The Effect of Panretinal Photocoagulation on Visual Acuity and Macular Thickness in Proliferative Diabetic Retinopathy

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ABSTRACT

Aim: -To report any changes in central macular thickness (CMT) measured by optical coherence tomography (OCT) and visual acuity (VA) measured by Snellen chart after Pan retinal photocoagulation (PRP) in patients with proliferative diabetic retinopathy (PDR) without macular edema.

Patients and methods: - This was a prospective, interventional case series study in Baquba teaching hospital in which patients with PDR treated with two sessions of panretinal photocoagulation and for each patients, we record the pretreatment central macular thickness (CMT) and visual acuity (VA). The post-treatment CMT and VA at one month and three months were recorded.

Results: -30 eyes with PDR underwent PRP laser, the mean of prelaser central macular thickness was 232.5+/-42µm which increased to 267.5+/-35µm at one month after the second session and to 252.47+/-33µm after three months of the second session and in both the p–value is < 0.0001.

The prelease visual acuity was 6/6-6/9 in 30% and 6/12-6/24 in 70% of patients ,and at one month after the second session 73.3% of patients had the same visual acuity ,while 20% of patients had a decrease of one line in visual acuity and 6.7% of patients had a decrease of two lines of visual acuity, and at three months after the second session 83.3% of patients had the same visual acuity, while 13.3% of patients had a decrease of one line in visual acuity and 3.4% of patients had a decrease of two lines of visual acuity.

Conclusion: -This study suggests that central macular thickness and visual acuity significantly change after 2 sessions of PRP in PDR.

Keywords:

Introduction

Proliferative Diabetic Retinopathy: -

Proliferative Diabetic Retinopathy (PDR) represents an advanced stage of diabetic eye disease characterized by the growth of newly formed retinal vessels on the retina or optic disc that extend along the retinal surface or into the vitreous cavity, significantly increasing the risk of vision loss.[1,2]

These new vascular growths are commonly accompanied by progressively increasing fibrous proliferation, the subsequent contraction of the fibrous tissue can lead to traction retinal detachment , vitreous hemorrhage and rubeosis iridis, the three most common complications associated with visual loss in PDR. Invariably, treated or untreated, PDR will eventually reach an involutional quiescent stage which may remain stable for decades.[3]

The visual outcome is dependent on the degree of damage to critical visual structures that has occurred by that point. Laser photocoagulation

induces this quiescent state earlier, usually with less associated retinal damage and visual loss.[3]

Panretinal photocoagulation (PRP) treatment for proliferative diabetic retinopathy:

The Diabetic Retinopathy Study (DRS) conclusively demonstrated that PRP significantly reduces the risk of severe visual loss from PDR, particularly when high-risk PDR is present. [1,4,5]

Patients entering the DRS had PDR in at least one eye or severe non-proliferative diabetic retinopathy in both eyes.

High risk PDR:-

1. New vessels on the disc (NVD)>1/3 disc area.
2. Any NVD with vitreous or preretinal hemorrhage.
3. New vessels elsewhere (NVE) >1/2 disc area with vitreous or preretinal hemorrhage.[6-8]

Full PRP has done as used in Diabetic Retinopathy Study (DRS) and Early Treatment Diabetic Retinopathy Study (ETDRS), including 1500 or more burns with size 500µm been separated from each other by one-half burn width, at 0.1 second duration and treatment divided into 2 or more sessions. [7, 9]

Complications of PRP:-

Although visually threatening complications from PRP may arise, such as (vitreous haemorrhage, macular oedema, choroidal detachment, choroidal effusion, tractional retinal detachment and malignant glaucoma).[7,8] The long-term safety and efficacy of PRP in reducing the risk for severe visual loss has been confirmed by numerous large multicenter clinical trials and PRP is the only proven long-term therapy for PDR .[3,7]

The Early Treatment Diabetic Retinopathy Study (ETDRS) divided PRP into two or more sessions in an effort to reduce side effects, including exacerbation of macular edema.[7,9]

Aim of study:-

To report any changes in central macular thickness (CMT) measured by optical coherence tomography (OCT) and visual acuity (VA) measured by Snellen chart after Panretinal photocoagulation (PRP) in patients with proliferative diabetic retinopathy (PDR) without macular edema.

Patients And Methods

This is prospective, hospital based study, performed in Ibn Al-Haitham teaching eye hospital in Iraq, Baghdad. Patients with proliferative diabetic retinopathy referred to the retinal clinic in the hospital included in this study during period from October 2015 to June 2016.

All patients were informed verbally about the PRP and their side effects and enrolled with their written consent insured.

Inclusion criteria:-

1. Type 1 and 2 diabetic patients.
2. Any type of diabetic control, insulin and oral hypoglycemic agents.
3. PDR without macular edema, and central macular thickness was less than 300µm by OCT.

