



RESEARCH ARTICLE

EFFECT OF LASER PHOTOCOAGULATION ON CONTRAST SENSITIVITY, VISUAL ACUITY AND COLOUR VISION IN PATIENTS OF DIABETIC MACULAR EDEMA.

Nirmala Jyothi Pamu¹, V. Rajeswara Rao² and Chandana Priyanka S³.

1. Associate Professor, Department of Ophthalmology, AMC, Vishakhapatnam. Andhra Pradesh, INDIA.
2. Professor, Department of Ophthalmology, AMC, Vishakhapatnam Andhra Pradesh, INDIA.
3. Postgraduate, Department of Ophthalmology, AMC, Vishakhapatnam Andhra Pradesh, INDIA.

Manuscript Info

Manuscript History

Received: 11 December 2018

Final Accepted: 13 January 2019

Published: February 2019

Abstract

Aim: To assess the effects of laser photocoagulation on contrast sensitivity, visual acuity and colour vision in patients of diabetic macular edema.

Methods: It is a hospital-based prospective analytical study conducted on 30 eyes of type 1 and types 2 of diabetes mellitus patients with NPDR and non-centre involved diabetic macular edema of more than 18 years of age of both the sexes for a one-year duration.

Results: The majority belonged to the age group of 51-60 yrs. Males represented 60% with a peak incidence at 51-60 years and females represented 40%. BCVA was stabilized in 63%, improved by 26% and decreased by 10%. In this study, the mean baseline contrast sensitivity was 0.49 log CS which improved significantly to 0.60 log CS and 0.64 log CS at 3 and 6 months respectively. No change in colour vision was noted at 6 months follow up.

Conclusion: Timely treatment of Diabetic macular edema with laser retinal photocoagulation prevents further dysfunction and salvages involved retina causing statistically significant improvement in vision and quality of life.

Copy Right, IJAR, 2019, All rights reserved.

Introduction:-

Diabetes is a major global burden nowadays Diabetes mellitus is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion and insulin action or both. Chronic hyperglycemia is associated with damage to different organs especially to eyes kidneys and nerves heart and blood vessels. The prevalence of diabetes is increasing globally and is anticipated to rise from 4% in 1995 to 5.4% in 2020¹. So the prevalence of its complications is also increasing globally. As per the World health organization, India has 31.7 million diabetic subjects². Macular edema is the most common cause of moderate visual loss which occurs as a complication of diabetes³. Moderate visual loss is defined by ETDRS as a doubling of the visual angle that is a drop of 3 or more lines of Snellen's chart. The ETDRS demonstrated that focal laser photocoagulation reduces the risk of moderate visual loss in CSME.⁴

As the macula is concerned with visual acuity, colour vision, contrast sensitivity and form vision, the disease of the macula is associated with defective form vision, colour vision and contrast sensitivity. The changes in the contrast

Corresponding Author:-Nirmala Jyothi Pamu.

Address:-Associate Professor, Department of Ophthalmology, AMC, Vishakhapatnam. Andhra Pradesh, INDIA.

sensitivity are present in the diabetics even with normal visual acuity recorded by the Snellen's chart. Mechanism of loss of contrast sensitivity in DME (diabetic macular edema) is not known but may be due to accumulation of abnormal fluids in the macula^{5,9} and enlargement of foveal avascular zone¹⁰ macular edema, is the thickening of retina in the region of macula caused by break down of inner retinal barrier at the papillary endothelial level. The prevalence of macular edema is more in non-insulin dependent diabetes mellitus patients requiring insulin for glycemic control⁶. The diabetic macular edema is broadly divided into focal macular edema and diffuse macular edema.

Optical coherence tomography (OCT) provides insight into underlying retinal layers and yields useful information. According to OCT, there are 5 distinct patterns of macular edema. (11)

1. Sponge-like retinal thickening
2. Cystoid macular edema
3. Subserous retinal detachment
4. Focal tractional retinal detachment
5. Taut posterior hyaloid membrane

According to current ETDRS guidelines, focal or grid laser photocoagulation remains the gold standard for diabetic macular edema without central involvement. ETDRS gave the treatment strategies for diabetic macular edema and is followed worldwide. The central macular thickness was found to be the most predictive factor for visual prognosis. According to ETDRS Diabetic macular edema can be graded into CSME which is a good indicator of laser photocoagulation. It includes any of the following findings:-

1. Retinal thickening at or within 500 microns of the centre of the macula
2. Hard exudates at or within 500 microns of the centre of the macula with the adjacent retinal thickening
3. An area or areas of retinal thickening at least disk area in size part of which is within one disc diameter of the centre of the macula

OCT definition retinal thickening due to DME > 2 SD beyond the normal value outside the central subfield but < mean +SD in spectral domain OCT within the central subfield. All through the central macular thickness was found to be most predictive factor additional factors like angiographic leakage at the inner subfields also contribute to loss of visual acuity (VA).

