

Comparison of CT800 non-contact tonometer and Perkins applanation tonometer in community practices

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Declaration

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Objectives

- ▶ Estimated 76.0 million of worldwide population will suffer from glaucoma by year 2020¹
- 1. Compared CT800 non-contact tonometer to the Perkins applanation (handheld reference method) during eye screening
- 2. To demonstrate the agreement between these two instruments

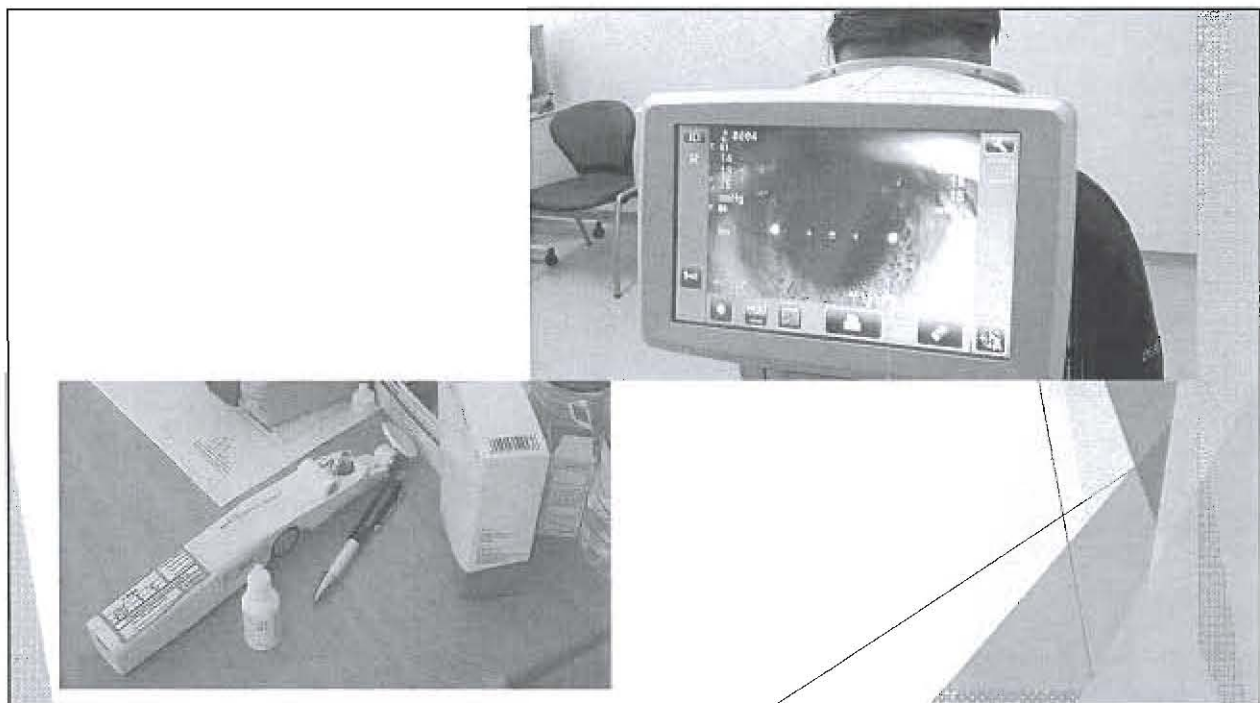
1. Tham, Y.-C., et al., Global Prevalence of Glaucoma and Projections of Glaucoma Burden through 2040. Ophthalmology, 2014. 121(11): p. 2081-2090.

Methods

- ▶ A cross sectional, non- interventional study 1 April-31 May 2017
- ▶ *Inclusion criteria* :Subject attended eye screenings
- ▶ *Exclusion criteria*: corneal scar, corneal pathology, active ocular infective disease, recent intraocular surgery, glaucoma patients, allergic to topical anaesthetic drop.
- ▶ IOP measurement by computerised tonometer CT 800 non contact tonometer (Topcon, Japan) was done first by an optician in sitting position. Three measurements were done on the right eye followed by the left eye without topical anaesthetic drop. The average of three measurements was taken for analysis.

Method

- ▶ After 1/2 hour, IOP measurement was read using Perkins MK3 applanation tonometer (Haag-Streit, UK) by a single ophthalmologist who was masked about NCT IOP reading. Each eye was instilled with an anaesthetic agent (proparacaine 5%) and application of fluorescein 1%.
- ▶ Subjective preference of measurement methods by subject was documented.



Results

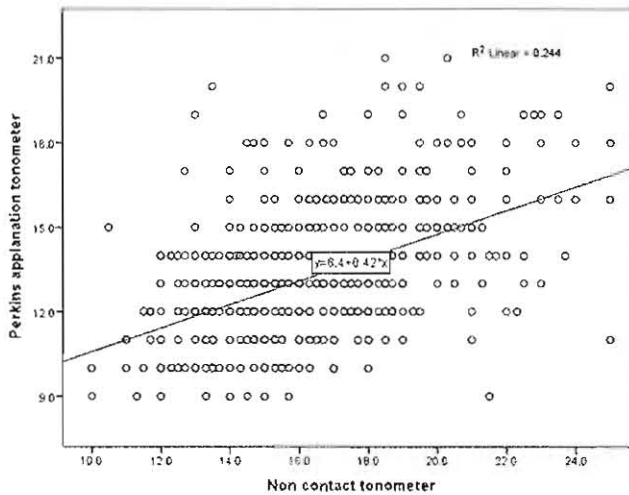
- ▶ A total of 687 eyes of from 344 subjects were recruited.
- ▶ The mean age of subjects was 42.3 ± 18.48 years and the range was 7 to 82 years.
- ▶ 66% of subjects were female.

