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Research Article

Comparison of Pupillary Dynamics among Emmetropes, High Myopes, High Hypermetropes and Patients under the Medications of Benign Prostatic Hyperplasia, Diabetes and Hypertension

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Abstract

Purpose: a) To evaluate the pupillary dynamics of emmetropes, myopes, hypermetropes, patuents sufferimg with Benign prostatic hyperplasia, Diabetes and Hypertension. b) To compare the effects of alpha adrenoreceptor antagonist(tamsulosin),diabetes and hypertension on pupillary dynamics.

Methodology: In our study,20 emmetropes,12 myopes,11 hypermetropes,4 patients suffering from Benign Prostatic Hyperplasia, Diabetes and Hypertension,3 patients with BPH and Diabetes,4 patients with BPH and hypertension and 3patients with BPH were screened while they visited our General Out Patient Department at Dr Om parkash eye Institute. The patients were then taken to the diagnostic unit of the same hospital where the pupillometry of each patient was done using Oculus Keratograph 5 under the LED bulb with 12 watt power and 1080 lm of luminous intensity. The measurements recorded by the pupillogram of OK5 included mean minimum pupillary aperture (mm), mean pupillary mean aperture (mm), mean maximum pupillary aperture (mm), velocity of pupillary constriction (mm/sec) and velocity of pupillary dilatation (mm/sec). The minimum, mean and maximum pupillary apertures were directly measured by the OK5 while the velocity of pupillary constriction and velocity of pupillary dilatation were measured on the basis of graphical positioning which shows the size of pupil at each point of time.

Result: The mean pupillary apertures of emmetropes, myopes, hypermetropes, patients with BPH, diabetes and Hypertension, BPH and Diabetes, BPH and hypertension and BPH were 4.72 ± 0.63 mm, 4.87 ± 0.71 mm, 4.15 ± 0.67 mm, 3.30 ± 0.17 mm, 3.43 ± 0.63 mm, 3.32 ± 0.23 mm, and 3.93 ± 0.76 mm respectively. The velocity of pupillary constriction and velocity of pupillary dilatation in patients with Benign Prostatic Hyperplasia under the effect of tamsulosin are considerably less than the velocity of pupillary constriction and velocity of pupillary dilatation in emmetropes.

Conclusion: Refractive errors do not have significant effects on the pupillary dynamics. However there is a significant effect of tamsulosin on the anatomic and functional structure of dilator pupillae muscle. Comparatively, the effects of hypertension and diabetes are less than the effects of tamsulosin on pupillary dynamics.

Keywords: Emmetropes; Prostatic Hyperplasia; Diabetes; Hypertension

Introduction

Blur perception is one of the elemental features of human visual system. Accommodation and vergence responses are clearly driven by the blurred retinal images which allow one to see clearly as well as to resolve fine details [1]. However, the role of retinal blur due to refractive error/s on pupillary dynamics is still not fully understood. There is no common conclusion regarding the sizes and dynamics of pupils of ametropes [2]. The process of proliferative changes in epithelial and stromal elements of the prostate gland results into the enlargement of the prostate causing bladder outlet obstruction. This condition of enlargement of prostate gland is called Benign Prostatic Hyperplasia (BPH) [3]. Tamsulosin, being Alpha 1A and Alpha 1D adrenergic receptor antagonist, causes the relaxation of smooth muscles in the prostate and bladder neck thus relieves the symptoms of urinary retention. The adrenergic receptors are present on various structures of the eye. More specifically, the medication tamsulosin which is known to be an irreversible adrenergic antagonist pharmacologically alters the iris dilator muscle

anatomic structures and its functions [4]. Diabetic Retinopathy is one of the serious complications of Diabetes Mellitus. The steady-state pupil size is abnormally small in diabetic patients. The intrinsically photosensitive Retinal Ganglion Cells (iPRGCs) which are third class of photoreceptors containing melanopsin as photoreceptors are now thought to be driving factors for the afferent pupillary response to light. Hence, the pupillary response can be used as an index of iPRGCs function [5]. The significantly High blood pressure in artery (Hypertension) has not been found to affect the pupillary dynamics.

Purpose

To evaluate the pupillary dynamics of ametropes, patients under medications for Benign Prostatic Hyperplasia, Diabetes and Hypertension and compare the effects of refractive error, alpha adreno receptors antagonist, diabetic and hypertensive medicaions on pupillary response.

