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Analysis of change in the pupil mydriasis produced with the installation of topical anesthetic drop

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Abstract

The aim of the present study is to determine the role of Proparacaine (0.5%) (PP) followed by Tropicamide (0.5%) (T) on pupil dilation.

Objective

To evaluate whether prior instillation of PP to T drug produces any clinically significant changes in Pupil Diameter (PD), Speed of dilation, Anterior Chamber Depth (ACD) and Central Corneal Thickness (CCT) changes during diagnostic eye examination.

Keywords: anaesthetic, mydriatic, pupil, anterior chamber depth, corneal thickness

Introduction

Installation of topical anaesthetic drops prior to the introduction of mydriatic drops is a common clinical practice. Though the actual reason for the usage is not known usage of anaesthetic drops will improve corneal permeability (Bryant, 1969; Talley and Bartlett, 1995), which further increase the amount of mydriatic substance to reach the receptor sites in the anterior chamber. Additionally, as mydriatics typically produce stinging, (Bartlett, 1995) an anaesthetic should lessen the irritation and reflex tearing so that more of the medication can stay in the conjunctival sac and be available for absorption. Two prior studies on the installation of topical anaesthetic drops and its effect on the mydriasis has shown the following findings, Haddad D et al (2007) has observed that 1. Usage of tropicamide followed by either proparacaine or saline didn't show any clinical significant change in the pupil diameter even after interaction of drug over a period of time 2. Effect of anaesthetic drops on the subjects with brown iridis and the one's with light coloured iridis didn't show any clinical significance 3. Response to the four mydriatic drugs proparacaine, tropicamide after proparacaine, saline and tropicamide after saline among the subjects has shown that tropicamide after proparacaine is significantly different from other three ($p<0.0001$).

Similarly, Sandhya R et al (2016) observed that 1. Pupil diameter was compared among study group (0.5% of proparacaine + 0.8% tropicamide- 5% phenylephrine) and control group (0.8% tropicamide- 5% phenylephrine) has shown that at 10 and 20 minutes, there was a statistically significant difference in the diameter of the pupil between the study eyes and the control eyes (P 0.021 for 10 min, P 0.001 for 20 min) 2. After 60 minutes, the study group pupil dilated to 8 mm and 7.99 mm in the control eye 3. The augmenting impact of proparacaine did not differ statistically significantly between age groups of research participants.

Neither of the above studies have shown the effect on anterior chamber depth and central corneal thickness when a topical anaesthetic drop is installed priorly. So, in this study the effect of the anaesthetic drugs prior to the introduction of mydriatic drops on pupil dilation, speed of dilation, anterior chamber depth (hereafter referred as ACD) and central corneal thickness (hereafter referred as CCT) is assessed.

Methodology

The study was performed on 100 emmetropic eyes. One drop of PP was instilled into subjects one eye (chosen at random) followed by one drop of T (0.5%) in both eyes at a time interval of 2 minutes. Speed of dilation was observed by taking digital photographs with mobile phone at 0,10,20,30,40,50 and 60 minutes. PD, Speed of dilation, ACD and CCT changes were checked by AS OCT. The effect of PP was observed by comparing the eye that is installed with PP+T and with the eye that is installed with only T.

This study was performed among 100 healthy participants at Vishakha Eye Hospital, Visakhapatnam. The sample size is similar to the one study by Sandhya R et al (2016). The Institutional Ethics Committee approved the trial, and because the treatment is a typical outpatient ophthalmology procedure, consent was waived. All the participants underwent comprehensive eye examination where visual acuity, refraction and slit lamp examination was tested and those whose visual acuity is 6/6 and are free from any ocular conditions were chosen. One drop of proparacaine (0.5%) was installed in one eye (either right or left eye chosen randomly) and

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2 minutes later tropicamide (0.5%) was introduced in both the eyes. The droplets were administered using common, commercial dropper bottles. Only one drop of the solution was injected at a time, with great care. Subjects were told to occlude their puncta bilaterally for 1 minute after receiving each medication.

