. Kishiko et al[9] included naïve cases of diabetes and any intravitreal injections if required were excluded out of the study. In this study rescue injections were a part of the study. We studied the number recue injections needed in each group and monthly comparison of average number of rescue injections needed. Squirrell et al[13] noted improvement in CMT followed by MPLT but they their study was with 810 nm laser and the sample size was only 10 eyes whereas we studied 62 eyes.

Baseline SFCT (Sub foveal choroidal thickness) was 173.8µ in MMG group. At the end of 6 months it was 171.06µ. The mean change was -2.74µ. The baseline SFCT in MPLT group was 171µ and 170.9 microns at 6months. The mean change was -0.1 microns. There was decrease in SFCT in MMG group whereas SFCT was almost the same in MPLT group over 6 months. In this study we noted that there was no significant difference between SFCT of MPLT and MMG group at the end of 6months.

Baseline Macular volume in MMG group was 8.83mm3. At the end of 6 months it was 8.85mm3. Baseline macular volume in MPLT was 8.70mm3. At the end of 6 months it was 8.79 mm3. There was no significant change in macular volume in both MMG and MPLT group. There was slight increase in macular volume in MPLT group compared in MMG. Stella Vujosevic et al[11] studied comparative analysis of change in macular volume in MPLT yellow laser and 810 nm laser and found that there was no significant difference in macular volume at 6month follow up. In this study also we compared yellow MPLT laser with MMG laser and there was no significant change in macular volume at 6 month follow up.

Baseline maximum macular thickness in MMG group was 367.73µ and 373.3µ at the end of 6 months. The mean change in MMT was 5.57µ. Baseline macular thickness in MPLT group was 371.46µ in MPLT group and 378.15µ at the end of 6 months. The mean change in MMT was 6.69µ. There was slight increase in MMT in both the groups but there was no significant mean change of MMT in MPLT and MMG groups. Sinclair et al[15] studied the effect of MPLT laser on MMT over a period of 7 months and noticed that that there was no significant change in MMT over 7 months if Baseline MMT was < 350µ, but there was significant decrease in MMT if Baseline was > 350µ. In this study the Baseline MMT was >350µ there was no statistically significant

change in MMT contradictory to Sinclair et al study. The usage of rescue injections was a confounding factor in our study.

27.8% patients required rescue injections in MMG group and 27.6% patients required rescue injections in MPLT group at the end of 6 months. The need for rescue injection was higher in 4th month (40.6%) of follow up in MPLT group which again reduced at the end of 6 months (31.3%). In MMG group the need was relatively lesser compared to that of MPLT group with 33.30% at 4th and 6thmonth respectively. Sinclair et al[(6)] studied MPLT 810 nm laser over a period of 7 months. In this study patients who required anti VEGF in the course of study were removed from the study. In this study we analysed the number of monthly rescue injections required in both MPLT and MMG laser group over a period of 6 months.

To the best of our knowledge there were no studies comparing MPLT yellow laser with MMG laser in Indian eyes. There is paucity of literature on yellow 577 nm laser, most of the studies which studied MPLT were 810 nm Laser. In this study we studied effect of yellow 577 nm MPLT laser in the treatment of diabetic macular edema, in Indian eyes. And also, we compared its efficacy with conventional MMG laser. The outcomes were compared in terms of BCVA, CMT, SFCT, MV, MMT. To the best of our knowledge all these parameters were never analysed in a single study. This study revealed that there was no significant difference in any of the above parameters between MMG group and MPLT group.

Sub foveal choroidal thickness was expected to decrease in MMG group as compared to MPLT group, because, the action of MPLT laser was proven to be at RPE level. Interesting observation in this study was that the SFCT in MMG group and MPLT group were comparable, there was no statistically or clinically significant difference among both the lasers in terms of effect on choroidal thickness.

Another peculiar feature of this study was Rescue injections, Unlike other studies,We did not exclude the patients who required Rescue injections during the study period. We analysed the monthly percentage of patients requiring rescue injections in each group and we also have compared rescue injections required in each group at the end of 6months. This study revealed that there was no statistically significant difference between the rescue injections needed in MPLT and MMG group.

V. Conclusion

In patients with moderate diabetic macular edema, both sub thresholdmicropulse diode yellow laser and Mild Macular Grid laser were equallyeffective in maintaining the visual acuity, macular volume, sub foveal choroidalthickness and maximum macular thickness. Whereas, mild macular grid laser wascomparatively more effective in maintaining the central macular thickness.

