

# A Comparative Study of Intraocular Pressure Measurements by Goldmann Applanation Tonometer and Schiottztonometer and the Study of Schiottz Tonometer a Screening Tool in North Karnataka Population

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## Abstract

**Background:** Glaucoma is a multifactorial disease with common end point characteristics affecting the optic nerve. It is defined as an optic neuropathy characterised by specific structural findings in the optic disc (increased Vertical Cup Disc Ratio (VCDR) or VCDR asymmetry >97.5 percentile) and particular functional deficits in automated visual field testing. It consists of three components: the optic nerve head, the visualfield, and intraocular pressure. Detecting the intraocular pressure is essential in not only initiating treatment, but also in monitoring the response to treatment.

**Method:** 210 purposively selected patients were subjected to three methods of tonometry – Goldmannapplanation tonometry, Schiottz indentation tonometry (with the 5.5g, 7.5g and 10 g weights). Three recordings were obtained with each method and the arithmetic mean taken as the intraocular pressure. The data was statistically analyzed using the intra-class correlation coefficient. Sensitivity and specificity were also calculated for the Schiottz tonometer.

**Results:** The Schiottz tonometer showed fair agreement with the Gold mannappplanationtonometer. The Schiottz tonometer scored low as an effective screening tool.

**Conclusion:** The current study shows that the Schiottz tonometer compares favourably with the Goldmannapplanation tonometer showing fair agreement with it. It showed good specificity and was reliable in detection of positives, excluding false positives.

**Keywords:** Goldmannapplanation tonometer, Schiottz indentation tonometer; screening tool, Intra Ocular pressure (IOP)

## Introduction

Glucoma is the leading cause of irreversible blindness worldwide and world health organisation ranks. It is the second most cause of blindness after

cataract<sup>(1)</sup>. Approximately 40 million population aged above 40 years either has glucoma or at the risk of developing glucoma disease<sup>(2)</sup>. Intra ocular pressure (IOP) is one of the most critical risk factors and the only modifiable in glucoma severe major clinical

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trials have show that, little increase in IOP may lead to damage in visual field and progression in glaucoma. Therefore accuracy and precision in measuring intra ocular pressure are important requirements to predict and monitor disease progression (3) (4). Ophthalmic surgeon to detect glaucoma hence latest technique are required to measure IOP by screening visual fields hence attempt is made to evaluate and compare the Goldmannapplanation tonometer and schiottzapplanation tonometer. So that it will be easy for earlier diagnose and prevent the further complications of irreversible blindness.

### Material and Method

210 (Two hundred ten) patients regularly visited to ophthalmic department of Khaja Banda Nawaz university Faculty of medical sciences Kalaburgi-585102, Karnataka were studied.

**Inclusive Criteria:** Patients above 40 years of age and given their consent for study were selected for study.

**Exclusion Criteria:** Patients already on anti-glaucoma treatment scarred or hazy cornea, patients undergone previous corneal surgery including refractive surgery, microphthalmos, Blepharospary, manifest Nystagmus, Keratoconus, patients having corneal infections.

**Method:** The detailed ocular examination included visual acuity with or without pin hole which will be taken with the help of snellens chart for literates and C chart for illiterate patients. Redinoscopy and auto-refractometry will be used to find refractive error. The conjunctiva, sclera cornea, iris pupil anterior chamber lens, posterior chamber and posterior segment were examined.

Each patient was then subjected to two methods of tonometry Goldmann Applanation tonometry and schiottz Indentation tonometry under topical anaesthesia with proparacaine eye drops (0.5%). First the readings were measured using the Goldmannapplanation tonometer followed by sechiottzindentation tonometer. Three consecutive readings were taken for each eye by each method and average calculated will be taken as the intraocular pressure. The prescribed procedure of Goldmann tonometry and schiottzindentation Tonometry were

carried in every patients and obtained results were noted and compared.

The duration of study Marc-2021 to August-2022

**Statistical analysis:** Various parameters of intraocular pressure were carried out in both schiottz indentation tonometer and Goldmannapplanation tonometer were compared with t test, correlative co-efficient methods, and significant results were noted. The statistical analysis was carried out in SPSS software. The ratio of male and female was 2:1.

### Observation and Results

**Table-1:** Distribution of age group in the present study

113 (53.7%) were aged between 40-50 years old, 56 (26.7%) were aged between 51-60 years, 31 (14.8%) were between 61-70 years, 8 (3.8%) were aged 71-80, 2 (1%) were aged >80 years

**Table-2:** Correlation of GAT and schiottz Tonametre

GATV/s ST 5.5gm  $r=0.321$  and  $p<0.001$

GATV/s ST 7.5gm  $r=0.321$  and  $p<0.001$

GATV/s ST 10gm  $r=0.425$  and  $p<0.001$

All the correlated value were highly significant ( $p<0.001$ ).