Design

Prospective Cohort Study

Settings

DR Om Parkash Eye Institute, Mall Road, Amritsar, India

Materials and Methods

Institutional Review Board approval was obtained for a prospective cohort analysis of patients with refractive errors, Benign prostatic Hyperplasia, Diabetes and Hypertension at Dr Om Parkash Eye Institute, Mall Road, Amritsar and informed consent was obtained in the diagnostic area in compliance with the Declaration of Helsinki. Exclusion Criteria included the ammetroes with spherical equivalent less than (-5or+5DS) and patients under glaucoma medications, neuro-ophthalmic disroders and Iris abnormalities. Initially as a part of routine eye examination, the patients were assessed for refractive error. The patients having refractive errors (S.E equal to or greater than -5 or +5),patients under the medications of Benign Prostatic Hyperplasia, Diabetes and Hypertension were taken to diagnostic area for pupillometry. Pupillometry measurements were taken with the help of Oculus Keratograph 5 in standardized photopic ambient lighting (Light Emitting Diode bulb). The total luminous flux of the over head ambient light was 1080 lumen lying at zero degree angle to the head of patient. The measurements recorded by the pupillogram of OK5 included mean minimum pupillary aperture (mm), mean pupillary mean aperture(mm), mean maximum pupillary aperture(mm), velocity of pupillary constriction (mm/sec) and velocity of pupillary dilatation (mm/sec). The minmimum, mean and maximum pupillary apertures were directly measured by the OK5 while the velocity of pupillary constriction and velocity of pupillary dilatation were measured on the basis of graphical positioning which shows the size of pupil at each point of time. At every 10 seconds interval, the glare was projected on the eye for 0.2 second by the instrument itself and in reaction to it the iris would begin to constrict up to certain point which could be clearly seen in graph. The sizes of the pupil after the halt of projection of glare and at the point of maximum constriction were noted as shown on the instrument. The difference in their sizes divided by the difference in their corresponding time interval was the velocity of pupillary constriction calculated in mm/sec. Similarly, the sizes of pupil from the point where the pupil started to redilate after its maximum constriction up to the point of maximum dilatation were noted. The velocity of pupillary dilatation was calculated by dividing the difference in the sizes of pupil at maximum constriction and maximum dilatation by the corresponding difference in time taken to be fully dilatated from the point of maximum constriction.

Results

The results are tabulated which consist of Mean Age of patients, total of number of patients under each group, mean pupillary minimum aperture, mean pupillary mean aperture, mean pupillary maximum aperture, velocity of pupillary constriction, velocity of pupillary dilatation and mean Spherical Equivalent (Table 1).

Discussion and Conclusion

The pupillary responses and dynamics are not very much influenced by the state of refraction. Pupillary dynamics are independent of the state of refraction. However, the size of pupil of myopes is comparatively larger than the size of pupil of hypermetropes and emmetropes. The effects of adrenoreceptor antagonist can be clearly seen while analyzing the above tabulated results. The combined effect of diabetes, hypertension and tamsulosin has resulted into the adverse effects in the pupillary dynamics followed by the effects of tamsulosin and diabetics and tamsulosin only. The significant decrement of velocity of dilatation of pupil in patients under tamsulosin medications clearly indicates that the adrenoreceptor antagonist has clear cut altering effect on the iris dilator muscles functions and its anatomy. The velocity of pupillary constriction is also significantly decreased in patients under tamsulosin medications. However, the effects of diabetes and hypertension in comparison to the effect of tamsulsoin are minimal but cannot be ignored. Hence, we can conclude from the above results that retinal blurring due to refractive error does not control pupillary response. Pupillary response is controlled by the pupillary light reflex.

S.N	Emmetropes	Myopes	Hypermetropes	BPH + diabetic + HYpertensive	BPH + Diabetic	BPH + Hypertensive	BPH
1) Mean Age of patients(Yrs)	27.8 ± 6.5	25.33 ± 7.5	23.12 ± 0.26	57.75 ± 2.18	59.66 ± 2.89	57.6 ± 1.5	53.6 ± 2.3
2) Total number of patients	20	12	11	4	3	4	3
3) Total number of eyes	40	24	22	8	6	6	6
4) Total number of male patients	9	7	5	4	3	4	3
5) Total number of female patients	11	5	6	0	0	0	0
6) Mean min Pupillary apertures(mm)	2.93 ± 0.44	3.16 ± 0.35	3.01 ± 0.57	2.0175 ± 0.23	2.10 ± 0.23	2.08 ± 0.11	2.87 ± 0.11
7) Mean mean pupillary aperture(mm)	4.72 ± 0.63	4.87 ± 0.71	4.15 ± 0.67	3.30 ± 0.17	3.43 ± 0.63	3.32 ± 0.23	3.93 ± 0.76
8) Mean max Pupillary aperture(mm)	5.72 ± 0.61	5.79 ± 0.54	5.32 ± 0.58	4.80 ± 0.23	4.98 ± 0.11	4.87 ± 0.54	5.15 ± 0.36
9) Mean veloity of pu[pillary constriction (mm/sec)	3.07 ± 0.23	3.17 ± 0.23	3.10 ± 0.23	1.99 ± 0.23	2.07 ± 0.43	2.19 ± 0.44	2.32 ± 0.16
10) Mean velocity of pupillary dilatation(mm/sec)	0.26 ± 0.019	0.249 ± 0.029	0.251 ± 0.18	0.113 ± 0.066	0.134 ± 0.017	0.13 ± 0.023	0.13 ± 0.0104
11 Mean Spherical equivalent(DS)	± 0.25	-5.75	+5.50	_	_	_	_

Table 1

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