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# Effect of topical anesthetics on intraocular pressure and pachymetry

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PURPOSE. *The determination of intraocular pressure (IOP) by noncontact tonometry (NCT) has been reported to be affected by central corneal thickness (CCT) and by the instillation of topical anesthetics.*
METHODS. *In order to determine the influence of topical anesthetics on CCT and IOP measured by NCT, 80 eyes from 49 patients were examined before and after the instillation of topical anesthetics.*
RESULTS. *Average age was 55.3 years (SD 18.4, range 18 to 93). Twenty-eight patients were female and 21 were male. Average basal IOP was 16.1 mmHg (SD 5.2, range 8 to 35.3). IOP was 14.8 mmHg (SD 4.6, 7.4 to 32.4) (p=0.0005, Student t test for paired data) 5 minutes after topical anesthetics instillation. CCT averaged 541 µm (SD 32, range 482 to 604) before topical anesthetic drops and 541 µm (SD 32, 490 to 607, p=0.89, Student t test for paired data) 5 minutes after topical anesthetics instillation.*
CONCLUSIONS. *The study confirms that the instillation of topical anesthetics causes a reduction in IOP. These changes do not seem to be associated with changes in CCT. (Eur J Ophthalmol 2008; 18: 748-50)*

KEY WORDS. *Intraocular pressure, Noncontact tonometry, Pachymetry, Topical anesthetics*

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## INTRODUCTION

Determination of intraocular pressure (IOP) is among the usual procedures in everyday ophthalmic practice and is a central feature in the diagnosis and management of glaucoma. Clinical IOP determinations are usually performed by procedures depending on corneoscleral rigidity (1), such as Goldman and Perkins tonometry, noncontact tonometry (NCT), Tono-Pen, and ocular blood flow tonography. For this reason, the value of IOP has lost importance in the study of normal pressure glaucoma and ocular hypertension in favor of IOP value corrected for corneal thickness. Central corneal thickness (CCT) is probably the most important factor influencing IOP determinations (2), with special relevance due to the frequency of refractive procedures reducing corneal thickness such as laser-assisted in situ keratomileusis and photorefractive keratectomy, and the risk of underestimating high IOP in operated patients. However, some other studies claim that this influence has been overestimated. Other influencing factors such as lid squeezing, breath holding, and Valsalva maneuvers should also be considered. The repetition of the measuring procedures usually tends to elucidate them (3).

During the past decade, Baudouin and Gastaud reported on the influence of anesthetic drops to decrease IOP measured by air pulse noncontact tonometry (4). However, the influence of other parameters was not established.

We present our results after measuring IOP and CCT prior to and after topical anesthesia.

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## METHODS

This is an observational study conducted conforming to the provisions of the Declaration of Helsinki in 1995 (as revised in Edinburgh 2000). The patients' informed consent was obtained prior to performing the tests.

Eighty eyes from 49 consecutive patients who were not receiving topical treatment were studied for CCT and IOP. CCT was measured by noncontact pachymetry (Pach meter Haag Streit, Switzerland). Immediately afterwards, IOP was determined by noncontact pneumotonometry (Full autotonometer Canon TX-F) and two drops of topical anesthesia (tetracaine chlorohydrate 1 mg and oxybuprocaine chlorohydrate 4 mg per 1 mL) (Colircusi Anestesico Doble, Alcon-Cusi, Spain) were instilled into the inferior conjunctival cul-de-sac.

The determinations of CCT and IOP were repeated 5 minutes after the instillation of anesthetics.

The IOP and CCT determinations were performed by automated procedures. The examiner (M.F.-M.) was masked to the results of basal determinations and the results were printed and collected by a different examiner (J.A.M.).

Each of these determinations was repeated three consecutive times and the average value was used for calculation. The results were compared and the influence of CCT and age was analyzed using descriptive statistics and Student *t* test for paired data.

