

**COMPARATIVE EVALUATION OF INTRAOCULAR PRESSURE MEASUREMENT WITH INDENTATION (SCHIOTZ) AND NON-CONTACT TONOMETRY: AN OBSERVATIONAL STUDY****Dr. Pranjal Bhuyan**

Assistant Professor. Department of Physiology, Lakhimpur Medical College.

Dr. Babi Das.*Assistant Professor. Department of Ophthalmology, Lakhimpur Medical College.
*Corresponding Author**Dr. Santana Saikia.**

Associate Professor & i/c HOD. Department of Physiology, Lakhimpur Medical College.

ABSTRACT

Introduction: Estimation of Intra Ocular Pressure (IOP) is an essential part of comprehensive ocular examination and should be measured in every patient, specially over 40 years of age. IOP being the only modifiable risk-factor of glaucoma, its use in screening is of immense importance. In our study we have compared indentation tonometry (Schiotz) with Non-Contact Tonometry (NCT) to find an agreement in measurement of IOP by both the instruments. **AIM:** To compare IOP measured with NCT and Schiotz tonometry. **Materials and Methods:** Our study is a cross-sectional observational study including 50 individual (100 eyes) including both male and female patients in the age group of 21 – 50 years. In all patients NCT was done first followed by Schiotz tonometer. Bland-Altman method is used to find out any agreement between the IOP measured by both the methods. **Results:** After analysing the IOP measured for 100 eyes, we found that IOP measured with NCT is slightly Higher than Schiotz tonometry. However, this difference is statistically insignificant. **Conclusion:** Our study's findings lead to the conclusion that when screening a significant number of patients in an OPD setup or in a screening camp within a relatively short time frame, IOP measurement using the Non-Contact Tonometer (NCT) is a viable alternative to the Schiotz tonometer.

KEYWORDS : Intra Ocular Pressure (IOP), Indentation Tonometer (Schiotz), Non-Contact Tonometer (NCT), Tonometry.**INTRODUCTION:**

Estimation of Intra Ocular Pressure (IOP) is an essential part of comprehensive ocular examination and should be measured in every patient, specially over 40 years of age. Glaucoma is the second most common cause of irreversible vision loss due optic neuropathy characterized by structural and functional damage to the optic nerve head.^{1,2} Ocular hypertension being the only reversible risk factor of Glaucoma, its detection at an early stage can be helpful not only for early diagnosis of Glaucoma but also for monitoring its progress and response to treatment.

Measurement of IOP is known as tonometry and the instruments used are called tonometer. Although, various tonometers are available, Goldmann Applanation Tonometry is considered gold standard for measurement of IOP. However, due to the need of a slit lamp, installation of anesthetic eye drops and fluorescein, upright posture of the patient, risk of spread of ocular infection and above all need of a skilled ophthalmologist, its use in large scale screening is not practical in periphery. Perkins tonometry, though portable have the risk of spread of ocular infection along with its high price.³ Indentation tonometry using a relatively inexpensive and portable Schiotz indentation tonometer can be done for mass screening of IOP. Being a contact tonometer, it has the same risk of spread of ocular infection and need of anesthetic eye drops. Use of a non-contact tonometer (NCT) however, eliminates the risks of contact tonometer, and can screen large number of patients without the need of a skilled ophthalmologist.

The aim of our study is to determine whether NCT can measure IOP accurately, and compare the results with IOP measured with Schiotz indentation tonometer.

Aim of the Study:

1. To compare IOP measured with NCT and Schiotz tonometry.

MATERIALS AND METHODS:

This cross sectional, observational study was in the Ophthalmology OPD of a tertiary healthcare centre. The study comprises of 100 eyes of 50 patients visiting ophthalmology OPD in the age group of 21 – 50 years including both male and female patients on a first contact basis, after taking voluntary and informed written consent as per the inclusion and exclusion criteria. All the patients were examined by the same ophthalmologist using the same instrument as a part of routine comprehensive ophthalmological Examination.

