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Research Article

Comparing and Evaluating Photo Stress Recovery Time in Diabetic and Normal Population

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Abstract

Background: Photo stress recovery time is the time it takes for the macula to come back to its normal function level after exposure to a strong light source. Early diagnosis is well known to be important for effective diabetic retinopathy treatment. In recent years, the focus has been on considering macular recovery after glare as a parameter that is altered not only in manifest retinopathy, but also in the preclinical stage.

Method: A cross-sectional study was conducted at ASG Eye Hospital, Nepal. The study population consisted normal, diabetic and diabetic retinopathy patients. The photo stress test was performed on each patient. Statistical analysis was performed using SPSS for windows.

Result: Of total 90 subjects**,** the mean photo stress recovery time (PSRT) of normal patients on right eye and left eye were 7.46 ± 1.87 and 7.5 ± 1.54 sec respectively, mean PSRT of diabetic patients on right eye and left eye were 14.03 ± 2.39 and 14 ± 2.32 sec respectively and mean PSRT of diabetic retinopathy patients on right eye and left eye were 55.83 ± 8.26, 57.46 ± 7.76 sec respectively. PSRT obtained from the 3 groups of subjects was statistically different ($p < 0.001$).

Conclusion: PSRT values depend upon the clinical status of the retina. These findings highlight the need and efficacy of simple technique which can be very useful to anticipate diabetic retinopathy from diabetic patients.

Keywords: Diabetes; Diabetic Retinopathy; Macular Function; Photo Stress Recovery Time; Retinal Recovery

Introduction

Early diagnosis is well known to be important for effective diabetic retinopathy treatment. Consequently, there is growing interest in predictive and diagnostic procedures. In recent years, the focus has been on considering macular recovery after glare as a parameter that is altered not only in manifest retinopathy, but also in the preclinical stage [1].

The chemical balance of the retinal cells is troubled when the eye is exposed to a bright light. It can be used to test retinal function otherwise known as the photo stress test for the time it takes to recover the retina. Photo stress recovery time (PSRT) is the time it takes for the macula to come back to its normal functional level after exposure to a strong light source. PSRT relies on the speed of photo pigment regeneration after bleaching and this regeneration normally occurs when retinal metabolic processes or links are intact for both retinal pigment epithelium and photoreceptors [2].

The number of clinical techniques used to evaluate macular function is minimal. The common methods used in the office of the ophthalmologist are Snellen visual acuity and Amsler grid test-

ing. The visual fields of the central 30° can document the macular scotoma area. Foveal and macular electroretinography and visual response testing may be used to quantify macular function, but in the office of the ophthalmologist these techniques are not widely available. Macular function screening is often performed in the examination of patients with reduced vision, Nevertheless. The easily and commonly used macular function measures Snellen visual acuity and Amsler grid testing do not asses the pathophysiological characteristics of the diseases process [2-7].

The Macular photo stress test (MPT) hypothesis involves:

- The bleaching of retinal pigments by an intense light stimulus,
- The transient state of visual insensitivity and scotoma's afterimage production, and
- The return of retinal sensitivity due to visual pigment resynthesis in the retinal pigment epithelium complex (RPE)-photoreceptor.

The Recovery Time (RT) is presumably dependent on the anatomical and biochemical events occurring in the retina during the vision photopic process [8]. The MPT was used in the study to examine diabetic retinopathy, known to have impaired macular function. Several factors such as aging, eye diseases and medications can affect PSRT [9-12]. The impact of aging on PSRT is still under discussion as some studies found increased age-related PSRT while other found no significant effect [13].

Diabetic retinopathy affects the inner retina's microvasculature [14] and causes neurodegeneration, which can occur regardless of changes in microvasculature [15] several studies have shown that PSRT in people with diabetes is high [16,17]. In primary open angle glaucoma (POAG), characterized by progressive death of retinal ganglion cells, elevated PSRT was found. PSRT remains a useful screening tool for the photo stress test. Some additional points concerning the photo stress test are that it is safe short non-invasive and inexpensive in the duration of the procedure [11,18,19].

Therefore, it is believed that there is a need for more studies to ensure a better understanding and standardization of the test. In this study we measured PSRT in people with diabetes retinopathy to determine whether the PSRT values are affected by these conditions or not. Measurements were performed using Margrain and Thomson's best clinical technique [9].

