KASR ALAINY

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Agreement between Rebound and Applanation Tonometry in Children

Presented by

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Agreement profiles for rebound and applanation tonometry in normal and glaucomatous children

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IOP measurement

- Goldmann applanation
  - Gold standard
  - Perkins
- In Pediatric age group: (Challenges)

But

Challenges

Sitting at the Slit lamp?

Cooperation????

In office Sedation?

In theatre General anesthesia? (type/stage)

Advantages of I-Care

- Handheld RBT
- **Fine** sensor **tip** (less than 2 mm in diameter)
- **Fast**: Measurements are taken within 0.1 s.
- The force is minimal →**No blink reflex**.
- **No topical anesthesia** is required.
- **Awake**

So what do we have?

A Gold standard

- Challenges

PAT

New promising tool

- Needs validation

I-Care TA01

Purpose

- To detect the degree of **agreement** between IOP measurements by RBT and PAT **in children with and without PCG**

- Test devices' **agreement** with varying **age and IOP**
- Investigate whether there is an **IOP limit**, above which the degree of agreement changes.

Methods

- A prospective non-interventional comparative study (Jan-June 2017)
- 223 eyes of 115 children(<16 years)
  - 161 normal eyes
  - 62 PCG eyes.
- Excluded patients:
  - 2ry glaucoma, corneal edema, uncooperative

Methods

- IOP measured in upright position
  - First by I-Care (TA01)
  - then topical anesthetic (Benox ® eye drops)
  - then by Perkins applanation tonometer.



- 9 cases required sedation (chloral hydrate) for measuring with PAT

Statistics

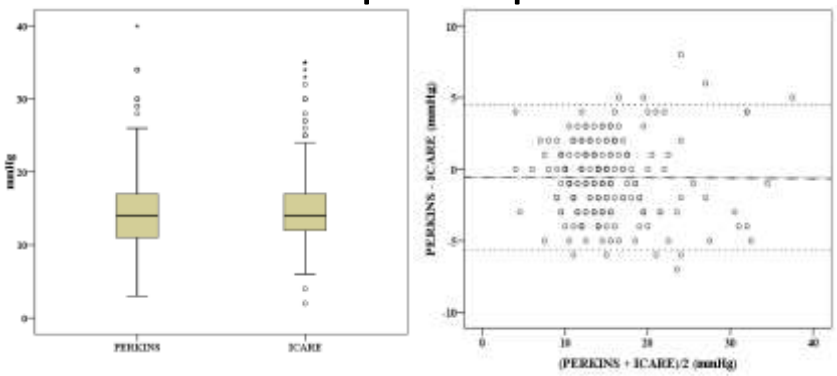
- Groups
  - Normal and PCG
  - ≤3 years and >3 years
  - IOP ≤ 15 mmHg and those > 15 mmHg
- The Bland-Altman plot was used to compare the bias, and 95% LOA between I-Care and PAT in each group.

Results

	Normal	PCG	p value
Age (y)	6.3 (4mo-14y)	7 (8mo-16y)	0.205

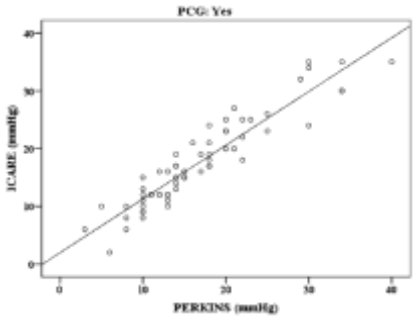
	PAT	I-Care	Difference	p-value	Regression
IOP all	14.6± 5.5	15.2± 5.5	−0.59 ± 2.6	p = 0.001	r = 0.9 and r^2 = 0.79 (p < 0.001)

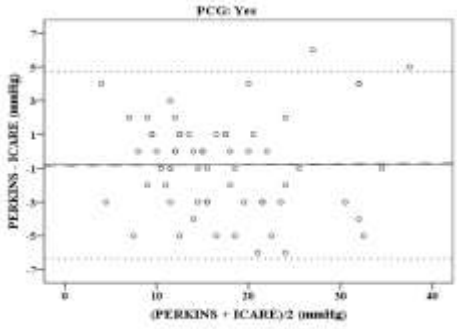
For all participants



- **Bland–Altman plot** between average and mean difference in IOP by both devices.
- The thin solid line is the mean of difference (−0.59 ± 2.6)
- The dashed line is the 95% LOA −5.67 and +4.49 mmHg
- **Fixed bias** (p = 0.001)
- Dash dotted line is the regression line (r = 0.9 and r^2 = 0.79 (p < 0.001)

For PCG patients

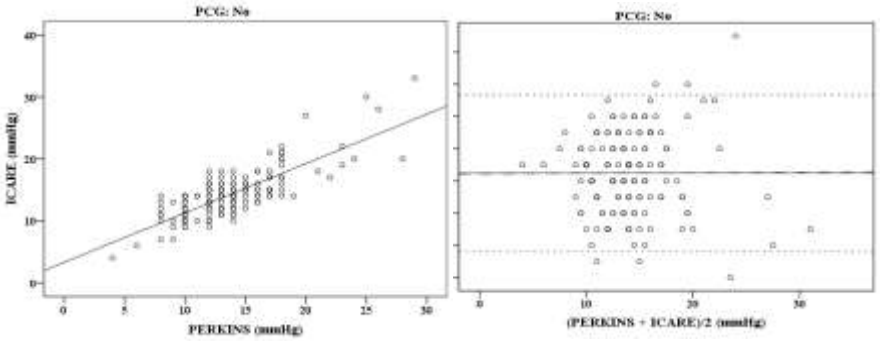




The regression analysis showed a **strong positive correlation**
Correlation coefficient **(r) 0.935**
Determination coefficient (r2) 0.874
p 0.001

The Bland–Altman plot showed 95% **LOA** from **−6.34 to +4.76** mmHg
Fixed bias
(p = 0.032).