In this study, we compared the changes in the VA, macular thickness and volume parameters measured with OCT in patients with non-central-involved macular edema (Non-CME) treated with focal laser photocoagulation.

Aims and Objectives:-

To evaluate visual acuity, colour vision, and contrast sensitivity in patients with non-centre involved diabetic macular edema following laser photocoagulation.

Materials and Methods:-

It is a hospital-based prospective analytical study conducted on 30 eyes of type 1 and type 2 of diabetes mellitus patients with NPDR and non-centre involved diabetic macular edema of more than 18 years of age of both the sexes. Definite retinal thickening due to diabetic macular edema within 3000 microns of the centre of macula but involving the central subfield.

According to DR CR. NET approved spectral domain OCT machine –ZEISS, cirrus < 290 in women and <305 in men. Patients with media not clear, active proliferative diabetic retinopathy and those who had undergone prior photocoagulation and patients with a history of recent ocular surgery, a patient with other disorders of retina / optic nerve in which contrast sensitivity is already compromised and best corrected visual acuity less than 3/60 were excluded from the study

Visual acuity was recorded with the help of self-illuminated Snellen acuity chart placed at a distance of 6 meters and best corrected visual acuity (BCVA) taken after giving appropriate spherical and cylindrical lenses. These BCVA measurements are converted into log mar units for statistical analysis.

Then the contrast sensitivity test was conducted by using Pelli Robison chart, which is a wall mount chart kept at a distance of 1 meter which is illuminated by room light. A contrast sensitivity test was conducted before the dilatation of the pupils.

Colour vision was recorded by using FARN'S WORTH D12 test then detailed anterior segment evaluation was done by slit lamp examination and ocular comorbidities were ruled out.

The fundus evaluation was done with the help of direct and indirect ophthalmoscope. Then OCT was performed through dilated pupils using cirrus zeiss HD-OCT macular scans

After fundus fluorescein angiography to detect the areas of the leak, laser photocoagulation was done by a single retina specialist in the retina clinic after obtaining written consent from the patient.

Focal direct laser treatment:-

Directly treat all leaking microaneurysms in areas of retinal thickening between 500 and 3000 μm from the centre of the macula (but not within 500 μm of the disc). -Spot size - 50 μm - Burn duration - 0.05 to 0.1 sec -power 50–150mwatt.

Modified grid laser: focal treatment for leaking microaneurysms and grid treatment to the areas of retinal thickening with diffuse leakage located more than 500 microns from the centre of the macula and 500 microns from the temporal margin of the optic disc. Spot size should be 100 to 200 microns, duration of laser 0.10 second power-100-150mWatt.

Results:-

The age groups of the patients included under the study ranged from 40-75 years with a mean age of 58.48 ± 7.8 years.

Figure 1:-

Age group	Males	Females	Total
41-50	3	5	8
51-60	9	5	14
61-70	5	2	7
71-80	1	-	1
Total	18	12	30

Figure 2:-

Duration of diabetes	No. of eyes
0-5 yrs	10
6-10 yrs	12
11-15 yrs	4
16-20 yrs	3
21-25 yrs	1
Total	30