Exclusion criteria:

1. Clinical Significant Macular Edema (CSMO) and/or central macular thickness was more than 300µm.
2. History of recent cataract surgery within one year.
3. Corneal opacity.
4. Dense cataract.
5. Uveitis.
6. Glaucoma.
7. Vitreous Hemorrhage.
8. Epiretinal membrane/Vitreomacular traction.
9. Tractional retinal detachment.
10. VA less than 6/24 by Snellen chart.

All patients' data were recorded including age, sex, duration of diabetes, and type of glycemic control, BCVA by Snellen chart and central macular thickness (CMT) by OCT(CIRRUS HD–OCT, Carl Zeiss) as baseline (pretreatment) then 1 month after 2nd session and 3 months after 2nd session, VA and OCT examination done by the same optometrist and operator.

PRP done as two sessions of two weeks apart and in each session did 750-1000 shots (500µm diameter and 0.1 duration and the power titer to get mild to moderate reaction).

Statistical analysis:-

Statistical analysis was done using SPSS v.21. P< 0.05 was considered the lowest limit of significance. The results were expressed in form of mean ± standard deviation. The difference between the means of any parameter in study was assessed by the use of dependent samples t-test.

Results

This study included 33 eyes of 22 patients (3 eyes of 2 patients were excluded due to occurrence of vitreous hemorrhage before completing the treatment), so continue on 30 eyes of 20 patients (11 females and 9 males).

The demographic data showed that 13 patients representing (65%) were in the middle age group (46-60 years old) while only 3 patients (15%) were between (30-45 years old) and 4 patients (20%) were between (61-75 years old).

Table (1) Distribution of the study sample by their demographic data:

Demographic Data	Age intervals/Sex	Number of patients	Percent
Age/Years	30 – 45	3	15%
	46 – 60	13	65%
	61 – 75	4	20%
Sex	Male	9	45%
	Female	11	55%

The types of glycemic control in this study show that 10 patients (50%) use insulin for glycemic control, while 8 patients (40 %) use oral hypoglycemic drugs and only 2 patients (10%) use both, as shown in table(2).

Table (2) Distribution of the study sample by their types of glycemic control:

Types of glycemic control	Number of patients	Percent
Insulin	10	50%
Oral hypoglycemic	8	40%
Both	2	10%

The pre-laser central macular thickness was (200–250μm) in 27 eyes (90%) while 3 eyes (10%) was (251–300μm).

The prelaser visual acuity show that 21 eyes (70%) were between (6/12 – 6/24) while 9 eyes (30%) were between (6/6 – 6/9) as shown in table (3) and figures (1,2).

Table (3) Distribution of the study sample by their pre – laser measures:

Measures	Range	Number of patients	Percent
Central macular thickness(μm)	200 – 250	27	90%
	251 – 300	3	10%
Visual Acuity	6/6 – 6/9	9	30%
	6/12-6/24	21	70%

The central macular thickness at 1 month after 2nd session of PRP show that 26 eyes (86.6%) was between (251–300μm) ,while 2 eyes (6.7%) was between (200–250μm), and 2 eyes (6.7%) was between (301–350μm). The visual acuity at 1 month showed that 22 eyes (73.3%) was the same visual acuity, 6 patients (20%) had decreased one line and 2 eyes (6.7%) had decreased two lines as shown in table (4) and figures (1,2).

Table (4) Distribution of the study sample according to their measures 1 month after 2nd session:-

Measures	Range	Number of patients	Percent
Central macular thickness(µm)	200 - 250	2	6.7%
	251 - 300	26	86.6%
	301 - 350	2	6.7%
Visual Acuity	Same VA	22	73.3%
	Decrease one line	6	20%
	Decrease two lines	2	6.7%

The central macular thickness at 3 months after 2nd session of PRP showed that 17 eyes (56.7%) was between (200–250µm), while 13 eyes (43.3%) was between (251–300µm).

The visual acuity at 3 months show that 25 eyes (83.3%) had the same visual acuity, while 4 eyes (13.3%) had decreased one line, and 1 eye (3.4%) had decreased two lines as shown in table(5) and figures(1,2).

