



CLINICAL EVALUATION OF INTRAOCULAR PRESSURE MEASUREMENTS USING DIFFERENT TONOMETERS IN PATIENTS OF VARIOUS REFRACTIVE ERRORS

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ABSTRACT

Background: Intraocular pressure (IOP) is an important first indicator of probability and suspicion of Glaucoma. The virtual IOP status is grossly influenced by multiple factors including Refractive errors, corneal biomechanics, central corneal thickness (CCT) and Scleral rigidity. **Aim:** To compare relative IOP measurements and its variability in Emmetropes, myopic and hypermetropic patients using Schiottz, Goldmann Applanation (GAT) and I-Care Rebound tonometer to establish an equation between virtual and real time IOP. **Materials and Methods:** This observational prospective study comprised of 100 subjects above the age of 18 years inclusive 37 Emmetropes, 31 Hypermetropes and remaining 32 belonged to myopia. **Statistical Analysis:** Descriptive statistics were performed using SPSS for Windows version 17.0 to calculate the demographic characteristics of the study cohort. The data were expressed as mean values including the standard deviation (SD) and the 95% confidence interval (CI). Mean IOP measurements between Schiottz, I-Care and GAT were compared by One way ANOVA along with Individual pair wise comparison by applying Post Hoc Tukey Test for comparison of IOP measurements using a particular method of Tonometry in individuals of myopia, hypermetropia and emmetropia. **Results:** The highest mean value of CCT 536.667 μm was in Hypermetropes whereas the lowest CCT value of 507.031 μm was in myopic eyes with statistically significant ($P < 0.05$). The mean value for IOP in Emmetropes was 16.665 mm Hg for Schiottz, 15.027 Hg for GAT and 15.081 mm Hg for I-Care. Whereas Hypermetropes revealed mean value of 15.055 mm Hg for Schiottz, 14.323 mm Hg for GAT and 14.065 mm Hg for I-Care. The mean value for IOP in Myopic eyes was 16.875 mm Hg for Schiottz, 14.375 mm Hg for GAT and 14.688 mm Hg for I-Care. **Conclusion:** The study had revealed higher mean value of IOP in Myopic eyes as compare to Emmetropic and Hypermetropic subjects. IOP measurements by the Schiottz tonometer were significantly higher as compare to GAT and I-Care tonometer. Whereas recordings by GAT and I-Care tonometers were almost in agreement. Definitive correlation could not be established between pachymetry readings and adjusted IOP following GAT and I-Care tonometry.

KEYWORDS: Correlation of IOP and refractive errors, comparison of efficacy of Schiottz, Goldmann Applanation and I-CARE Rebound tonometer. IOP in Myopia. Correlation of CCT and IOP

INTRODUCTION

Measurement of Intraocular pressure (IOP) is an integral component of any Ocular examination as well as the very first indicator of probability and suspicion of Glaucoma.

There are numerous methods and tonometers are available to record Intra IOP (1,2). Schiottz Tonometer remained as a standard portable tool for the purpose of quick recording of IOP despite its limitations in the consistency and factors like scleral rigidity (1).

The Noncontact tonometer has replaced Schiottz tonometer as a screening tool and general OPD protocol but it has significant inconsistency in results. (2) However Goldman Applanation tonometer (GAT) remained a Gold Standard due to its high accuracy and precision despite constraints of need of Slit lamp and use of Fluorescein Dye to stain Cornea. Ocular Response Analyser, Corvis ST (3,4) followed by I-Care rebound tonometer (1,2) are newer modalities in the field of IOP measurement. I-Care rebound tonometer is gaining wide attention as it is easy to use, portable and non contact technology that without using any dye to stain cornea. (1,2)

The real IOP status is grossly influenced by multiple factors including existing Refractive errors, corneal biomechanics, central corneal thickness (CCT) and Scleral rigidity. (5,6,7,8,9,10,11,12,13,14) Over and above, virtual IOP recorded by different methods are invariably influenced by such factors. Hence it is very difficult to have absolute accuracy in IOP recordings by any method. There for this study was undertaken to compare outcome of IOP recording by different methods in prevailing refractive errors so as to establish an optimal equilibrium between virtual and real time IOP clubbed with maximum precision.

To the best of our knowledge, the present study is a maiden attempt to compare and evaluate the efficacy of Schiottz, Goldmann Applanation and I-Care rebound tonometer in all three refractive status including Emmetropia, Hypermetropia and Myopia in the non glaucomatous Central Indian population.

Materials and Methods: This observational prospective study was comprised of 100 subjects of both sexes and above the age of 18 years inclusive of 37 Emmetropes, 31 Hypermetropes and remaining 32 were having myopic refractive errors.

The exclusion criteria were, any subject below the age of 18 years, known history of Glaucoma, any previous corneal surgery including refractive surgery, Scarred or Hazy corneas, Microphthalmos, Blepharospasm, Manifest Nystagmus, Keratoconus. Eyes associated with any active conjunctival or corneal infections were also excluded.

The study was conducted in accordance with the Declaration of Helsinki. Ethical approval was obtained from the Ethics Committee of the Institution.

Study Design

Detailed ophthalmic examination including assessment of visual acuity, refractive errors, anterior and posterior segment evaluation was essentially carried out in all subjects.

Central corneal thickness (CCT) was measured by a solid-tip, ultrasonic pachymeter. After installation of a drop of 0.5% proparacaine hydrochloride, nine readings were performed in rapid succession and the average value was recorded.

The IOP measurement was performed in supine position for

Schiotz Tonometer, where as in sitting position for GAT and I-CARE rebound tonometry in the sequence of I-CARE and GAT followed by Schiotz tonometry .All the instruments were regularly calibrated according to the manufacturers' instructions. A 10min break was set between each IOP measurement to minimize after-measurement fluctuations in the IOP.