**Table-3:** Comparison of specificity and sensitivity in GAT and ST

GTT had 52% specificity, 95.3% sensitivity and 80.1% PPV, 89.2% NPV and ST had 54% specificity 97.2% sensitivity, 82.3 PPV and 90.8% NPV (schiottz tonometers shown high specificity sensitivity PPV, NPV as compared to GAT).

**Table 1: Age wise distribution of patients**

Age groups in years	Number of patients	Percentage (%)
40-50	113	53.7
51-60	56	26.7
61-70	31	14.8
71-80	8	3.8
>80	2	1
Total	210	100
Mean $\pm$ SD	52.92 $\pm$ 10.04	--

**Table 2: Correlation of GAT and schiottz tonometer**

Correlation	Correlation coefficient	p value
GAT v/s ST 5.5 g	r=0.321	P<0.001
GAT v/s ST 7.5 g	r=0.360	P<0.001
GAT v/s ST 10 g	r=0.425	P<0.001

**Table 3: Comparison of sensitivity and Specificity of GAT and schiottz tonometer**

Tonometer	Specificity	Sensitivity	PPV	NPV
GAT	52%	95.3%	80.1%	89.2%
Schiottz	54%	97.2%	82.3%	90.8%

Schiottz tonometer showed high specificity and positive predictive value (PPV) as compare to GAT

### Discussion

In the present comparative study of IOP measurement by GAT v/s ST as a screening tool in north Karnataka population. Out of 210 patients 113 (53.7%) were aged between 40-50 years, 56 (26.7%) were aged between 51-60 years, 31 (14.8%) were aged between 61-70, 8 (3.8%) were aged between 71-80, 2 (1%) were above 80 years (Table-1). In the correlation study of GAT and schiottz tonometer GAT v/s ST 5.5 gm r=0.321 p<0.001, GAT v/s ST 7.5 gm r=0.360 p<0.001, GAT v/s ST 100 gm r=0.425 p<0.001, All the values have significant p value (Table-2). In comparative study of specificity and sensitivity of GAT and ST specificity in GAT was 52%, 54% in ST sensitivity 95.3% in GAT, 97.2% in St PPV was 80.1% in GAT, 82.3% in ST NPV was 89.2% in GAT, 90.8% in ST (Table-3). These findings are more or less in agreement with previous studies<sup>(5)(6)(7)</sup>.

Glaucoma is a multi-factorial disease with common end point to affect optic nerve. It is defined as optic Neuropathy characterised by specific structures findings in the optic disc (Increased vertical cup Disc ratio (VCDR) or VCDR asymmetry >97.5 percentile) and particular functional deficit in automated visual field testing<sup>(8)</sup>.

Normal ocular pressure is essential to maintain the shape of the eye and visual function with prolonged elevation in IOP resulting in irreversible damage to the rational ganglion cells and post ganglionic nerve fibres<sup>(9)</sup>. Detecting IOP is not only initiating treatment, but also in monitoring response

to treatment.

Despite of being gold standard there is some intra and inter reader variability with Goldmannapplanation tonometer (GAT) however GAT is not appropriate for the use of patients who are confined to beds in operating rooms or by general practitioner who provide primary care<sup>(10)</sup>. Schiottz indentation tonometer (ST) provides only a range of pressures within which the actual IOP lay<sup>(11)</sup>. ST is about 1.2 mm Hg lower than the mean GAT pressures, indicating that the ST can read lower than GAT confirming the IOP specificity and sensitivity<sup>(12)</sup>. Hence readings of ST are more reliable in detection of positive findings ST can be used in primary health centres to roughly monitor the IOP in established cases of glaucoma and patients with provisional diagnosis of abnormal IOP must be subjected GAT along with visual acuity and examination of optic nerve involvement but since introduction of the dynamic contour tonometer Monometry, being a direct method would have been superior to GAT.

### Summary and Conclusion

The current study shows that the Schiottz tonometer compares favourably with the Goldmannapplanation tonometer showing fair agreement with it. It showed good specificity and was reliable in detection of positives, excluding false positives. Thus it comes across as a fair screening tool. It may be used in primary health centers to roughly monitor the intraocular pressure in established cases of glaucoma and patients with provisional diagnosis of abnormal IOP must be subjected to Goldmannapplanation tonometer, along with visual fields and examination of optic nerve head for conformation and follow-up.

**Limitation of study:** Owing to tertiary location of research centre and small number of patients and lack of latest technologies, we have limited findings and results.

This research paper was approved by Ethical committee of KBN university faculty medical sciences Kalaburgi.

**Conflict of Interest:** No

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