

# Comparision of Intraocular Pressure Measurements with Huvitz Non Contact Tonometer and Goldmann Applanation Tonometry

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## Abstract

**PURPOSE :** To study the reliability of non-contact tonometer and Goldman applanation tonometer at various levels of intraocular pressure.

**MATERIALS AND METHODS :** It is a cross sectional hospital based study, conducted at Govt Regional Eye Hospital between Feb 2015 to Aug 2015 .A total 100 patients enrolled in this study Total number of males 41 and total number of females 59 included in this study shown in figure 1. Age distribution of the patients shown in figure 2.

IOP was measured by NCT and GAT after explaining the procedure. The data was analyzed using SPSS software.

**RESULTS :** The mean age of subjects was 39.9 (mean) years and the range was 21 - 70 years. The mean IOP, as taken by NCT, was 15.05mmHg  $\pm$ 4.08 and the range was 10- 39 mmHg. The mean IOP measurement by GAT was 14.33mmHg  $\pm$ 3.69 with a range of 10 - 32mmHg. The difference between the mean of the NCT and GAT reading was not found to be statistically significant ( $p=0.067$ ). Pearson's correlation coefficient was determined between the two tonometers and was found to have a positive correlation of .945( $p=0.0001$ ). Bland and altman analysis show fair agreement show fair agreement between the two instruments at lower IOP range but poorer agreement at high IOP ranges

## A. Materials and methods

This was a non-interventional, cross sectional study conducted at a tertiary care centre GOVERNMENT REGIONAL EYE HOSPITAL /AMC, VIZAG. 200 eyes of 100 randomly selected patients attending OPD were included in the study. IOP was measured by HUVITZ NCT and a slit lamp mounted GAT in all the subjects.

12 out of 100 subjects were diagnosed as glaucoma and remaining 88 subjects had normal eye examination. The diagnosis of glaucoma was based on IOP, visual fields and disc evaluation. The normal subjects were taken as

**CONCLUSION :** As NCT is simpler, faster, portable can be used as screening tool for community practices but not reliable in the subjects with higher IOP range

**KEY WORDS** – Applanation tonometry, NCT, IOP, Glaucoma, Fluorescein.

## INTRODUCTION

Glaucoma is an optic neuropathy of multivariate etiology where in intraocular pressure (IOP) is the most important and only modifiable risk factor[1]. The accurate IOP measurement has a very important role in diagnosis as well as management of glaucoma. However, Goldmann Applanation Tonometry (GAT) is still the gold standard for the measurement of IOP.[2][3]

HUVITZ noncontact tonometer (NCT) is an air puff tonometer having basic working principle same as that of GAT and compared by many authors[4]

In this study, we compared the IOP measurements by HUVITZ NCT and GAT in patients attending OPD of regional eye hospital.

The readings were taken by properly calibrated GAT. The standard clinical methods, recommendations and guidelines of the manufacturers were followed for appropriate readings.[14]-[16]

The data were entered in Microsoft excel spread sheet. Statistical analysis was done with SPSS 16 software (Chicago, IL, USA). The mean IOP measured by each instrument were compared. Pearson's correlation coefficient was used to explore correlation between the two methods of IOP measurements. An agreement between the

controls.

#### B. Inclusion criteria

200 eyes of 100 patients who were attending OPD of above 20 years and patients who gave informed consent were included in the study

#### C. Exclusion criteria

- (1) corneal opacity, dystrophies, degenerations
- (2) Any active eye disease – uveitis, corneal disease, infection, discharge, etc.
- (3) Any condition that did not allow taking measurements like keratoconus, pterygium

#### D. Methods

##### I. Measurement by HUVITZ NCT:

this was done first in each patient followed by applanation tonometry. It was done before applanation tonometry because touching the cornea by applanation prism might have effect on NCT readings.[6]-[8].The subjects were made to sit with chin and forehead touching the chin rest and forehead rest and IOP was measured by the HUVITZ NCT.The measurements by the HUVITZ NCT were taken three times. The average of three measurements was taken for analysis because it has been found that HUVITZ NCT records first reading high followed by lower consecutive readings.

##### II. Measurement by GAT:

The applanation tonometry was done by a slit lamp mounted applanation tonometer on Haag-Streit device (Haag-Streit, Switzerland). The subjects were seated comfortably on the slit lamp after explaining the procedure. Xylocaine eye drops were instilled as an anesthetic agent followed by application of sterilized strip of Fluorescein (1%) in the inferior fornix of the eye.[2],[3],[9]-[11] The applanation prism tip was cleaned to avoid transmission of infection.[12]-[13]

period[8]. There are other sources of error like thickness of mires, amount of fluorescein dye, inability to be used in young children and physically disabled persons who cannot be positioned properly on slit lamp

In this tonometer an air puff is directed towards cornea which gradually flattens the corneal surface. The moment of applanation is determined by an optical sensor which detects obliquely reflected light rays from the cornea when its surface is flat A microcomputer present in the tonometer calculates the IOP from the known force and area and displays it in digital form. NCT does not require touching the cornea and can be used safely in early post operative cases as the risk of infection is minimal[8]. Moreover, any resident or healthcare personal can be

instruments was calculated by Bland and Altman plots by Medcalc software (Mariakerke, Belgium). A p-value of <0.05 was taken as significant.

#### F. Results

The mean age of subjects was 39.9 (mean) years and the range was 21 - 70 years.

The mean IOP, as taken by NCT, was 15.05mmHg  $\pm$ 4.08 and the range was 10- 39 mmHg.

The mean IOP measurement by GAT was 14.33mmHg  $\pm$ 3.69 with a range of 10 - 32mmHg.