## RESULTS

Average age was 55.3 years (SD 18.4, range 18 to 93). Twenty-eight patients were female and 21 were male.

Mean basal IOP was 16.1 mmHg (SD 5.2, range 8 to 35.3). IOP 5 minutes after topical anesthetics instillation was 14.8 mmHg (SD 4.6, 7.4 to 32.4) (p=0.0005, Student *t* test for paired data).

Mean CCT before topical anesthesia was 541 µm (SD 32, 482 to 604). Five minutes after instillation, CCT was 541 µm (SD 32, 490 to 607, p=0.89, Student *t* test for paired data). The change in CCT averaged 0.07 µm, median 0.00 (range –12 to 14 µm).

A simple linear regression analysis was performed to investigate the association between age or CCT and IOP changes. No significant variation was found between age and IOP changes or CCT and IOP changes (Pearson correlation coefficient r=0.13 and r=0.12, respectively).

## DISCUSSION

Determination of IOP in clinical practice must face procedural errors of several different origins, mainly but not only corneal biomechanics, thickness, and curvature (5, 6). Air pulse NCT is a safe and reproducible way to measure IOP. Some of its advantages are being reproducible and independent of the operator, avoiding the use of topical anesthesia and fluorescein drops, and providing multiple IOP determinations, thus reducing measurement errors (7). CCT has been reported to affect IOP determination, especially after corneal refractive surgery (3). Ko et al found that CCT influenced IOP determinations as measured by Goldman tonometry, NCT, and ocular blood flow tonometry (8).

Baudouin and Gastaud demonstrated the effect of topical anesthetics on IOP determinations measured by NCT (4). However, IOP was not affected by the instillation of indomethacin suspension. The effect of IOP reduction after topical anesthetic drops instillation can only be demonstrated by NCT since this is the only type of procedure that does not require the use of anesthetic drops.

The mechanism of IOP reduction may be attributed to reduced lid squeezing or breath holding of the patient preparing for the procedure. However, topical anesthesia only reduces corneal and conjunctival sensitivity, and the patient will still be prepared for the air puff and feel it on lids and lashes. Other possible mechanisms such as the mechanical effects of repetitive IOP measurements or massage by eyelids secondary to corneal irritation by eyedrops do not explain this reduction either, since IOP reduction should also appear on eyes treated with anesthetic and nonanesthetic drops (4).

In a previous article, we reported on the temporal effect of IOP reduction by the instillation of topical anesthetics (9). The greatest reduction in IOP was found to occur during the first minute after anesthetics instillation. In this article, the changes induced by topical anesthetics were significant for those eyes with corneas over and under 560 µm CCT; however, the results were more significant for the thinner corneas. This fact led us to believe that the decrease in IOP might be related to changes in corneal thickness, as suggested by Asensio et al (10).

Topical anesthetic drops (oxybuprocaine) have been found to reduce corneal thickness with variations higher than 10 µm 3 minutes after instillation in 10 to 30% of eyes according to Asensio et al (10). However, in our series the mean change in CCT after anesthetics instillation

was 0.07 µm (median 0.00 µm) and still we have found significant IOP reduction.

Corneal and conjunctival sensitivity are known to decrease with age (11). In our previous series no statistically significant changes in IOP were found for the different age groups, though based on a merely anesthetic effect of the drops in decreasing IOP determination this effect should be less noticeable among elderly patients.

To our knowledge, the effect of topical anesthetic drops on IOP examination by applanation tonometry (AT) has not been studied since topical or general anesthesia are required for AT and the reduction of IOP is more marked during the first minute after the administration of anesthetic drops.

The effect of topical anesthetic drops to decrease IOP determination by NCT is a well-demonstrated fact, though not easily explained. This effect adds to other known factors influencing IOP measurement by NCT, and probably also affects contact procedures. Further studies on corneal thickness, curvature, and sensitivity as well as underlying ocular conditions are needed to verify the influence of topical anesthetics on IOP.

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