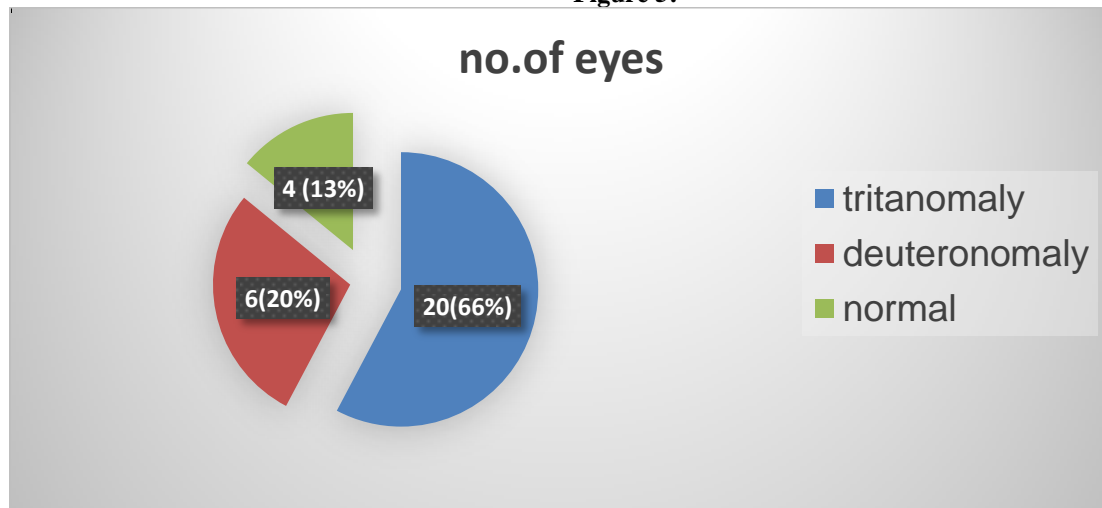
Figure 3:

Stage of diabetic retinopathy	no. of eyes in laser arm
-------------------------------	--------------------------

MILD NPDR	-
MODERATE NPDR	21
SEVERE NPDR	9
Total	30

Figure 4:-

Visit	VISUAL ACUITY	CONTRAST SENSITIVITY	MEAN CST	IZT	OZT
Baseline	0.35	0.49 log cs	251.8	354.52	308.02
3 month	0.34	0.60 log cs	245.44	337.57	295.25
6 month	0.33	0.64 log cs	243.20	334.33	292.14

Figure 5:-**Figure 6:-**

BCVA	
Improved	8
Stable	19
Decreased	3
No. of eyes	30

Discussion:-

In the present study age group of the patients included under the study ranged from 41-75 years. The majority belonged to the age group of 51-60 yrs. This is in concordance with Seo and Park et al.¹² study which showed the mean age of 57.9 ± 13.8 years. It was also in concordance with Arevalo et al. study with a mean age of 59.7 ± 9.3 years.

In the present study, males represented 60% with a peak incidence at 51-60 years and females represented 40%. A similar male preponderance was documented in Nagasawa T et al, Arevalo et al²⁰, Ozkiris A et al¹⁵ which showed male to female ratio of 1.7:1, 1.2:1, 1.3:1 respectively. In a study conducted by Lee CM, and Olk RJ¹³ on modified grid laser photocoagulation in patients with diffuse diabetic macular oedema between the years 1981 and 1990 visual acuity improved in 14.5%, unchanged in 60.9%, and worse in 24.6% after treatment.

In our study, BCVA was stabilized in 63%, improved by 26% and decreased by 10%. In a study conducted by Talwar Det al¹⁴ on contrast sensitivity following laser photocoagulation in CSME, the mean pre-laser contrast sensitivity score was 121.3 ± 83.6 which increased significantly to a mean of 151.6 ± 80.5 which concluded that focal argon laser photocoagulation in CSME helps in improving the contrast sensitivity and stabilizes the visual acuity. In

our study, the mean baseline contrast sensitivity was 0.49 log CS which improved significantly to 0.60 log CS and 0.64 log CS at 3 and 6 months respectively.

In the present study Tritan defect was seen in 20 eyes (66%), deutan defect seen in 6 eyes (20%) and colour vision was normal in 4 eyes (6%). No change in colour vision was noted at 6 months follow up. Sadiqulla et al¹⁶ reported a red-green loss pattern prevailing then total colour blindness, Shin et al¹⁷ reported a blue-yellow loss pattern, the same reported by Patzelt¹⁸ and Ma'ar et al¹⁹.

Limitations of the study are Limited duration of follow up, Long term complications of laser photocoagulation were unknown. Small sample size

Conclusion:-

Timely treatment of Diabetic macular oedema with laser retinal photocoagulation prevents further dysfunction and salvages involved retina causing statistically significant improvement in vision and quality of life.

