Contrast Sensitivity in Adult Type II Diabetes Patients without Retinopathy, with Retinopathy and Post-Laser Photocoagulation

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ABSTRACT

BACKGROUND
India is emerging as world’s diabetic capital. The cases of diabetic retinopathy are also increasing. We wanted to determine whether contrast sensitivity can be used as early indicator in diabetic retinopathy and also to measure and compare the contrast sensitivity in adults with type 2 diabetes mellitus with retinopathy and post-laser photocoagulation and correlate the contrast sensitivity in patients without diabetic retinopathy.

METHODS
This cross-sectional study included 50 diabetic patients with and without retinopathy and also 30 patients who had undergone laser photocoagulation who were above 30 years. Detailed history was obtained; ocular examination, and measurement of contrast sensitivity with Pelli Robson E and alphabet chart were done. Statistical analysis was done using Spearman’s coefficient of correlation, analysed using Epi Data / SPSS.

RESULTS
Contrast sensitivity was found to be reduced in post laser photocoagulation group and retinopathy group when compared to no retinopathy group. CS value between 'No Retinopathy' and 'Post Laser' groups, the p value by unpaired t test was found be statistically significant (p<0.0001). Similar reduction in CS between 'No Retinopathy' group and 'Retinopathy' group (p<0.0001) was reported.

CONCLUSIONS
Contrast sensitivity could be a useful and easily available clinical tool in assessing retinal function in diabetic patients at a primary OPD setup.

KEYWORDS
Contrast Sensitivity, Diabetes Retinopathy, Retinal Photocoagulation, Pelli-Robson Chart.
BACKGROUND

Diabetes mellitus (DM) is the commonest chronic illnesses in Indian subcontinent and India is emerging as diabetic capital of world. A WHO estimate that by year 2030, 79.4 million people will be suffering from diabetes. Early Screening with monitoring is one of the most effective future means of minimizing the complications associated with diabetes mellitus. There is a definitive social benefit of increasing life span with good visual performance by early screening and treatment. Diabetic retinopathy (DR) refers to the retinal changes seen in patients with diabetes mellitus. Both vascular and metabolic factors play a role in its pathogenesis of diabetic retinopathy. A pan India AIOS (All India Ophthalmic Society) study in 2014 the prevalence of diabetic retinopathy was 21.27% with range from 12.27% to 34.06% depending upon zones.

Contrast sensitivity (CS) is a macular function test and it evaluates the central vision. Vision has many components like visual acuity, CS and dark adaptation. CS is the ability of the visual system to detect subtle differences in patterns and shading, so as to discriminate object or details from their background. DR involves all retinal layers and affects both visual acuity and CS. In DR there is a dissociation of VA and CS in the initial stages of disease itself. Visual function disturbances like CS occurs early in diabetes before any structural abnormalities in fundus that can be detected by ophthalmoscopy or by fluorescein angiography. Hence out of many screening test in diabetic retinopathy measuring contrast sensitivity can be considered as a potential tool. The present study is done to measure the contrast sensitivity in adults with Type 2 Diabetes Mellitus without retinopathy, with retinopathy and post laser photocoagulation.

METHODS

This is a cross sectional study in adult type II diabetes patients without retinopathy, with retinopathy and post-laser photocoagulation presenting to the ophthalmology outpatient department of a tertiary eye care hospital. The study followed the principles of the Declaration of Helsinki and was approved from the institutional ethics committee MIMS Mandya. Written informed consent from participants of this study was obtained. The study included 50 diabetic patients without retinopathy in group 1, 50 patients with diabetic retinopathy in group 2 and 30 patients post-laser photocoagulation in Group 3. Male and female patients of age group more than 30 years and less than 70 years with type II DM willing to participate in the study were included. Patients with any other retinal or ocular diseases were excluded. Patients on local or systemic medication which can cause retinopathy, mentally challenged individuals, patients with history of second cranial nerve injury or head injury which can affect his/her CS and cataract cases were excluded from the study. Age and gender of the patients were recorded in a proforma. A brief ocular and systemic history was taken. Enquiry regarding the duration of diabetes and its treatment was made. Using Snellen’s distant chart, visual acuity in each eye was assessed. Using Appasamy I chart HD (Appasamy Associates Chennai India) which contains Pelli-Robson Chart CS was measured. The grey scale of letter and E chart of Pelli-Robson Chart has a font size corresponding to Snellen’s chart optotype 6/24. There are lines of increasing contrast corresponding to 100%, 80%, 60%, 40%, 20%, 10%, 5%, 4%. CS of 5% and less is considered as normal. Values above 5% are abnormal which denotes a decrease in CS. The test chart was illuminated by room light. Testing was carried out at 1 m (LogMAR equivalent 1.3) before dilating the pupils by a single trained observer. CS testing was carried out at a distance of 1 meter (3.33 feet) with the patient wearing his spectacle correction. The anterior segment was examined using slit-lamp. Posterior segment was examined using +90D (Volk Optical Inc) lens, slit lamp biomicroscopy after dilating the pupils and also by indirect ophthalmoscope with +20 D (Volk Optical Inc) lens. Patients with even one microaneurysm or intraretinal haemorrhage were included as diabetic retinopathy. Diabetic retinopathy was further classified according to ETDRS guidelines. Patients with proliferative diabetic retinopathy and Clinically Significant Macular Oedema were treated as per modified ETDRS guidelines. Subjects received retinal photocoagulation using frequency doubled Nd: YAG Laser (Neodymium-doped yttrium aluminium garnet) supplied by Carl Zeiss Germany. Data collected using proforma was entered in excel sheet and analysed using Epi data /SPSS software. Descriptive statistics like percentage, mean, standard deviation has been applied and other relevant inferential statistics like chi square test (to know the association), t test (to know the difference between two groups).