Methods and Methodology

Research place and Study design

A cross-sectional study was conducted at ASG Eye Hospital, Nepal. A total of 90 participants were included in the study. Every participants were made aware of the test prior examination.

The study was conducted study with the objective of analysing the photo stress recovery time in diabetic patients and to compare with the control group as well as to study macular function in diabetic patients.

Examination

The photo stress test was done to each patient and control group by an experienced examiner using a direct ophthalmoscope with full charge. All the participants were explained about the test. Best corrected visual acuity at distance was determined for each eye, and all subsequent acuity determinations were made using appropriate lens corrections. Snellen test letters was used at 6 meters (20 feet). In cases of unilateral visual defect the normal eye (control) was tested first; otherwise, the right eye was tested first.

With the opposite eye shielded, the patient looked directly into the ophthalmoscope. Immediately after the light was removed, the patient was asked to begin reading the test letters just larger than best acuity. For example, an eye with visual acuity of 6/6 (20/20) was tested on the 6/7.5 (20/25) or 6/9 (20/30) line after the photo stress test. The direct ophthalmoscope (adjusted to full intensity) was projected directly onto the macula for 30 seconds. The ophthalmoscope was held 5cm from eye and fixation was confirmed visually by the examiner.

After this procedure the time taken for acuity to return within two line of pre-bleach was measured. Pupil size was not measured during the test.

Patients with diabetes (Type I and II) were included for the study. No patients were included with ocular alterations except diabetic retinopathy.

Statistical analysis

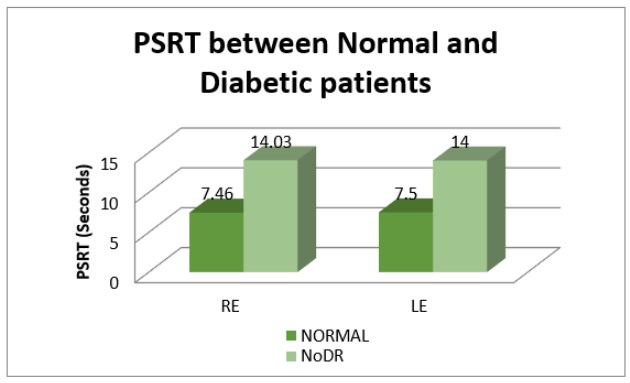
Statistical analysis was performed using SPSS for windows ver. 19.0. SPSS was used to record and analyse the data.

Results

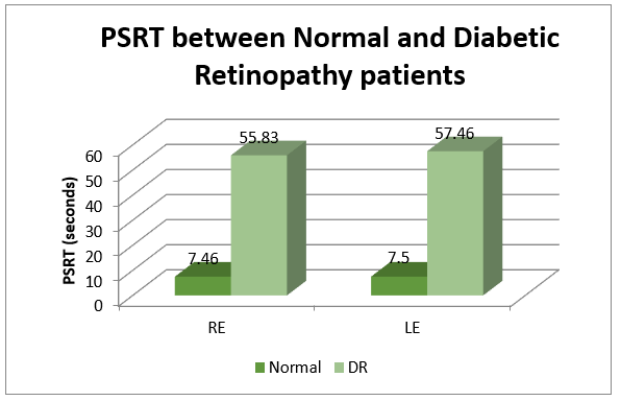
A total of 90 subjects were enrolled for the study and of these 30 (33.33%) were normal patients, 30 (33.33%) were diabetic patients and 30 (33.33) were diabetic retinopathy patients. There were 53 (58.88%) males and 37 (41.12%) females. The age range of the patients was 10 to 80 years (mean 49.86 ± 19.32). The visual acuity of the 53 male and 37 female patients in the study ranged from 6/6 to 6/18. None of the patients had hypertension and renal failure requiring dialysis. The mean PSRT of normal patients were right eye (7.46 ± 1.87) and left eye (7.5 ± 1.54) sec, mean PSRT of diabetic patients were right eye (14.03 ± 2.39) and left eye (14 ± 2.32) and mean PSRT of diabetic retinopathy patients were right eye (55.83 ± 8.26) and left eye (57.46 ± 7.76) respectively. Photo stress recovery time obtained from the 3 groups of subjects was statistically different ($p < 0.001$). Since the data of samples were statistically independent with each other, Two-sample t test was used to calculate the significance.