References:-

1. King H, Aubert RE, Herman WH. Global burden of diabetes, 1995–2025: prevalence, numerical estimates, and projections. *Diabetes Care* 1998;21:1414–31
2. Wild S, Roglic G, Green A. Global prevalence of diabetes, estimates for the year 2000 and projections for 2030. *Diabetes Care* 2004;27:1047-53.
3. Klein R, Barbara EKK, Moss SE, Davis DM, DeMets DL. The Wisconsin Epidemiologic study of diabetic retinopathy IV. Diabetic macular edema. *Ophthalmology* 1984;91:1464-74
4. Early Treatment Diabetic Retinopathy Study Research Group. Treatment techniques and clinical guidelines for photocoagulation of diabetic macular oedema: Early Treatment Diabetic Retinopathy Study. Report Number 2. *Ophthalmology* 1987;84:761-74
5. Bresnick GH. Diabetic maculopathy: a critical review highlighting diffuse macular edema. *Ophthalmology*. 1983; 90: 1301 – 1317
6. Dosso AA, Bonvin ER, Morel Y. Risk factors associated with contrast sensitivity loss in diabetic patients. *Graefes Arch Clin Exp Ophthalmol*. 1996; 234: 300 – 305.
7. Ghafour IM, Foulds WS, Allan D. Contrast sensitivity in diabetic subjects with and without retinopathy. *Br J Ophthalmol*. 1982; 66: 492 – 495.
8. Sala SD, Bertoni G, Somazzi L. Impaired contrast sensitivity with and without retinopathy: a new technique for rapid assessment. *Br J Ophthalmol*. 1985; 69: 136 – 142.
9. Hellstedt T, Kaaja R, Teramo K. Contrast sensitivity in diabetic pregnancy. *Graefes Arch Clin Exp Ophthalmol*. 1997; 235: 70 – 75.
10. Arend O, Remky A, Evans D. Contrast sensitivity loss is coupled with capillary dropout in patients with diabetes. *Invest Ophthalmol Vis Sci*. 1997; **38**: 1819 – 1824.
11. Vishali Gupta, Amod Gupta, Mangat R Dogra. Atlas Optical Coherence Tomography of Macular Diseases. 2004;22.
12. Seo JW, Park IW. Intravitreal bevacizumab for the treatment of diabetic macular edema. *Korean journal of Ophthalmology*. 2009 Mar 1;23(1):17-22.
13. Olk RJ. Modified grid argon (blue-green) laser photocoagulation for diffuse diabetic macular edema. *Ophthalmology*. 1986 Jul 1;93(7):938-50.
14. Talwar D, Sharma N, Pai A, Azad RV, Kohli A, Viridi PS. Contrast sensitivity following focal laser photocoagulation in clinically significant macular oedema due to diabetic retinopathy. *Clinical & experimental ophthalmology*. 2001 Feb;29(1):17-21.
15. Özkiris A, Evereklioglu C, Erkilic K, Tamcelik N, Mirza E. Intravitreal triamcinolone acetate injection as a primary treatment for diabetic macular edema. *European journal of ophthalmology*. 2004 Nov;14(6):543-9.
16. Sadiqulla M, Khan IA, Rahmath AG. OCT determined macular thickness in diabetic retinopathy and relation to colour vision deficiency patterns. *International Journal of Medical Science and Public Health*. 2014 Mar 1;3(3):265-9.
17. Shin YJ, Park KH, Hwang J-M, Wee W, Lee J, Lee I, Hyon J. A novel colour vision test for detection of diabetic macular edema. *Invest Ophthalmol Vis Sci*. 2014; 55:25–32. DOI:10.1167/iov.13-11698.
18. Patz A, Schatz H, Berkov J. Macular edema: an overlooked complication of diabetic retinopathy. *Trans Am Acad Ophthalmol Otolaryngol*. 1973; 77: 34–42.
19. Ma'ar N, Tittl M, Stur M, Reitner A. A new colour vision arrangement test to detect functional changes in diabetic macular oedema. *Br J Ophthalmol*. 2001; 85:47–51.
20. Arevalo JF, Fromow-Guerra J, Quiroz-Mercado H, Sanchez JG, Wu L, Maia M et al Pan-American Collaborative Retina Study Group. Primary intravitreal bevacizumab (Avastin) for diabetic macular edema: results from the Pan-American Collaborative Retina Study Group at 6-month follow-up. *Ophthalmology*. 2007;114:743–50.