In case of Schiotz Tonometer , Three consecutive measurements within 2 mm Hg on each eye were performed. In case of any deviation of more than 2 mm Hg in the readings , another measurement was obtained. The average of three final measurements was taken for analysis.During the I-Care measurement, a disposable, single-use probe was loaded into the device and aligned 4-8 mm perpendicular to the central cornea. Six consecutive measurements were performed. The software automatically discarded the highest and the lowest values, and the IOP was calculated from the remaining four values. Only proper measurements(the green back ground indicating within reasonable limits) were accepted. GAT was performed with the Goldmann applanation device mounted on a slit-lamp biomicroscope. After installation of a drop of 0.25% fluorescein with 0.5% proparacaine hydrochloride, in each eye, three sequential measurements were performed and the average value of three measurements were documented .

Statistical Analysis

Descriptive statistics were performed to calculate the demographic characteristics of the study cohort. The data were expressed as mean values including the standard deviation (SD) and the 95% confidence interval (CI).Mean IOP measurements between Schiotz, I-Care and GAT were compared by One way ANOVA along with Individual pair wise Juxtaposition by applying Post Hoc Tukey Test for comparison of IOP measurements using a particular method of Tonometry in case of myopia, hypermetropia and emmetropia.

Values were considered significant if p values were less than 0.05 and non significant if p values were more than 0.05.

All analysis were performed using SPSS for Windows version 17.0 (SPSS Inc, Chicago, IL)

RESULTS

Of these 100 subjects ,37(37%) Emmetropes ,31(31%) Hypermetropic and remaining 32(32%) were Myopic all inclusive 51% females and 49% males respectively.

Table 1: Comparison Of Mean IOPVariable By Schiotz, GAT And I-care Methods In All Three Refractive Status

Refractive error	Schiotz tonometer (in mm Hg)	Goldmann Applanation (in mm Hg)	I-Care (in mm Hg)
Emmetropia	16.665	15.027	15.081
Myopia	16.875	14.375	14.688
Hypermetropia	15.055	14.323	14.065

The mean value for IOP by the Schiotz tonometer was highest among all three methods of IOP measurement with in all subjects inclusive Emmetropic, Myopes and Hypermetropes. Whereas readings of GAT and I- Care were in agreement with insignificant P value. .

Table 2: Comparison Of Mean IOP Variable Among Applanation & Schiotz Methods.

Variable	Method	N	Mean	Std. Dev	T Test	P Value	Result
IOP	APPLANATION	100	14.600	3.002	3.	0.001	Sig
	SCHIOTZ	100	16.073	3.366	266		

Table 2, represented the comparison of mean IOP variable among Applanation & Schiotz methods.T-test was applied to

compare the difference between the mean value of IOP among different methods which was found to be statistically significant (P<0.05).The mean value 14.600 of applanation method was significantly lower than the mean value 16.073 of Schiotz method.

Table 3: Comparison Of Mean IOP Variable Among GAT & I-care Methods.

Variable	Method	N	Mean	Std. Dev	T Test	P Value	Result
IOP	GAT	100	14.600	3.002	0.098	0.922	Non Sig
	I-Care	100	14.640	2.758			

Table 03, showed the comparison of mean IOP variable among GAT & I-Care methods. T-test was applied to compare the difference between the mean value of IOP among different methods which was found to be statistically non-significant (P>0.05).The mean value 14.600 of GAT method was non-significantly lower than the mean value 14.640 of I-Care method.

Table 04 : Comparison Of Mean IOP Variable Among Schiotz & I-care Methods

Variable	Method	N	Mean	Std. Dev	T Test	P Value	Result
IOP	SCHIOTZ	100	16.073	3.366	-3.712	0.000	Sig
	ICARE	100	14.640	2.758			

Table 5 :Comparison Of Mean Value Of Pachymeter Among Different Groups

Variable	Groups	N	Mean	Std. Dev	F Test	P Value	Result
Pachymeter	Myopia	32	507.031	24.3237	8.	0.	Sig
	Hypermetropia	31	536.677	33.4797			
	Emmetropia	37	525.541	29.1782			
	Total	100	523.070	31.2718			

The table No.5 had shown the mean comparison of mean value of Pachymeter among three different groups. One way ANOVA test was applied to compare the difference between the mean value of three groups .The highest mean value of CCT 536.667 mum was in Hypermetropes whereas the lowest CCT value of 507.031mum was in myopic eyes with statistically significant (P<0.05). Whereas comparison in hypermetropia with Emmetropia was statistically non-significant (P>0.05).

The individual pair wise comparison of all three groups was done by applying Post Hoc Tukey Test.

Table 6 :Post HOC Tukey Test: The Individual Pair Wise Comparison Of All Three Groups

Dependent Variable			Mean Diff	Std. Error	P Value	Result
PACHY-METER	Myopia	Hypermetropia	-29.646*	7.355	0.000	Sig
		Emmetropia	-18.509*	7.045	0.027	Sig
	Hypermetropia	Emmetropia	11.137	7.106	0.265	Non Sig

In the above pairwise post hoc comparisons, the pair myopia and hypermetropia,pair myopia with hypermetropia & emmetropia was statistically significant (P<0.05)whereas hypermetropia with emmetropia was statistically non-significant (P>0.05).

Table 7 :comparison Of Mean Value Of Adjusted IOP Among Different Groups

Variable	Groups	N	Mean	Std. Dev	F Test	P Value	Result
Adjusted IOP	Myopia	32	17.406	3.499	1.089	0.341	Non Sig
	Hypermetropia	31	15.014	2.579			

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