Inclusion Criteria:

1. Patient visiting Ophthalmology OPD in the age group of 21 – 50 years.

Exclusion Criteria:

1. Patients beyond the age group of 21 – 50 years.
2. Patients with infective and/or inflammatory Corneal or Conjunctival pathology.
3. Patients with history of previous ocular surgery.
4. Known patients of glaucoma.
5. High degree of refractive error (Spherical and astigmatism) $\pm 3D$.

All the patients who fulfilled the inclusion and exclusion criteria underwent comprehensive ophthalmological Examination. Topcon CT800 Computerized Tonometer is used for NCT. NCT was performed first in sitting position and average of three reading was taken. Then after 5 minutes interval cornea was anaesthetized with 0.5 % (w/v) proparacaine hydrochloride ophthalmic drop and Schiotz tonometry was performed in supine position. Average of three reading was taken.

After completion of the tests, results obtained were compiled and analysed with Microsoft Office Excel 2021 (Version 2307).

RESULTS AND OBSERVATIONS:

The study was conducted among 50 individuals and both the eyes were included. Therefore, demographic data analysis was calculated using sample size of 50. However other remaining part of the analysis were done sample size of 100.

This study comprises of 27 (54%) male and 23 (46%) female. The mean age of male participants is 38.70 ± 9.24 years (95% CI 35.21 – 42.19, Range 21 – 50 years) and for female is 41.26 ± 7.95 years (95% CI 38.01 – 44.51, Range 23 – 50 years). For all the participants mean age is 39.88 ± 8.68 (95% CI 36.61 – 43.15, Range 21 – 50 years)

In Table-1, the IOP measured by NCT and Schiotz tonometry is shown for the entire study population and its gender wise distribution. It has been observed that there is no significant difference of IOP both for NCT and Schiotz tonometry, between male and female patients ($p > 0.05$). No significant difference ($p > 0.05$) of IOP is also observed between Right and Left eyes for NCT and Schiotz tonometry (Table 2)

Table-1: Gender-wise distribution of IOP in mm measured by NCT and Schiotz tonometry

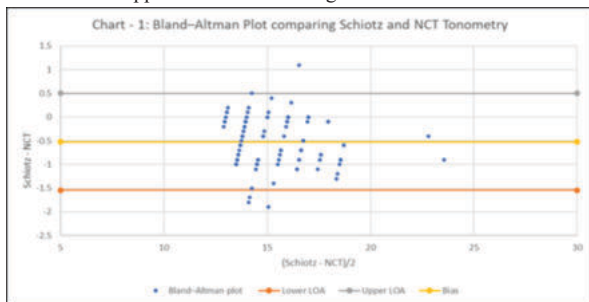
Population Characteristics		Male	Female	Total Population	P value Between Male and Female
Number of Eyes		54	46	100	
Schiotz (mm Hg)	Mean $\pm$ SD	15.07 ± 2.09	15.15 ± 1.80	15.11 ± 1.96	0.8362

	95% CI	14.28 - 15.86	14.63 - 15.67	14.73 - 15.49	
	Range	12.8 - 23.1	12.9 - 18.4	12.8 - 23.1	
NCT (mm Hg)	Mean $\pm$ SD	15.56 $\pm$ 2.11	15.72 $\pm$ 1.93	15.63 $\pm$ 2.02	0.6915
	95% CI	14.77 - 16.35	15.16 - 16.28	15.23 - 16.03	
	Range	13 - 24	13 - 19	13 - 24	
P value Between Schiottz and NCT (for 100 eyes)				0.0648	