The difference between the mean of the NCT and GAT reading was not found to be statistically significant ( $p=0.067$ ).

Pearson's correlation coefficient was determined between the two tonometers and was found to have a positive correlation of .945( $p=0.0001$ ) shown in figure 3

Bland and altman analysis show fair agreement show fair agreement between the two instruments at lower IOP range but poor agreement at high IOP ranges shown in figure 4

#### G. Discussion

GAT is the gold standard tonometer for IOP measurements but associated problems are attachment with slit lamp, need for a skilled examiner, and portability of the instrument [17],[18].Moreover, GAT requires touching the cornea and staining with fluorescein. This touching of cornea raises the issue of sterilization and predisposes the eye to risk of infection [11]-[13], especially in early post-operative

Agreement between the instruments was fair in IOP ranges of low teens. But it was not reliable in the eyes with high IOP.

The shortcomings of the present study were the immediate IOP testing by the GAT after HUVITZ NCT. It might cause probe bias in the patients which is not known. The parameters that can influence the results like. High refractive error especially astigmatism[5], corneal curvature, biomechanics and axial length were not considered.[23]-[25]These might also have some bearing on the IOP measurements.

trained to measure IOP with this device

Our study included subjects between 40 years and 78 years of age. The mean IOP was less with GAT than with NCT and it was found to be non-statistically significant. The findings of Oguchi et al. suggested that the NCT consistently read higher reading as seen in our study[19]. On Contrary, A study done by Yucell et al. showed that the NCT records IOP lesser than GAT[21] The study done by Babalola et al. from Africa showed no significant difference between the two instruments [20].This could be due to racial differences as their subjects were Africans as in our study that was done on subjects with Indian origin.

The mean of the paired difference in IOP was lesser in IOP less than 20 than above that. These differences in IOP were more common at the higher IOP ranges than the IOP in lower teens. This indicated that in most of the patients the HUVITZ NCT measured IOP correctly if it was within normal range but one has to become cognisant if measured IOP is 20mmHg or above with HUVITZ NCT. This observation has been seen in other studies also The study done by Moseley et al. also showed that at low IOP ranges the NCT tends to underestimate the readings whereas at high IOP ranges it tends to overestimate the IOP[22] .

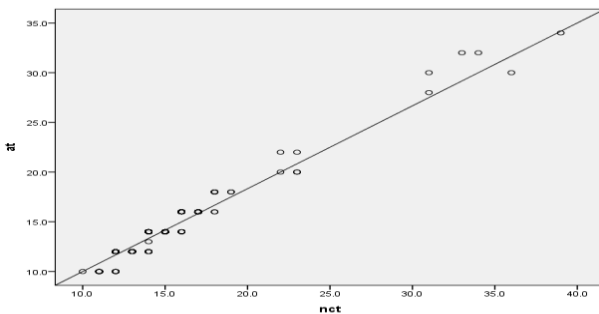


Figure.3 Scatter plot of IOP measurements between GAT and NCT.

In conclusion, we can say that huvitz NCT is a fair tool for screening purposes in community practices as can be easily used by residents and health care personals. The reliability of the instrument decreases if IOP is above 20mmg

#### H. Figures and Tables

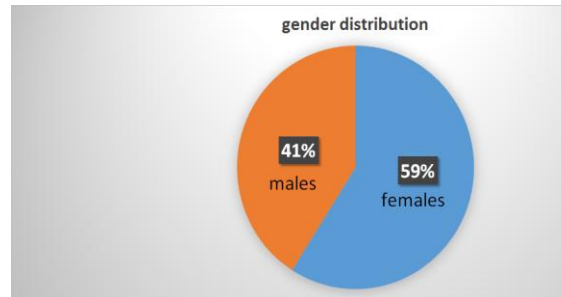


Figure.1

Age distribution

20- 30 years	26
31- 40 years	33
41- 50 years	22
51- 60 years	15
61- 70 years	4

Figure.2

**Financial Disclosure:** No Author has any financial interest.

#### ACKNOWLEDGEMENTS :

We thank Superintendent and Professor Dr.V.V.L. Narasimha Rao and Dr.P.Krishana Prasad .Professor and HOD for permitting to carry out this work.

We thank all the patients who gave their support and participated in this study.

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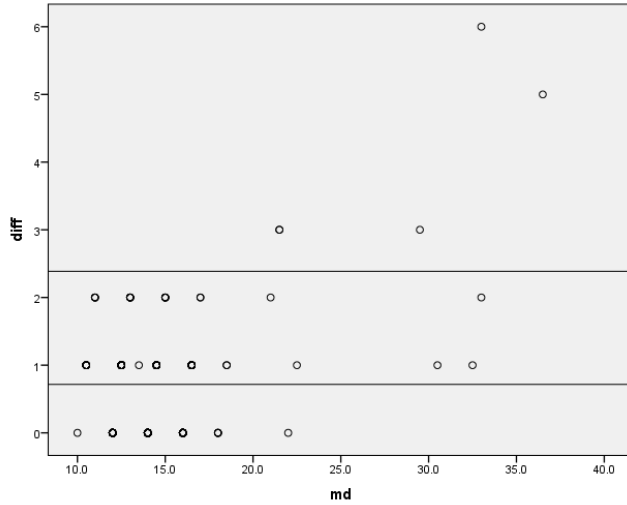


Figure.4 Bland and Altman plot between GAT and NCT.

### E. Conclusion

*NCT can be used for screening tool for community practices but not reliable in subjects with higher IOP range*

*Hence applanation tonometry is gold standard for measurement of IOP*

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