CHANGES IN MACULAR THICKNESS AND VISION IN PATIENTS UNDERGOING PANRETINAL PHOTOCOAGULATION FOR DIABETIC RETINOPATHY WITHOUT MACULAR OEDEMA

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ABSTRACT

BACKGROUND
Panretinal photocoagulation (PRP) is done for severe nonproliferative diabetic retinopathy (NPDR) or early proliferative diabetic retinopathy (PDR). When it is done for patients without macular oedema PDR may induce a macular oedema which may worsen the visual acuity.

MATERIALS AND METHODS
A prospective cohort study was conducted for one year with minimum follow up period of 6 months. Seventy eyes of 41 patients who were undergoing PRP for severe nonproliferative diabetic retinopathy or early proliferative diabetic retinopathy were studied. These eyes had best corrected visual acuity (BCVA) ≥0.6 and no macular oedema as determined by clinical examination using 78 diopter lens and Optical Coherence Tomography (OCT) (Zeiss Cirrus HD OCT). The BCVA was determined using decimal charts and converted into logarithm of minimal angle of resolution scale for statistical analysis. Visual acuity and macular thickness at 1, 3, 6 and 12 months post PRP were studied.

RESULTS
The Central Macular Thickness (CMT) measurements (mean±standard deviation) were 160±15 before PRP and 176±16, 178±20, 189±30, 187±25µm at 1, 3, 6 and 12 months after PRP respectively (P<0.05 for each). The mean±standard deviation of the visual acuity measurements converted into logarithm of the minimal angle of resolution was 0.03±0.12 before PRP and 0.04±0.13, 0.04± 0.12, 0.03±0.08, 0.03±0.08 at 1, 3, 6 and 12 months after PRP. There was no statistically significant difference in visual acuity in follow up examinations from the pre PRP levels (P>0.05 for each).

CONCLUSION
Routine PRP with 2000 burns given in two divided sessions at two weekly intervals can safely be performed with no effect on visual acuity in patients with severe DR without pre-existing macular oedema.

KEYWORDS
Panretinal Photocoagulation, Central Macular Thickness, Vision.

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BACKGROUND
A prospective study in 1976, the Diabetic Retinopathy study (DRS), demonstrated that panretinal photocoagulation (PRP) reduced the risk of severe vision loss due to complications of proliferative diabetic retinopathy (PDR).¹ Subsequently Early Treatment Diabetic retinopathy study (ETDRS) reported that severe vision loss in patients with severe nonproliferative diabetic retinopathy (NPDR) or PDR can be reduced by more than 50% by treatment with PRP.² Consequently PRP has been accepted as the standard care for patients with PDR.³ PRP has been associated with numerous complications including macular oedema causing decreased visual acuity.⁴,⁵,⁶ Other complications of PRP include angle closure glaucoma, visual field defects, choroidal detachment and accommodation problems.⁷,⁸,⁹ Mc Donald and Schatz.⁶ reported that 8% patients experienced permanent macular oedema and vision loss after PRP. In the detection of diabetic macular oedema optical coherence tomography (OCT) is more sensitive than clinical examination especially in case with macular thickness of 200 to 300 µm.¹⁰,¹¹,¹²,¹³ Some previous studies have reported development of macular oedema after PRP and these studies had not utilized OCT. Atleast some part of this reported new onset macular oedema after PRP might have been worsening of preexisting macular oedema that had not been detected by clinical examination and OCT was not utilized in such studies.¹⁴,¹⁵ Therefore we examined the alteration in macular thickness and visual acuity after PRP in patients with...
severe NPDR and non-high-risk PDR both without macular oedema as determined by OCT and clinical examination.

MATERIALS AND METHODS
Seventy eyes of 41 patients who were undergoing PRP for severe NPDR or early PDR were studied. These eyes had best corrected visual acuity (BCVA) ≥0.6 and no macular oedema as determined by clinical examination using 78 diopter lens and OCT (Topcon 3D OCT). The BCVA was determined using decimal charts and converted into logarithm of minimal angle of resolution scale for statistical analysis. The macular thickness was measured by OCT using a fast macular thickness map scan. In this program a 6 mm area around the fovea was scanned using 6 radial scans and it gives mean thickness in 9 regions, namely, a central ring of 1000 μm and the 4 quadrants each of an inner ring and an outer ring, were calculated. The diameter of inner and outer rings were 1000 μm to 3000 μm and 3000 μm to 6000 μm respectively. The thickness of the central ring and the mean thickness of the quadrants in the inner and outer rings were calculated before PRP and at 1, 3, 6 and 12 months post PRP. The central macular thickness (CMT) was calculated as the mean thickness of 6 separate measurements of the thinnest part of macular center. Patients with other ocular diseases like glaucoma, venous occlusion, other macular pathologies and previous history of any ocular surgery has been excluded. Visual acuity and macular thickness at 1, 3, 6 and 12 months post PRP were studied. ANOVA for repeated measures was used to study changes in macular thickness over the study period. To study changes in vision, McNemar-Bowker Test was applied.

OBSERVATION AND RESULTS
Seventy eyes of 41 patients who were undergoing PRP for severe NPDR or early PDR were studied. Sixty percentage of the patients had early PDR, 15.7% had severe NPDR and 24.3% had early PDR in one eye and severe NPDR in the other eye. The age of the study population ranged between 42 years to 58 years (mean, 50±12 years). Seventy three patients were males. No history of ocular disease other than refractive errors was reported. All the patients had type 2 diabetes with duration of 2 years to 12 years (mean 7±3 years). Out of 41 patients 51.2% were hypertensives taking antihypertensive treatment, 68.3% had hyperlipidaemia, 51.2% had coronary artery disease. The haemoglobin A1c level averaged 7.9 ± 1.4 mg/dL before PRP (Table 1). Because of the persistence of retinal neovascularisation additional PRP was required in 7 of the 70 eyes during the 12 month follow up period.

