AMERICAN JOURNAL OF APPLIED MEDICAL SCIENCE
ISSN: 2996-5101 (online) | ResearchBib (IF) = 10.81 IMPACT FACTOR
Volume-3| Issue-11| 2025 Published: |30-12-2025|

COMPARATIVE ANALYSIS OF INTRAOCULAR PRESSURE MEASUREMENT METHODS IN CHILDREN

https://doi.org/10.2851/zenodo.17901758

Narzullayeva Dildoa Uktamovna
*PhD, **Assistant.***
Tashkent State Medical University
(Tashkent, Uzbekistan)

Abstract

Background: Accurate measurement of intraocular pressure (IOP) in children is essential for diagnosing and managing primary congenital glaucoma and determining the need for surgical intervention. Various tonometry methods are used in pediatric practice, yet their measurements often differ, creating challenges for clinical decision-making.

Purpose: To perform a comparative analysis of IOP measurements obtained using three methods — the Maklakov applanation tonometer, the Icare IC 100 rebound tonometer, and the transpalpebral tonometer IGD-03 — in healthy children and in children with congenital glaucoma.

Materials and Methods: The study included 54 children aged 7–10 years, divided into two groups: healthy children (26 children, 52 eyes) and children with congenital glaucoma (28 children, 56 eyes). IOP was measured using the three methods according to standard clinical protocols. Mean values (M±σ) were compared, and statistical significance was assessed.

Results: The tonometer Icare IC 100 demonstrated significantly higher IOP values in children with glaucoma compared with the Maklakov tonometer ($p<0.001$). No statistically significant differences were found between the standard and modified versions of the Maklakov tonometer. Transpalpebral tonometry showed lower IOP values compared to applanation measurements but proved useful for dynamic postoperative follow-up.

Conclusion: The Maklakov tonometer remains the reference method for accurate IOP measurement in children. The Icare IC 100 tends to overestimate IOP, particularly in cases of elevated pressure, which should be considered in clinical practice. Transpalpebral tonometry serves as an additional method suitable for postoperative monitoring. Combined use of these techniques improves diagnostic precision and the management of pediatric glaucoma.

Keywords

AMERICAN JOURNAL OF APPLIED MEDICAL SCIENCE
ISSN: 2996-5101 (online) | ResearchBib (IF) = 10.81 IMPACT FACTOR
Volume-3| Issue-11| 2025 Published: |30-12-2025|

intraocular pressure, pediatric glaucoma, tonometry, Maklakov tonometer, Icare rebound tonometer, transpalpebral tonometry, children.

INTRODUCTION

Intraocular pressure (IOP) is a key diagnostic parameter in pediatric ophthalmologic examinations. Accurate IOP values are essential not only for confirming or excluding primary congenital glaucoma (PCG), but also for determining the scope of surgical intervention [1,2,3].

The earliest method for assessing IOP was palpation, which was used before the introduction of specialized instruments. Modern ophthalmology offers a variety of tonometers, although their measurements often vary, especially in pediatric patients, where diagnostic accuracy is crucial.

Materials and Methods

The study was conducted at the Department of Pediatric Ophthalmology of the Tashkent State Medical University. Children aged 7 to 10 years were included: those without ocular hypertension (main group) and children with elevated IOP due to glaucoma (control group). Main group: 26 children (52 eyes)

Control group: 28 children (56 eyes)

IOP was measured using the following methods:

Maklakov applanation tonometer — operates based on the Imbert–Fick law (P = F/S) and is considered the "gold standard" in CIS countries.

Icare IC 100 rebound tonometer — a modern device widely used abroad. It does not require anesthesia due to minimal contact time of the probe with the cornea, preventing a corneal reflex.

Transpalpebral tonometer IGD-03 — a portable device that measures IOP through the eyelid. It uses dynamic energy transmission instead of a ballistic principle, which improves accuracy and reproducibility [3–5].

Table 1.

Mean IOP values (M±σ) are presented in the table below:

Group	IOP	Maklakov Tonometer	Icare IC 100	Transpalpebral Tonometer IGD-03
Main group 26 children (52 eyes)	P_0	18,8±2,65	16,57±3,64	
	P_t	20,7±4,09$^{\Delta\Delta\Delta}$		17,7±3
Control group 28 children (56 eyes)	P_0	23,45±6,62**	28±10,54*	
	P_t	30,25±8,38*$^{\Delta}$		25±8,47*

Notes: IOP — intraocular pressure; R_0 — true IOP; Rt — tonometric IOP; * — $p<0.001$; ** — $p<0.01$; ns — no statistically significant differences between modified and standard Maklakov tonometers.

The analysis showed that the Icare IC 100 tonometer produced higher IOP readings in the glaucoma group, consistent with findings from other authors [4,5 Transpalpebral tonometry is not a primary diagnostic method but serves as an important tool for postoperative follow-up in children.

Discussion

The comparative assessment of IOP measurement methods in children revealed the following: The Maklakov tonometer remains the gold standard in CIS countries due to its accuracy and reproducibility. The Icare rebound tonometer tends to show higher IOP values in children with elevated pressures, making it useful for early detection of glaucoma. Transpalpebral tonometry is convenient for younger children and for postoperative monitoring because it does not require anesthesia and the device is compact.

Thus, the choice of IOP measurement method depends on the clinical situation: traditional applanation tonometry is preferred for precise diagnostics, rebound tonometry is suitable for screening and dynamic monitoring, and transpalpebral tonometry is useful in postoperative follow-up.

Conclusion

Different IOP measurement methods in children demonstrate varying degrees of accuracy and reproducibility. The Maklakov tonometer remains the reference method, the Icare IC 100 tonometer is effective for detecting elevated IOP in pediatric glaucoma, and transpalpebral tonometry serves as an auxiliary tool for dynamic observation. Combined use of these methods helps optimize the diagnosis and management of childhood glaucoma.

Conflict of Interest Statement

The author declares no competing interests.

Author Contributions

D. Narzullayeva, PhD:

Was responsible for the conceptualization of the case report, clinical assessment and follow-up of the patient, acquisition and analysis of clinical data, literature review, and preparation of the initial and final versions of the manuscript.

REFERENCES:

1. Badawi A. H., Al-Muhaylib A. A., Al Owaifeer A. M., Al-Essa R. S., Al-Shahwan S. A. Primary congenital glaucoma: an updated review // Saudi J. Ophthalmol. 2019. Vol. 33, № 4. P. 382–388.
2. Avetisov S.E., Erichev V.P., Antonov A.A., Poleva R.P., Kozlova I.V., Makarova A.S. Modern advances in the diagnosis and treatment of glaucoma. *Vestnik Oftalmologii*. 2023;139(3-2):96–106.
3. Narzullaeva D.U., Khamraeva L.S., Bobokho L.Yu., Makhmudova D.T. New ways to measure intraocular pressure in children with microphthalmia and blepharophimosis. «American Journal of Medicine and Medical Sciences» 14(4): 867-868.2024; США
4. Fayed M. A., Chen T. C. Pediatric intraocular pressure measurements: tonometers, central corneal thickness, and anesthesia // Surv. Ophthalmol. 2019. Vol. 64, № 6. P. 810–825.
5. Feng C. S., Jin K. W., Yi K., Choi D. G. Comparison of intraocular pressure measurements obtained by rebound, non-contact, and Goldmann applanation tonometry in children // Am. J. Ophthalmol. 2015. Vol. 160, № 5. P. 937–943.e1.