Effect of topical proparacaine 0.5% on tropicamide- induced mydriasis

Abstract:

PURPOSE: The topical anesthetic proparacaine (0.5%) is recommended to enhance the rate and magnitude of pupillary dilatation if it is instilled before mydriatic tropicamide. However there is scarcity of data supporting this. Therefore we conducted a study to analyze if preinstillation of topical proparacaine (0.5%) can potentiate the mydriatic efficacy of 0.8% tropicamide.

METHODS: The patients were divided into two groups for pupillary dilatation. The study group was given a drop 0.5% proparacaine before instilling one drop of tropicamide while the control group was given the tropicamide alone. The pupillary size was measured and recorded before the instillation of tropicamide at 0 min, 15 min, 30 min. The end point was taken as 6 mm pupillary size (clinically effective diameter).

RESULTS: There was a statistically significant difference in rate of pupillary diameter between the control and the study group. The rate of pupillary dilatation at 15min and 30 min was statistically significantly different between the control and study group.

CONCLUSION: The study concluded that prior instillation of topical proparacaine produced a statistically significant difference in the rate of pupillary dilatation at 30 mins. Therefore, we suggest the use of a topical anesthetic before tropicamide induced mydriasis.

INTRODUCTION:

Dilation of pupils is a mandatory step of routine ocular examinations and of many intraocular surgical procedures like phacoemulsification, small incision cataract surgery (SICS), and outpatient procedures such as treatment with laser. Tropicamide, a cholinergic anatagonist is recommended for mydriatic fundus examination.[5] Before putting any mydriatic, it is recommended to use a topical anesthetic like 0.5%

proparacaine.[5-11] Its mechanism of action is not clearly known; the proposed mechanism is that the corneal epithelium gets disrupted after using a topical anesthetic[11] and thus the absorption of mydriatic agent is facilitated through the cornea[5,12,13]. Also reflux tearing is reduced after prior instillations of anesthetic agent , because of which a higher amount of mydriatic is available for corneal penetration [5,14] . Other advantages of instilling an anesthetic prior to a mydriatic are increased rate, magnitude and duration of dilation of pupil.[9,10]. If local anesthectic is used, patient compliance is also improved due to reduction in discomfort.[5,14] In a study conducted by Ghose et al., it is reported that significant increase in pupillary dilatation is seen if lignocaine is used before instilling a drop of tropicamide, which indicates that prior instillation of a local anesthetic plays a beneficial role in papillary dilation[15].

METHODS

This experimental study was conducted in the outpatient clinic of the department of ophthalmology, M.D.M Hospital, Jodhpur from October 2019 to December 2019 over a period of 3 months. Informed written consent was obtained from every individual participants who took part in the study. Right eye was chosen for study and left eye for control .

A total of 58 patients aged between 20 and 60 years who attended the outpatient clinic in our department were selected randomly by lottery method and were enrolled in the study. Subjects with any history of allergy to drugs, pupillary abnormality, acute and chronic dacrocystitis, glaucoma, corneal scars, history of using any topical medication usage, uveitis, trauma, pseudoexfoliation were excluded from the study. After history taking , the subjects underwent thorough slit lamp examination.

Using a pupillary gauge, undilated pupil measurements were taken from both eyes in a dark room .

Patients were asked to look up towards the roof, eye drops were instilled into the lower conjunctival fornix and lacrimal passage was occluded by pressing on the medial side of the medial canthus to reduce the drainage. In the study group, proparcaine eye drop was instilled and the normal saline was put in the control group. Tropicamide eye drop was instilled in both the groups after 5mins. After 15 mins and 30 mins, pupillary measurements were taken using the same pupillary gauge and recordings were noted by the examiner. One investigator instilled eye drops and separately, another investigator measured pupillary size at the end of 15 mins and 30 mins.

The difference between two groups was found using student's t-test. $P<0.05$ was considered as statistically significant for all practical purposes.

RESULTS

Our study included 58 subjects, among which 23 (39.65%) were males and 35 (60.34%) were females. The mean age of subjects was 58.42±10.27 years. Right eye and left eye was the study eye and the control eye, respectively. At 0 min, mean undilated pupil diameter (in mm) in the study group was 2.896±0.42 and in the control group was 2.885±0.443. The difference in the pupillary diameter of both the study and the control group at 0 mins was not statistically significant (p value>0.05). As reported from the previous study, the pupillary diameter of Six millimeter (clinically effective diameter [CED]) is considered to be an adequate size for fundus examination[16]. At 15 mins, the mean pupillary diameter in the study group was 5.56±0.5 and in the control group was 5.24±0.45 (p<0.001) which was statistically significant. At the end of 30 mins , the pupillary diameter in the study group and control group was The 7.96±0.43 and 7.83±0.43, respectively (p<0.001), which was statistically significant.