	N	Minimum	Maximum	Mean (mmHg)	Std. Deviation
PAT	687	9.0	21.0	13.21	2.27
NCT	687	10.0	25.0	16.30	2.68

PAT: Perkins applanation tonometer

NCT: Non-contact tonometer

Results



Pearson's correlation coefficient showed a moderate positive correlation of $+0.494$ between the two methods of IOP measurement ($r = +0.494$, $p < 0.001$).

A linear regression analysis of PAT versus NCT measurements revealed a slope of 0.42 with a square of 0.244 .

Results

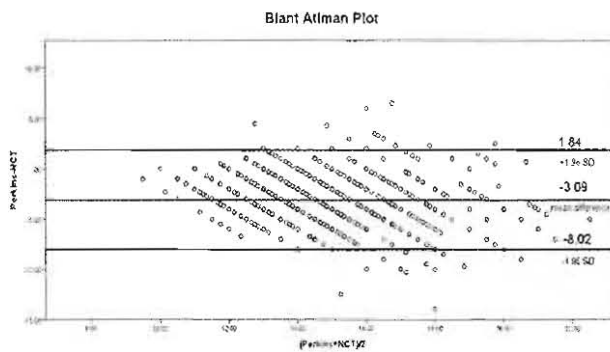
One-Sample paired t-test

Diff	N	Mean	Std. Deviation	Std. Error Mean	p
	687	-3.09	2.52	.096	<0.001

Paired t-test showed significant overall difference between two instruments ($p < 0.001$).

The mean difference between PAT and NCT was 3.09, standard deviation of 2.52mmHg. Overall, NCT measures measured 3.09mmHg higher than Perkins .

Results



The limit of agreement was calculated as -8.02 to 1.84 mmHg with 1.96 standard deviation of either side of mean difference.

Bland-altman plot showed fair agreement for both methods of IOP reading.

Subjectively, 69.8% of subjects preferred Perkins tonometry measurement than CT 800 NCT.

Discussion

1. Why Perkins measures lower IOP than CT800 non-contact tonometer?

Perkins

- ✓ operator dependent
- ✓ one IOP reading
- ✓ ocular massage effect¹⁻³
- ✓ topical LA

1. AlMubrad, T.M. and K.C. Ogbuehi. The effect of repeated applanation on subsequent IOP measurements. *Clinical and Experimental Optometry*, 2008 91(6): p. 524-529.

2. Moses, R.A. and C.H. Liu. Repeated applanation tonometry. *Am J Ophthalmol*, 1968, 66(1): p. 89-91.

3. C.E., K and W. K., On repeated tonometry. *Acta Ophthalmol Scand* 1971, 49: p. 611-614.

Discussion

2. Perkins versus CT800 NCT during community eye screening

Perkins	CT800 NCT
Cheaper	More expensive
Handy	Slight bulky
Slower	Faster
Eye doctor	Paramedic
Risk of cross infection ¹⁻²	Rare
Need topical LA and fluorescein	Air puff

1. PeWalia, J.S. and C.L. Chronister. Possible iatrogenic transmission of Creutzfeldt-Jakob disease via tonometer tips: a review of the literature. *Optometry*, 2001 72(10): p. 649-52.

2. Amin, S.Z., et al., Minimising the risk of prion transmission by contact tonometry. *The British Journal of Ophthalmology*, 2003, 87(11): p. 1360-1362.

Discussion

Studies compare Perkins tonometer with non contact tonometer

Author	subject	Eyes	method	Correlation	Mean Perkins (mmHg)	Mean NCT (mmHg)	Bias & SD	95% LoA (mmHg)
Bricker et al (1990)	30	-	Keeler pulsair vs Perkins	R=0.92, p<0.001				Not done
Prabhakar et al (2013)	83	166	Keeler pulsair vs Perkins	R=0.510	13.06	14.53	-1.47/nil	-4.5 to 7.5
Ragarajan S et al (2016)	400	800	Canon TX-10 vs Perkins		13.8	13.9	-0.02/3.9	-7.67 to 7.64
Our study (2017)	344	687	CT 800 vs Perkins	R=0.494, p<0.001	13.21	16.30	-3.09/2.52	-8.02 to 1.84

Bias: Mean difference

SD: Standard deviation

LoA: Limits of agreement of Bland Altman method

Discussion

- ▶ Ogbuehi compared Topcon CT80 non-contact tonometer, the older generation, with the Goldmann applanation tonometer .
- ▶ Topcon CT80 read 0.2 ± 1.5 mmHg higher than Goldmann.
- ▶ The 95% limit of agreement were -3.14 and +2.74 mmHg.
- ▶ Ogbuehi concluded that Topcon CT 80 NCT can be used as an objective clinical method to assess normal intraocular pressure.

Ogbuehi, K.C., *Assessment of the accuracy and reliability of the Topcon CT80 non-contact tonometer*. Clin Exp Optom, 2006. 89(5): p. 310-4.

Limitation

1. Small sample sizes
2. Narrow range of intraocular pressure were recruited
3. Cornea factor eg CCT, astigmatism not studied

Conclusions

1. CT 800 non contact tonometer is a fair screening tool in community practice.
2. There was statistically significant difference in IOP reading between CT 800 NCT and Perkins applanation with CT 800 NCT read 3.09mmHg higher than Perkins applanation tonometer.
3. We would suggest to get a confirmation IOP reading by Goldman applanation tonometer when non-contact tonometer read high IOP values.