A standard mobile phone was used to assess the pupil diameter and rate of dilatation in each eye at 0, 10, 20, 30, and 60 minutes after the 1 min of punctual occlusion. Pupil diameter was examined by an examiner who was unaware of in which eye the drops was instilled. ACD and CCT was measured by using AS OCT (Anterion)at the same interval

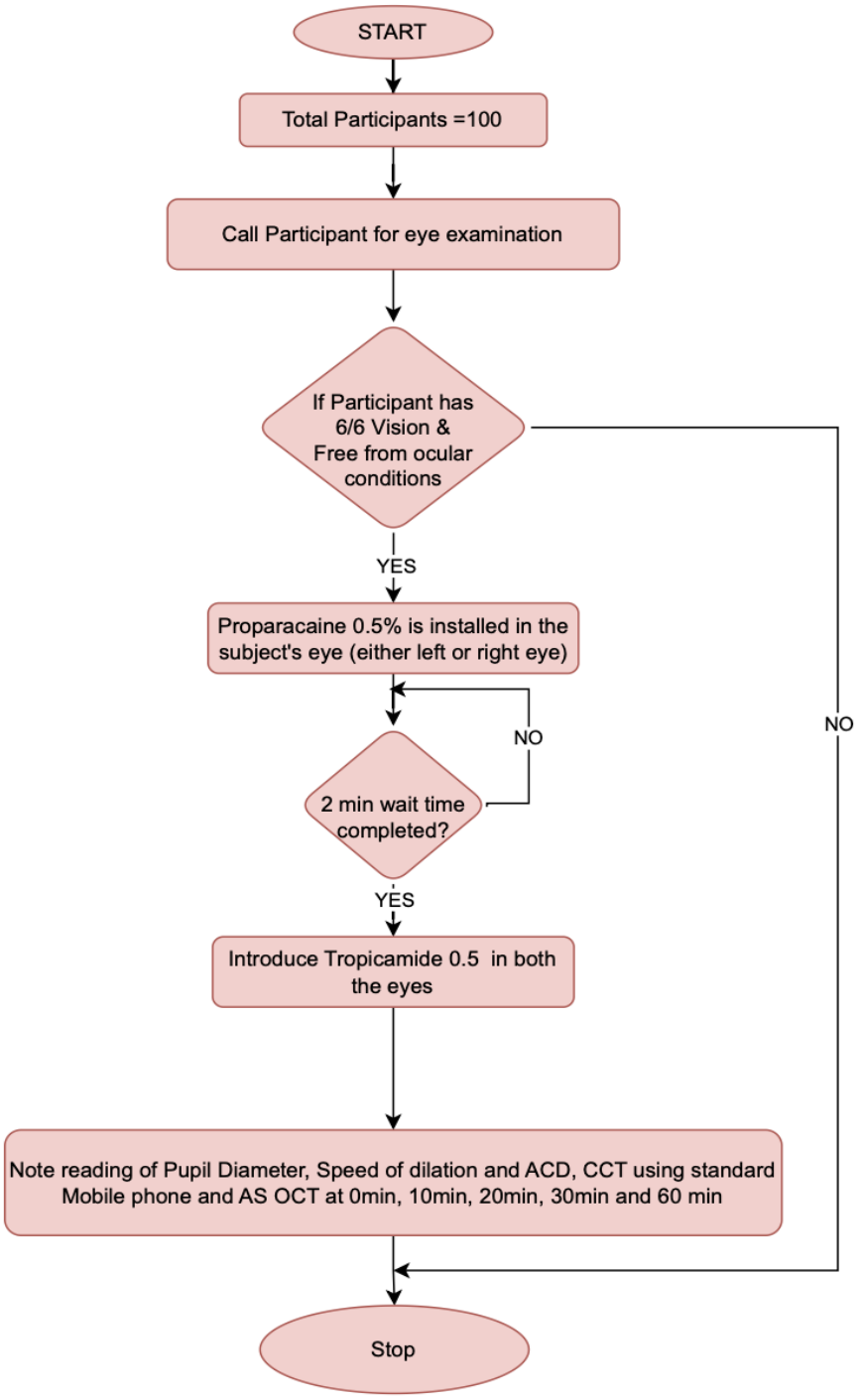

Figure 1- Flow chart of Methodology

Results

Out of 100 participants, 52, 48 are Female and Male whose age was ranging between 17-30 years (mean age is 23.3 years for Females and Male).

Pupil diameter

Eyes with Proparacaine + tropicamide (hereafter referred as PP+T) and the eyes with tropicamide (hereafter referred as T) only have mean pupil diameters of 4.05 mm and 4.09 mm at zero minutes, 6.16 mm and 6.19 mm at twenty minutes, 7.39 mm and 7.38 mm at sixty minutes.

The standard deviation of the eyes with PP+T and the eyes with T only is 0.60 and 0.64 at 0 minutes, 0.80 and 0.91 at 20 minutes, 0.69 and 0.67 at 60 minutes which shows that there is not statistically significant difference among the eyes with PP+T and the eyes with T.