References

[1]. Klein R, Klein BE, Moss SE, Cruickshanks KJ. The Wisconsin Epidemiologic Study of Diabetic Retinopathy: XVII. The 14-year incidence and progression of diabetic retinopathy and associatedrisk factors in type 1 diabetes. Ophthalmology. 1998 Oct;105(10):1801–15.

[2]. National Diabetes Prevention Program | Diabetes | CDC [Internet]. [cited 2018 Jun 16]. Available from: https://www.cdc.gov/diabetes/prevention/index.html

[3]. The Wisconsin Epidemiologic Study of Diabetic Retinopathy | JAMA Ophthalmology | JAMA Network [Internet]. [cited 2018 Jun 16]. Available from: https://jamanetwork.com/journals/jamaophthalmology/article-abstract/641178

[4]. Das T, Aurora A, Chhablani J, Giridhar A, Kumar A, Raman R, et al. Evidence-based review of diabetic macular edema management: Consensus statement on Indian treatment guidelines. Indian J Ophthalmol. 2016 Jan;64(1):14–25.

[5]. Akduman L, Olk RJ. Subthreshold (invisible) modified grid diode laser photocoagulation in diffuse diabetic macular edema (DDME). Ophthalmic Surg Lasers. 1999 Dec;30(9):706–14.

[6]. Sinclair SH, Alaniz R, Presti P. Laser treatment of diabetic macular edema: comparison of ETDRS level treatment with threshold-level treatment by using high-contrast discriminant central visual field testing. Semin Ophthalmol. 1999 Dec;14(4):214–22.

[7]. Writing Committee for the Diabetic Retinopathy Clinical Research Network, Fong DS, Strauber SF, Aiello LP, Beck RW, Callanan DG, et al. Comparison of the modified Early Treatment Diabetic Retinopathy Study and mild macular grid laser photocoagulation strategies for diabetic macular edema. Arch Ophthalmol Chic Ill 1960. 2007 Apr;125(4):469–80.

[8]. Friberg TR, Karatza EC. The treatment of macular disease using a micropulsed and continuous wave 810-nm diode laser. Ophthalmology. 1997 Dec;104(12):2030–8.

[9]. Ohkoshi K, Yamaguchi T. Subthreshold micropulse diode laser photocoagulation for diabetic macular edema in Japanese patients. Am J Ophthalmol. 2010 Jan;149(1):133–9.

[10]. Chen G, Tzekov R, Li W, Jiang F, Mao S, Tong Y. Subthreshold micropulse diode laser versus conventional laser photocoagulation for diabetic macular edema: A Meta-Analysis of Randomized Controlled Trials. Retina Phila Pa. 2016 Nov;36(11):2059–65.

[11]. Vujosevic S, Martini F, Longhin E, Convento E, Cavarzeran F, Midena E. Subthresholdmicropulse yellow laser versus subthreshold micropulse infrared laser in centerinvolving diabetic macular edema: Morphologic and Functional Safety. Retina Phila Pa. 2015 Aug;35(8):1594603

[12]. Lavinsky D, Cardillo JA, Melo LAS, Dare A, Farah ME, Belfort R. Randomized clinical trial evaluating mETDRS versus normal or high-density micropulse photocoagulation for diabetic macular edema. Invest Ophthalmol Vis Sci. 2011 Jun 17;52(7):4314–23.

[13]. Squirrell DM, Stewart AW, Joondeph BC, Danesh-Meyer HV, McGhee CNJ, Donaldson ML. Largespot subthreshold infrared laser to treat diabetic macular edema. Retina Phila Pa. 2008 Apr;28(4):615–21.
[14]. Vujosevic S, Bottega E, Casciano M, Pilotto E, Convento E, Midena E. Microperimetry and fundus autofluorescence in diabetic macular edema: subthreshold micropulse diode laser versus modified early treatment diabetic retinopathy study laser photocoagulation. Retina Phila Pa. 2010 Jun;30(6):908–16.
[15]. Luttrull JK, Dorin G. Subthreshold Diode Micropulse Laser Photocoagulation (SDM) as Invisible Retinal Phototherapy for Diabetic Macular Edema: A Review. Curr Diabetes Rev. 2012 Jul;8(4):274– 84

Dr Viplav Goutham Reddy B, et. al. "Comparison of Subthreshold Micro Pulse Diode Laser (Yellow Laser, 577nm) and Combination of Anti Vascular Endothelial Growth Factors and Mild Macular Grid (MMG) Laser in the Treatment of Diabetic Macular Edema." *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, 19(10), 2020, pp. 10-19.