During the study the pupillary size measurement was tabulated as follows.

The mean pupillary diameter in the right eye (proparacaine treated eye) increased from 2.89±0.42 at 0 min to 7.96±0.43 at the end of 30 mins. On the other side, the mean pupillary diameter in the left eye (placebo-treated eye) increased from 2.88±0.443 at 0 min to 7.83±0.43 at the end of 30 mins. At 15 mins and 30 mins the difference in the mean pupillary diameter between the study eye and the control eye was statistically significant(Table 1).Table 2 shows that in the proparacaine treated eyes; at the end of 15 mins , 21 (36.2%) cases reached CED and 37 (63.7%) cases did not reach CED. At the end of 15 mins, in placebo treated eyes only 7 (12.06%) cases reached the CED and 51 (87.9%) cases did not reach the CED .

TABLE 1: Pupillary size in RE (study eye) and LE (control eye)

	Mean pupillary dilatation (in mm)	SD	T value	P value
RE 0 min	2.896	0.4199	0.44	0.65
LE 0 min	2.885	0.4433		
RE 15 mins	5.562	0.5007	8.13	<0.001
LE 15 mins	5.246	0.4544		
RE 30 mins	7.966	0.4317	4.115	<0.001
LE 30 mins	7.834	0.4365		

RE: Right eye, LE: Left eye, SD: Standard deviation

TABLE 2: Proportion of study (RE) and control (LE) eyes reaching CED

	CED (%)	CNED (%)
RE	21 (36.2)	37 (63.7)
LE	7(12.06)	51(87.9)
Total	28	88

CED: Clinically effective diameter, CNED: Clinically non effective diameter,

DISCUSSION

There is a significant increase in pupillary diameter after instillation of one drop of proparacaine before tropicamide for pupillary dilation as compared to using tropicamide alone. After instillation of drug(s) every patient was asked to occlude the lacrimal passage by pressing on the medial canthus so that the drainage of drug(s) is reduced. The use of NLO for 5 minutes to enhance intraocular absorption and thus discourage systemic absorption of topically applied medications was supported b y numerous studies from different investigators published in peer-reviewed journals.[22]

Ghose et al. during his study on potentiating effect of 4% lignocaine on tropicamide-induced mydriasis found a mean maximum pupil size of 6.75±0.80 mm in the study eye and 6.08±0.97 mm in the control eye[15]. This result is much smaller in comparison to our present study where pupillary sizes of 7.96±0.43 mm in study eyes (proparacaine treated) and 7.±0.43mm in control eyes is obtained. Between both studies, the recorded difference in the maximum pupillary size, was about 1.88 mm and 1.75 mm in the drug treated eye and the control eye respectively. This much larger difference in the drug-treated eye suggests that proparacaine may have a higher potentiating effect on tropicamide than lignocaine treated eyes. It may be because lignocaine has lesser penetration and therefore lesser availability as compared to proparacaine.

Ogun et al. conducted a study in which the mean pupillary diameter was 6.01 ± 0.54 mm, which is very less compared to our study where the pupillary diameter in the proparacaine treated eye is 7.96 ± 0.43. Atypical dark skinned Nigerian patients has densely pigmented iris. This increased pigmentation in iris produces a difference in the pupillary diameter in a Nigerian subject as compared to ours[17]. Emiru suggested the same theory, which states that for poor pupillary dilation it is the iris pigmentation which is more likely to be responsible than the race. Emiru in his study found that even after 60 mins of dilatation, the large pupil size diameter was not achieved by the dark skinned africans[18]. In his theory he states that the mean pupillary diameter was 6.21 mm at 60 mins, which is very less to the mean diameter

of 7.96 ± 0.43 mm obtained at 30 mins in drug treated eye in this study. This theory supports that there is higher pigmentation rate in African population than Indian population. Chen and Poth also could explain that there is decreased drug absorption in iris crypts due to obstruction of pigments within the chromophores which leads to the decreased mydriatic effect[19].

The rate of corneal epithelial cell migration is inhibited by topical anesthetics by disrupting the cytoplasmic action in filaments that destroy superficial corneal epithelial microvilli[20]. The proparacaine has potentiating effect on the tropicamide induced pupillary dilation. The microscopic disruptions in the corneal epithelium and reduced tearing produces an increase in the intraocular penetration of tropicamide and thus greater bioavailability and more time of contact is achieved by the drug[9,13,16,21].

CONCLUSIONS

The study concludes that the use of proparacaine before instillation of tropicamide drug gives faster pupillaey dilation.Hence, we do recommend the use of proparacaine before instilling tropicamide for faster pupillary dilation.

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