S.N	Normal Patients	Diabetic Patients	Diabetic Retinopathy
Right Eye (sec)	7.46 ± 1.87	14.03 ± 2.39	55.83 ± 8.26
Left Eye (sec)	7.5 ± 1.54	14 ± 2.32	57.46 ± 7.76

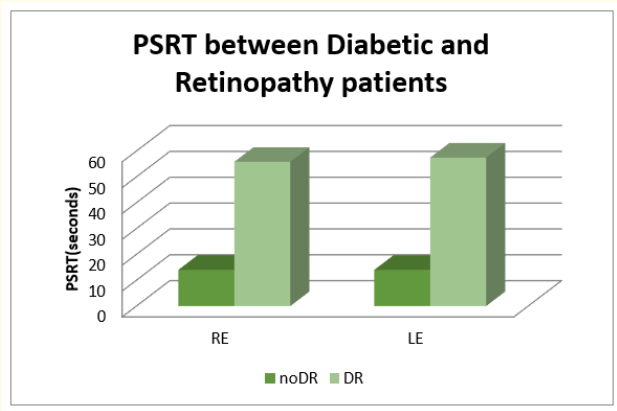
Table 1: Mean PSRT difference between normal, diabetic and diabetic retinopathy patients.



Graph 1: PSRT comparison between normal and diabetic patients.



Graph 2: PSRT comparison between normal and diabetic retinopathy patients.



Graph 3: PSRT comparison between diabetic and retinopathy patients.

Discussion

In this study, we analyzed the clinical status of retinas of normal, diabetic and diabetic retinopathy patients using simple technique i.e. Photo stress recovery test (PSRT) or macular photo stress test (MPT). PSRT has been used for the past four decades for varying presentations of retinal problems.

The eye with diabetic retinopathy in which the anatomic lesion involves the RPE-photoreceptor complex has a markedly prolonged recovery time. It is the RPE cell that plays an important role

in the storage and transport of retinol (vit-A), an essential component of the visual pigment rhodopsin. One can expect an abnormal processing of the light as it bleaches the rhodopsin, where the RPE and photoreceptor interaction is anatomically deranged.

In one of the previous studies, the eyes with macular edema whose lesion is in the outer retina rather than the RPE cell show a less-prolonged abnormal RT than the eyes with ARMD. It is interesting that the eyes with macular edema, some of which have excellent visual acuity (in the range of 20/20 to 20/40), still show a prolongation of the RT compared with normal eyes [20].

It can be assumed that if a diabetic subjects responds to the PSRT with the time values less than 47 sec, that subject behaves as a normal individual and therefore is at minimum risk of developing retinopathy. And greater than 47sec is at high risk of developing retinopathy.

Antonio., *et al*. [21] conducted a research on the macular photo stress test in diabetes, glaucoma and cataract respectively. The purpose of the study was to apply a recommended clinical technique to measure the PSRT in those eye diseases which may alter the PSRT values. 101 controls and 105 patients with diagnosed diabetes (with absence of diabetic retinopathy) primary open angle glaucoma (POAG) and cataracts underwent photo stress testing. Macula was illuminated for 30sec using Heine direct ophthalmoscope. They categorized the age into 3 groups i.e. A, B and C. Group A with 43 - 54, Group B with age 55 - 64 and Group C with 65 - 74 years respectively.

They concluded that PSRT changes with the age ($p > 0.02$). In group A, control group had slower PSRT than diabetic group. Cataracts and POAG did not affect the PSRT significantly.

The theoretical basis of the PSRT cannot be directly tested or validated in the clinical situation. The PSRT may measure physiologic function of the retina, but much still needs to be learned about its precise mechanism of action. Our study has given some interesting results, and the test may prove to be useful tool for macular function testing in the office setting.

Conclusion

We found that the PSRT values depend upon the clinical status of the retina. PSRT values were seen highest on diabetic retinopathy patients whereas least on normal patients. These findings highlight the need and efficacy of simple technique which can be very useful to anticipate diabetic retinopathy from diabetic patients. This technique can help detect diabetic retinopathy earlier hence reducing visual impairment and blindness.

Conflict of Interest

Nil.

Source of Funding

Nil.

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