The central macular thickness (CMT) measurements (mean± standard deviation) were 160±15 before PRP and 176±16, 178±20, 189±30, 187±25 μm at 1, 3, 6 and 12 months after PRP respectively (P <0.05 for each). The mean± standard deviation of central ring thickness measurements were 199 ±17 μm before PRP and 224±21, 233 ±24, 237 ±25, 243±25 μm at 1,3,6 and 12 months after PRP respectively (P<0.05 for each ). For the inner ring, the mean±standard deviation of the thickness were 272±23 μm before PRP and 278±22, 282±22, 284±22, 286±22 μm at 1,3,6 and 12 months after PRP respectively (P<0.05 for each). The mean±standard deviation of the visual acuity increased in macular thickness were 254±25 before PRP and 261±25, 261±37, 267±25, 271±24 μm at 1,3,6 and 12 months after PRP respectively (P<0.05 for each). During the entire study period all macular thickness measurements showed a steady increase from the pre PRP values. (Fig 1)

There was no statistically significant difference in visual acuity in follow up examinations from the pre PRP levels (P>0.05 for each).

DISCUSSION
Panretinal photocoagulation can prevent vision loss. According to ETDRS vision loss in severe NPDR or PDR can be reduced by >50% with PRP.2,3 But PRP was shown to produce macular oedema and so reduced visual acuity.4,5 McDonald and Schatz,6 reported an increase in macular oedema after PRP in 43% patients with PDR. Shimura et al7 and Lee et al15 obtained similar results in two independent studies. Another study done by Park et al16 also showed that mean central and peripheral macular thickness increased significantly after PRP. Yet another study conducted by Alexander et al17 while comparing the outcomes of PRP in single sitting versus 4 sitting, also noticed similar changes. So PRP should be performed with caution in patients with good visual acuity and no macular oedema. Moreover PRP may also produce accommodation problems, visual field defects, colour vision defects, vitreous haemorrhage and retinal detachment.7,8,9

Previously many studies had utilized clinical examination alone, with slit lamp biomicroscopy utilizing 90 or 78 noncontact lens to assess macular oedema. But OCT is more sensitive than clinical examination in detecting macular oedema especially when the macular thickness is between 201 μm to 300 μm.10-14 So in those studies where only clinical examination was utilized, many a times preexisting macular oedema would have been missed and it would have been increased after PRP. This worsening of macular oedema was
erroneously labelled as PRP induced macular oedema. Shimura et al[7] reported that increase in macular thickness was greater in eyes treated with PRP sessions separated by weekly intervals than those treated by 2 weekly intervals. The authors reported that there was a greater increase in central retinal thickness in eyes treated weekly than in the eyes treated biweekly and the resolution of the oedema was slower in eyes treated weekly. In this study there was a steady increase in the central ring middle ring and outer ring thickness from first month to twelfth month after PRP which was statistically significant (P<0.05). During the 12 month follow up period, additional PRP was required in 7 of the 70 eyes, because of residual retinal neovascularisation.

All our patients had a pre-laser visual acuity of 6/12 (+0.3 log MAR) or better. At the end of the study, 66 out of 70 eyes maintained their vision, 3 patients showed an improvement and 1 patient had a 2 line drop in vision due to vitreous haemorrhage following PRP. This was not statistically significant (P>0.05).Shimura et al[8] in their study suggested that for eyes with severe diabetic retinopathy and good visual acuity PRP did not affect post laser visual acuity after following up of 64 eyes of patients with severe NPDR or early PDR. Similar results were obtained by Lee et al[15] in their study to detect changes in macular thickness after PRP. Most of our patients had high pre-treatment visual acuity which may be one reason for maintained visual acuity among our patients. Another study by Park et al[16] concluded that in eyes with diabetic retinopathy treated with PRP the mean visual acuity did not decrease significantly, but mean central and peripheral macular thickness significantly increased after treatment. Yasuda et al[18] in their study to assess the retinal thickness before and after PRP in patients with severe diabetic retinopathy and intact visual acuity observed that visual acuity was maintained in 36 out of 43 eyes and decreased in 7 eyes. The study concluded that risk factors which caused decrease of visual acuity after PRP are thickening of macula before PRP and prominent increase of macular thickness after first session of PRP.

In this study, macular thickness progressively increased from pre-laser to post -laser period but the visual acuity was maintained in all eyes except one indicating that post PRP increased macular thickness has no relationship with visual acuity. The cause for vision drop may be due to vitreous haemorrhage as evidenced in present study or due to thickening of macula before PRP as evidenced by previous studies which we can easily be picked up by pre laser OCT and patient can be made aware of it. The possible explanations for the maintenance of visual acuity in our patients were high presenting visual acuity, pre laser OCT examination to detect any pre-existing macular oedema and 2 weekly intervals between PRP sessions.

CONCLUSION

In conclusion routine PRP with 2000 burns given in two divided sessions at two weekly intervals can safely be performed with no effect on visual acuity in patients with severe DR without pre-existing macular oedema. But our results need to be confirmed with a larger study population and a more prolonged follow up time.

REFERENCES