Table (5) Distribution of the study sample according to their measures 3 months after 2nd session:-

Measures	Range	Number of patients	Percent
Central macular thickness(µm)	200 - 250	17	56.7%
	251 - 300	13	43.3%
Visual Acuity	Same VA	25	83.3%
	Decrease one line	4	13.3%
	Decrease two lines	1	3.4%

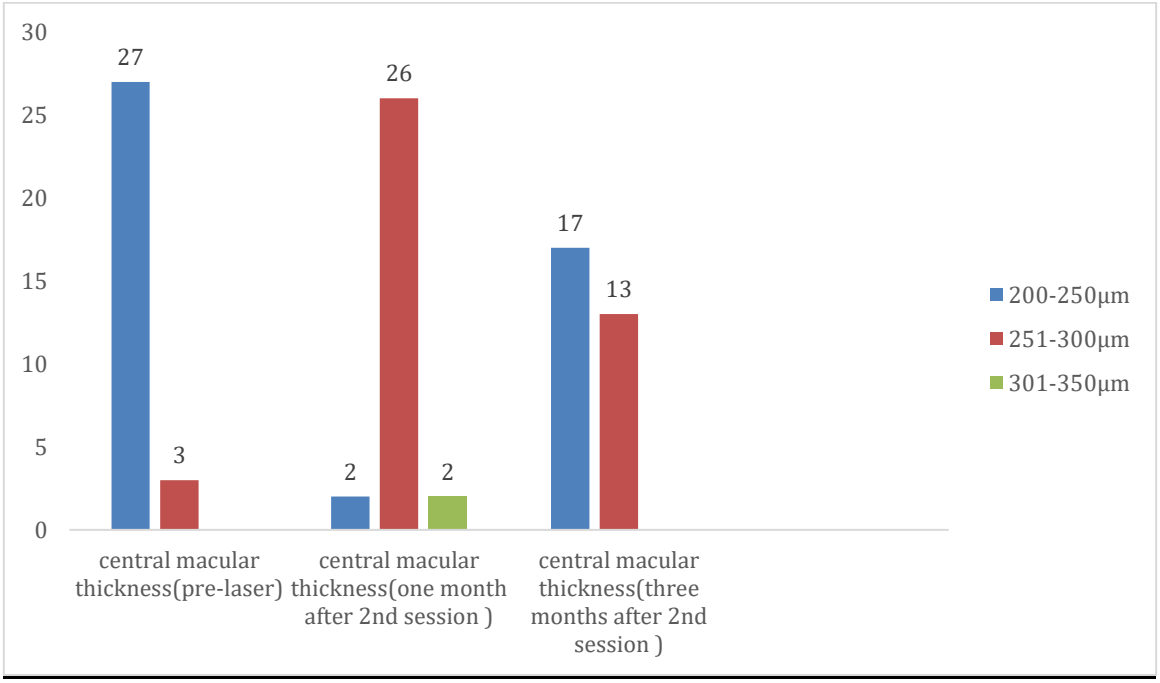

Figure (1) Changes in central macular thickness over time.

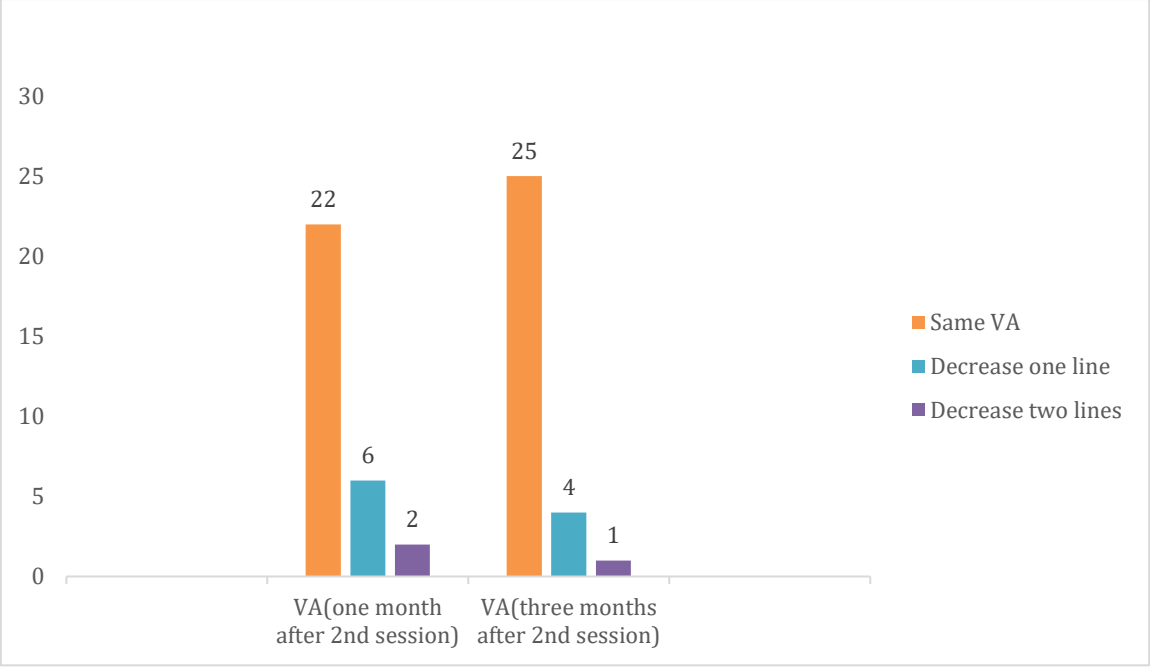

Figure (2) Changes in Visual Acuity over time

The mean central macular thickness was:-

1. (prelaser) 232.5±16.26µm,
2. (1month after 2nd session of PRP) 267.5±16.42µm
3. (3 months after 2nd session of PRP) 252.47±16.26µm.