Table-2: IOP measured in right and left eyes with NCT and Schiottz tonometry

Eye		Right	Left	Total	P value Between Right and Left Eye
Number of Eyes		50	50	100	0.8711
Schiottz (mm Hg)	Mean $\pm$ SD	15.08 $\pm$ 1.99	15.14 $\pm$ 1.95	15.11 $\pm$ 1.96	0.8827
	95% CI	14.53 - 15.63	14.60 - 15.68	14.73 - 15.49	
	Range	12.80 - 23.10	12.9 - 22.60	12.8 - 23.1	
NCT (mm Hg)	Mean $\pm$ SD	15.66 $\pm$ 2.08	15.60 $\pm$ 1.98	15.63 $\pm$ 2.02	0.8827
	95% CI	15.08 - 16.24	15.05 - 16.15	15.23 - 16.03	
	Range	13 - 24	13 - 23	13 - 24	
P value Between Schiottz and NCT (for 100 eyes)				0.0648	

In Chart - 1 the agreement between IOP values obtained by Schiottz and NCT is determined by use of Bland-Altman method.⁴ The mean of IOP with Schiottz tonometer is 15.11 $\pm$ 1.96 and NCT is 15.63 $\pm$ 2.02. The bias (Mean Difference) is -0.52 (95% CI -0.62 to -0.42, Range -1.90 to 1.10). From the chart it can be seen that majority of the plotted data are within the upper and lower line of agreement.



DISCUSSION:

Glaucoma leading to optic neuropathy is one of the leading causes of blindness worldwide including India.^{1,2,5} Intraocular pressure is the only modifiable risk factor which can be corrected either pharmacologically or surgically, depending on the pathology. Early diagnosis and treatment can prevent or delay optic neuropathy. As in the early stages, the symptoms are not evident it is usually diagnosed only after patient come to Ophthalmology OPD at a later stage of the disease when some irreversible damage has already occurred. Considering this German ophthalmological associations recommended regular screening for glaucoma by measurement of IOP from the age of 40 years.^{6,7}

Measurement of IOP can be done using various tonometers, among which Goldmann Applanation Tonometry (GAT) is considered gold standard. As discussed earlier, it is not usually suitable for mass screening, especially in countries like India, where resources are scarce. Schiottz tonometer is widely used due to its compact size, affordability and relative ease of use, and it gives a relatively accurate measurement. Therefore, it is widely used in screening camp in remote area. Ohana et al. found that Schiottz tonometer show higher reading compared to GAT. When Bland-Altman plots were studied it is seen that only two values out of 48 eyes studied were outside 95% agreement lines.⁸ Nagarajan et al. found that there is no significant difference of IOP measured with Perkins tonometer and Schiottz tonometer. Bland-Altman plot also shows most results within 95% agreement lines.⁷

In our study we found that the mean value of IOP measured with NCT is higher than the IOP measured with Schiottz tonometer for both male and female and for both right and left eyes, however, these differences

are not statistically significant ($p > 0.05$; Table: 1 and Table: 2). Nagarajan et al. also found no significant difference between IOP measured with NCT, Schiottz and GAT.² Radhakrishnan et al. compared NCT with GAT and found no significant difference.

In our study, we also didn't find any significant difference of IOP between male and female patients and between right and left eyes, with both the methods.

CONCLUSION:

In our study it has been seen that IOP measured with NCT is higher than IOP measured with Schiottz tonometer. However, this difference is not statistically significant. It has been found in various studies that, there is transient and reversible decrease of IOP occurs in supine posture.^{8,9,10} Anderson et al. found this decrease of IOP is significant only after 15 minutes of supine position, though decrease occurs immediately.⁹

Our study's findings lead to the conclusion that when screening a significant number of patients in a OPD setup within a relatively short time frame, IOP measurement using the Non-Contact Tonometer (NCT) is a viable alternative to the Schiottz tonometer.

The limitation of our study is that IOP measurements were not compared to GAT as it was not routinely done on all the study population, as the study was done to compare Schiottz tonometer and NCT for screening of large population in a limited period of time. However, in situation where there was any doubt and any patient with raised IOP or for all the excluded patients with known glaucoma GAT was done.

Conflict of Interest:

The study was done with the available resources in the institute without any internal or external aid and funding. There is no role of instrument manufacturer in this study.

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