



Comparison of Tono-pen Avia and Handheld Applanation Tonometry in Primary Congenital Glaucoma



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PURPOSE

To compare intraocular pressure (IOP) measurements obtained using Tono-pen AVIA (TPA) and a handheld version of Goldmann applanation tonometer (GAT) in children with primary congenital glaucoma (PCG).

METHODS

Forty-two eyes from 23 patients were evaluated for central corneal thickness (CCT), axial length (AL), biomicroscopy and IOP measurement with TPA and a handheld GAT under inhalation anesthesia. After one eye from each patient was randomized, paired Student's t-test and Pearson correlation were used for analysis. Generalized linear mixed model was used to estimate the difference between tonometers.

RESULTS

Mean age of children was 28.3 ± 20.5 months. Mean AL was 24.89 ± 3.33 mm and mean CCT was 605.9 ± 81.0 microns. Mean IOP was 22.1 ± 9.6 for TPA and 14.0 ± 4.5 mmHg for GAT. There was a significant difference of 8.1 ± 6.9 mmHg between TPA IOP and GAT IOP ($P < 0.001$). Each 6 months increase in age was associated with 1.32 mmHg reduction in the difference between tonometers ($P=0.002$) and each 1 mmHg higher of mean GAT IOP was associated with -0.73 mmHg in the difference between TPA and GAT ($P=0.002$). Also, for every 20 microns increase in CCT an increase of 1.16 mmHg in the difference between both devices was expected ($P = 0.003$), after adjustment for potentially confounding variables.

Table 1. Demographic and Clinical Characteristics of Study Subjects

Characteristics	Data
Number of patients (eyes)	23 (43)
Age (months), mean \pm SD	28.3 ± 20.5
Gender, male/female	16/7
Axial length (mm), mean \pm SD	24.89 ± 3.33
CCT (μ m), mean \pm SD	605.9 ± 81.0
DME, number (%)	7 (16.3)
CCL, number (%)	14 (32.6)

SD, standard deviation; CCT, central corneal thickness;
DME, diffuse microcystic edema;
CCL, central corneal leukoma.

Table 2. Intraocular Pressure of Eyes in the Study (n= 23)

Variables	Mean \pm SD	95% Confidence Interval		*P Value
		Lower	Upper	
TPA IOP	22.1 ± 9.6	18	26.3	
GAT IOP	14.0 ± 4.5	12	15.9	
TPA IOP - GAT IOP	8.1 ± 6.9	5.1	11.1	<0.001

GAT IOP, handheld Goldmann applanation tonometry intraocular pressure;
TPA IOP, tono-pen avia intraocular pressure; SD, standard deviation;
*P Value is derived from paired t test.

Table 3. Multivariable Generalized Linear Mixed Models of the Effect of Each Clinical Characteristic on the difference between TPA IOP and GAT IOP

Characteristics	Multivariable Model	
	Coefficient	P-value
Age (per months)	-0.22	0.002
Gender, female	0.91	0.727
Axial length (per mm)	0.85	0.055
CCT (per 10 μ m)	0.58	0.003
GAT (per mmHg)	-0.73	0.002
Diffuse microcystic edema		
Present	0 (base)	
Absent	2.95	0.426
Central corneal leukoma		
Present	0 (base)	
Absent	-0.77	0.831

SD, standard deviation; CCT, central corneal thickness;
GAT, handheld Goldmann applanation tonometry
TPA, tono-pen AVIA; IOP, intraocular pressure

CONCLUSION

There is a significant difference between TPA IOP and GAT IOP in PCG. The difference between TPA and GAT in PCG is influenced by CCT, age and GAT IOP value.

COMMERCIAL RELATIONSHIPS

Artur William Caldeira Abreu Veloso, None; Sebastião Cronemberger, None.

REFERENCES

- Calixto N, Cronemberger S. Oftalmologia Pediátrica. In: Dantas A, Moreira A, eds. Cultura Médica; 2006:251-294.
- Cronemberger S, Calixto N, Avellar Milhomens TG, et al. Effect of intraocular pressure control on central corneal thickness, horizontal corneal diameter, and axial length in primary congenital glaucoma. J aapos. Oct 2014;18(5):433-6. doi:10.1016/j.jaapos.2014.05.012
- Weinreb RN, Grajewski AL, Papadopoulos M, Grigg J, Freedman S. Childhood glaucoma. vol 9. Kugler Publications; 2013.
- Levy J, Lifshitz T, Rosen S, Tessier Z, Biedner BZ. Is the tono-pen accurate for measuring intraocular pressure in young children with congenital glaucoma? J aapos. Aug 2005;9(4):321-5. doi:10.1016/j.jaapos.2005.02.006
- Sampaolesi R, Zarate J, Sampaolesi J. Ocular echometry in the diagnosis of congenital glaucoma. The Glaucomas Pediatric glaucoma. Heidelberg: Springer-Verlag; 2009:41-54:chap 6.
- Kiskis AA, Markowitz SN, Morin JD. Corneal diameter and axial length in congenital glaucoma. Can J Ophthalmol. Apr 1985;20(3):93-7.
- Mok KH, Wong CS, Lee VW. Tono-Pen tonometer and corneal thickness. Eye (Lond). 1999;13 (Pt 1):35-7. doi:10.1038/eye.1999.7
- Draeger J, Rumberger E, Dauper J, Deutsch C. Microprocessor controlled tonometry. Eye (Lond). 1989;3 (Pt 6):738-42. doi:10.1038/eye.1989.114
- Kriegelstein GK, Waller WK. Goldmann applanation versus hand-applanation and .schlötz indentation tonometry. Albrecht Von Graefes Arch Klin Exp Ophthalmol. 1975;194(1):11-6. doi:10.1007/bf00408271
- Draeger J. Principle and clinical application of a portable applanation tonometer. Invest Ophthalmol. Apr 1967;6(2):132-4.