RESULTS

Among the 130 participants in the age group 30 to 70 years, 50 patients (90 eyes) had no retinopathy, 50 patients (91 eyes) had retinopathy changes and 30 patients (45 eyes) underwent laser photocoagulation. In our study totally 68 were males (No retinopathy group-26, with retinopathy- 25, post laser group-17) and 62 were females (No retinopathy group-24, Retinopathy group- 25, post laser group-13).

<table>
<thead>
<tr>
<th>Age Group Yrs.</th>
<th>No Retinopathy Group</th>
<th>Retinopathy Group</th>
<th>Post Laser Group</th>
</tr>
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<tbody>
<tr>
<td>&lt;40</td>
<td>6</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>41-50</td>
<td>15</td>
<td>17</td>
<td>0</td>
</tr>
<tr>
<td>51-60</td>
<td>18</td>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td>61-70</td>
<td>11</td>
<td>19</td>
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</tbody>
</table>

Table 1. Age Group Distribution in Diabetic Patients

<table>
<thead>
<tr>
<th>Contrast Sensitivity in %</th>
<th>No Retinopathy Group (Eyes)</th>
<th>Retinopathy Group (Eyes)</th>
<th>Post Laser Group (Eyes)</th>
</tr>
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</tr>
<tr>
<td>0.80</td>
<td>84</td>
<td>46</td>
<td>00</td>
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</table>

Table 2. Contrast Sensitivity Distribution in Diabetic Patients
Contrast sensitivity distribution (Table 2) shows deterioration in CS in retinopathy and post laser group.

Contrast sensitivity is one of potential tool for screening early stages in diabetic retinopathy. A study by Khosla PK et al evaluated contrast sensitivity in 22 diabetic patients (22 eyes without retinopathy and 16 eyes with background retinopathy and 10 control subjects (20 eyes) and concluded that CS was significantly lower in diabetic eyes with retinopathy than in the normal eyes (p =0.011) or the diabetic eyes without retinopathy (p = 0.033). They advocated that CS may be of value in screening diabetic patients for retinopathy in primary care facilities. In another study by S Della Sala et al, fifteen diabetic patients (6/20 with retinopathy and 9/22 without) had test scores more than two standard deviations below the norm for age-matched controls. Contrast sensitivity was significantly lower in diabetic eyes with retinopathy than in the normal eyes.

Verotti A et al measured contrast sensitivity in diabetics with and without retinopathy. They concluded an obvious decrease in contrast sensitivity in diabetic retinopathy. Even diabetic patients without retinopathy showed a reduced contrast sensitivity when compared to controls which was similar to our study. In our study there is a progressive deterioration of contrast sensitivity in as diabetic retinopathy advances in stages. In another study by Hellstedt et al. suggested that CS is a sensitive indicator of early changes in diabetic retinopathy. CS improved among patients receiving focal and grid laser therapy. They suggested changes in VA and CS were independent of each other.

In another study by Abrishami et al advocated that the loss of CS in diabetics is attributed to retinal changes, but also to lenticular changes. Risk factors for loss of CS is advanced age, lenticular opacity etc which was excluded in our study. Still we observed a significant CS loss in diabetic patients compared with normal subjects. In another study by Wong et al suggested decreased CS in diabetics with minimal or no retinopathy is not clear and hypothesised that probable mechanism cause could be disturbance of neural function in the retina and visual pathways by of the aldose reductase pathway overloading mechanisms.

CS is thus a useful tool in conjunction with BCVA in patients with DR as it correlates with the subjective visual disability better than high contrast visual acuity in Snellen’s charts. We thus recommend measurement of CS in all patients of DR. Further studies with much larger sample size need to be conducted to quantify the change in visual function.

CONCLUSIONS

Contrast sensitivity may be a sensitive tool in picking up subtle changes in visual function in patients and assessment can be included in routine workup of patients with DM. The cross-section sampling is a limitation of the study. A longer follow-up period will help in better understand as to for how long the effect of treatment actually lasts.
REFERENCES