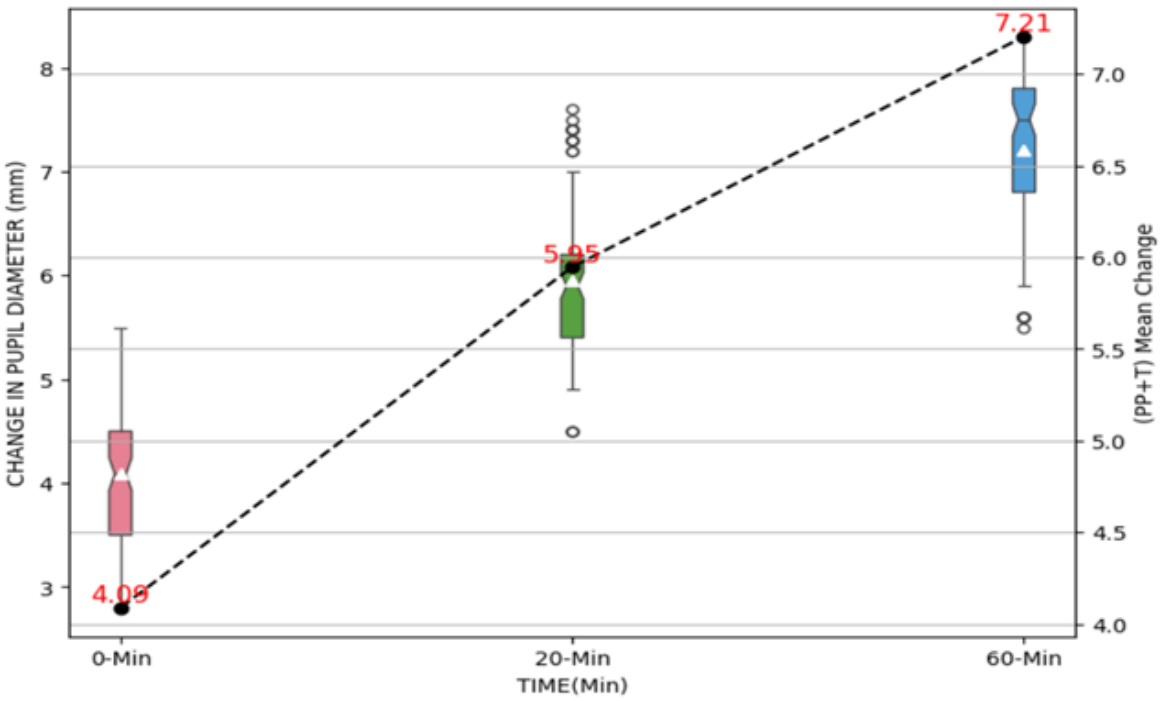

Figure-2 Data showing the mean change in pupil diameter with respect to the time in the subjects introduced with PP+T

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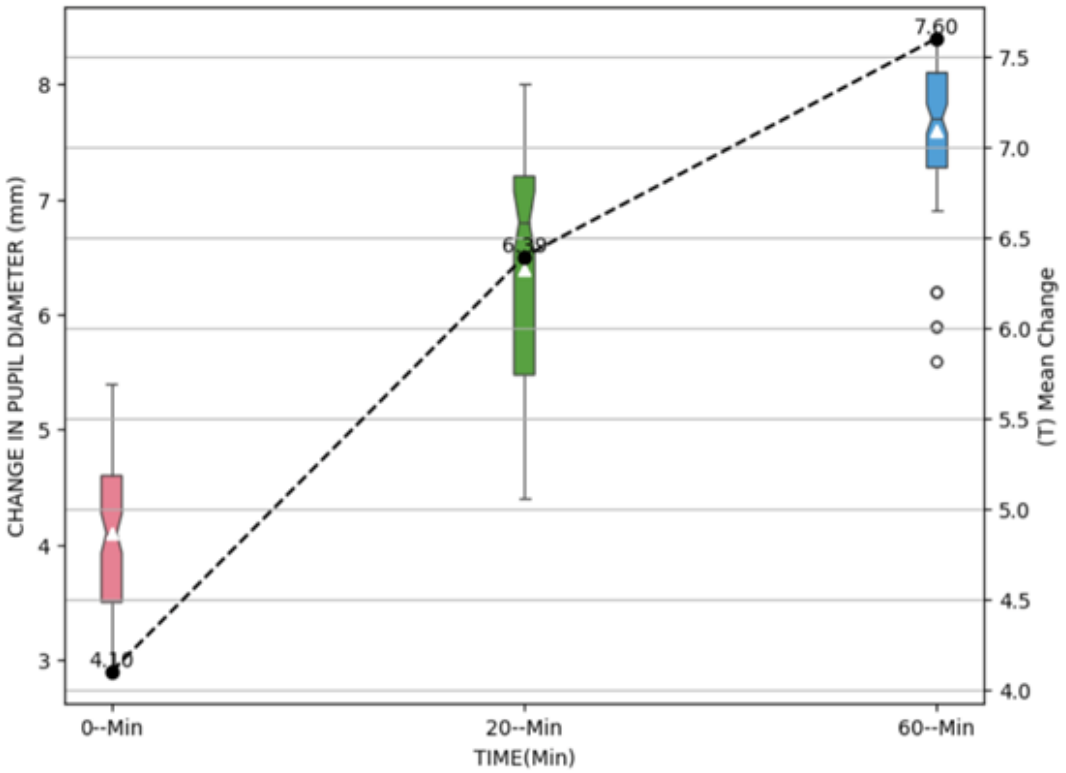