Table (6) showed that there was statistically significant difference between central macular thickness pre and after (1 and 3 months) of (PRP) laser.

Table (6) showed the central macular thickness pre and after laser :-

Main Measures	Mean (±SD)	p-value
Central Macular Thickness (prelaser)	232.5±16.26	
Central Macular Thickness(1 month after 2nd session)	267.5±16.42	0.0001
Central Macular Thickness (3 months after 2nd session)	252.47±16.26	0.0001

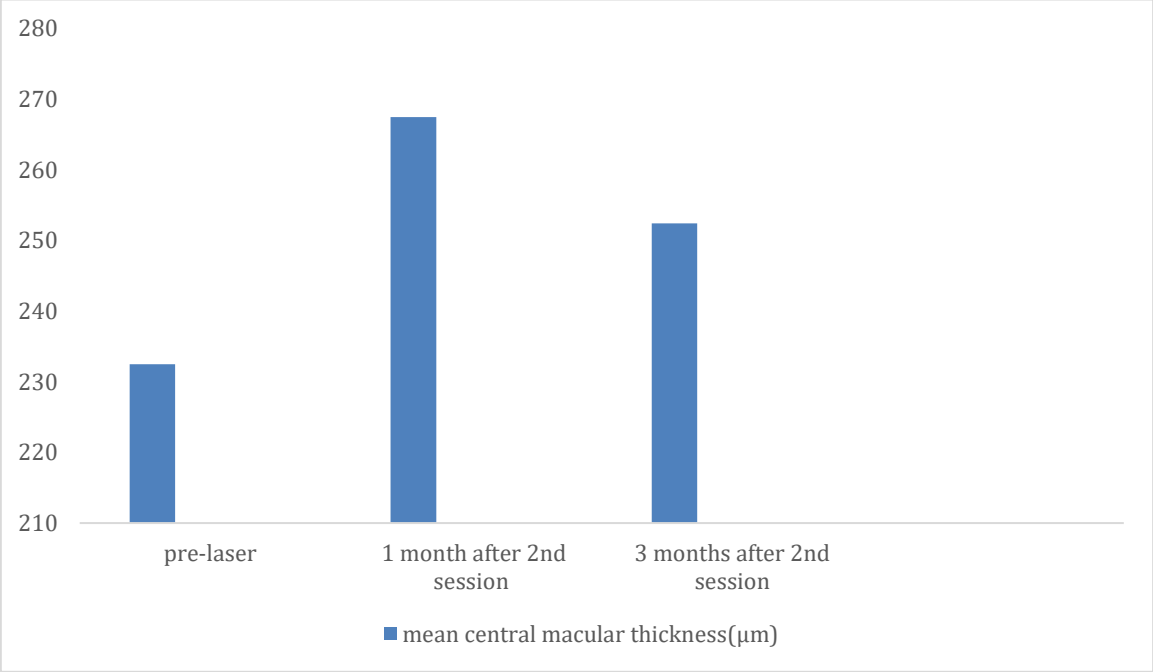

Figure (3) the mean central macular thickness pre and after laser.

Discussion

Proliferative Diabetic Retinopathy represents an advanced stage of diabetic eye disease and PRP is the only proven long-term therapy for PDR.

In this study, we found the mean CMT was increased about (35μm) after 1 month and (20μm) after 3 months and p-value < 0.0001 which is significant were comparable to Manoj Soman study[10] in which CMT was increased about (42μm) after 1 month and (34μm) after 3 months (that is may be because both studies were used conventional laser) and different to Nawat Watanachai study[11] in which CMT was increased about (24μm) after 1 month and (17.4μm) after 3 months. The difference may be because the latter was used PASCAL laser.

Regarding visual acuity; it was either stable {(73.3%) & (83.3%)} or worse {(26.7%) & (16.7%)} after 1 month and 3 months intervals respectively. It was comparable to Manoj Soman study[10] in which VA was stable (81.58%) or worse (18.42%) after 3 months and to M. Shimura study[12] in which VA was stable (84.4%) or worse (15.6%) after 3 months. That was may be due to usage of conventional laser.

Up to our knowledge, this is the first study to report the effect of panretinal photocoagulation on visual acuity and macular thickness in proliferative diabetic retinopathy in a sample of Iraqi population, still the major limitation of this study was small sample size.

Conclusions

This study suggests that there is a transient significant change in visual acuity (VA) and central macular thickness (CMT) after PRP due to macular edema which is maximum after one month and tend to decrease after three months.

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