Figure-3 Data showing the mean change in pupil diameter with respect to the time in the subjects instilled with T

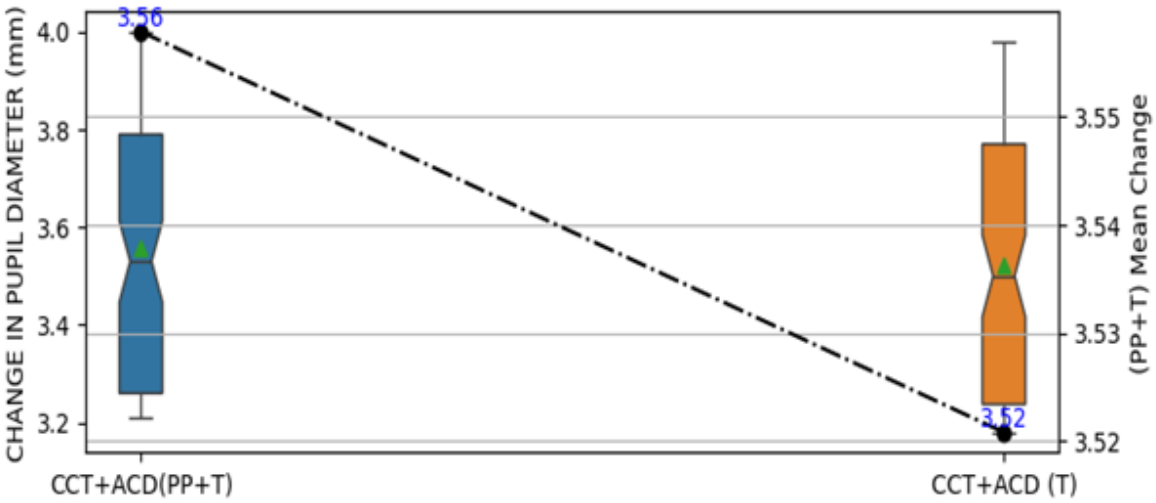

Figure- 4 Mean Change in ACD+CCT in the eyes with PP+T and T alone

ACD and CCT changes

The mean values of the ACD and CCT among the eyes with PP+T and the one's with only T is 3.55 and 3.56 at zero minutes, 3.55 (both PP+T &T) at twenty minutes, 3.50 (both PP+T &T) at sixty minutes.

The standard deviation of PP+T and T is 0.26 and 0.29 at 0 minutes, 0.29 and 0.26 at 20 minutes, 0.26 and 0.28 at 60 minutes. There is no much difference in ACD and CCT values in the eyes instilled with PP+T and T alone.

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Discussion

The discomfort caused by the injection of tropicamide (0.5%) is greatly lessened if a topical anesthetic is administered beforehand. The magnitude or rate at which pupillary mydriasis manifests, however, is not significantly increased. The findings of Siderov et al. (1997), who came to the conclusion that proparacaine does not enhance the mydriatic action of tropicamide by increasing corneal permeability, are supported by our observations. Additionally, these findings refuse the idea that the anesthetic improves the mydriatic's availability by reducing reflex tearing. For the PP+T and T groups, the mean maximal pupil diameters were measured, and they were 7.52 mm and 7.21 mm, respectively. Furthermore, in PP+T and T, the median time to a 6 mm pupil diameter is 17 min and 19 min, respectively.

Also considering the study by Brewitt et al. (1980) which has shown that there is disruption of intracellular spaces which leads to increase in the corneal thickness after introduction of topical anaesthetic drops, however the present study findings differ from the said study that there is no statistical significance of change in corneal thickness with the exposure to proparacaine.

Additionally, the patients employed in the current study were all young and devoid of any obvious ocular diseases. In those whose eyes are typically thought to be more difficult to dilate sufficiently, such as diabetic patients, it would be interesting to investigate whether proparacaine boosts the mydriatic efficacy of tropicamide (Bartlett, 1995) and Haddad D (2007).

Conclusion

The amount or rate at which mydriasis develops do not significantly increase when a topical anesthetic is injected. The anterior chamber depth or corneal thickness do not, however, change noticeably as a result.

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