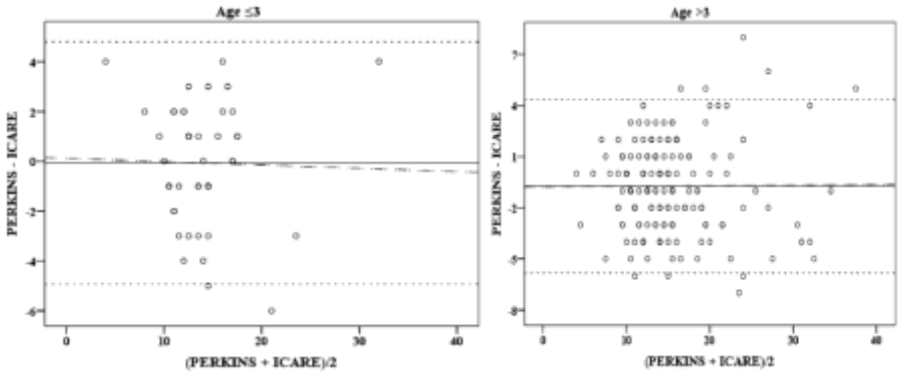
Normal participants



The regression analysis
strong **positive correlation** with
(r) = 0.8, (r^2) = 0.64,
p = 0.001

The Bland–Altman plot
95% **LOA −5.41 to +4.36** mmHg
Fixed bias
(p = 0.01).

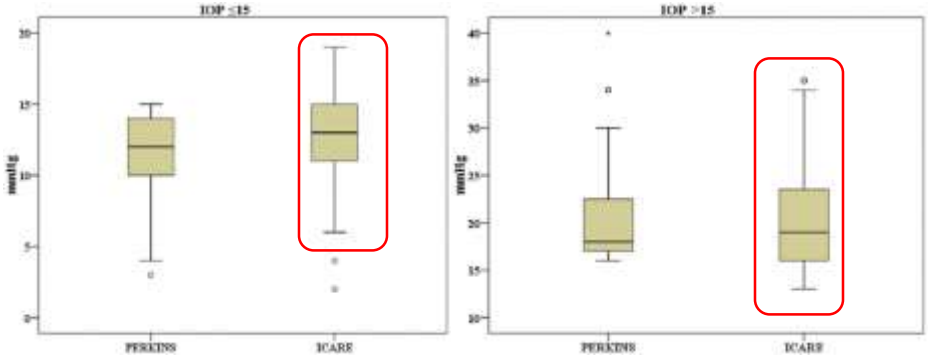
Age ≤ 3 (20%) vs. >3 years



The Bland–Altman plot
95% LOA **−4.93 and +4.8** mmHg
Proportional bias (p = 0.86)
?? Corneal biomechanical properties

The Bland–Altman plot
95% LOA −5.83 to +4.39 mmHg
Fixed bias (p < 0.001)

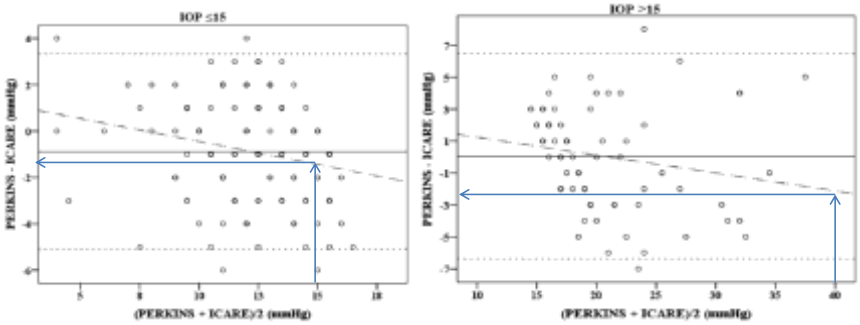
IOP≤ 15 vs. >15 mmHg



I-Care **Over Estimates**

I-Care **Over/Under- Estimates**

IOP≤ 15 (68%) vs. >15 mmHg



The Bland–Altman plot
95% of LOA **–5.1 and +3.32** mmHg
proportional bias ($p < 0.001$).

The Bland–Altman plot
95% LOA –6.38 and +6.46 mmHg a
proportional bias ($p = 0.914$)

Table 1. Bias and 95% LOA in all groups.

Group	Bias (mmHg)	SD	95% LOA
All	−0.59	2.59	−5.67 to +4.48
PCG	−0.79	2.83	−6.34 to +4.76
Healthy	−0.52	2.5	−5.41 to +4.36
IOP ⩽ 15 mmHg	−0.89	2.15	−5.1 to +3.32
IOP > 15 mmHg	0.04	3.28	−6.38 to +6.46
Age ⩽ 3 years	−0.07	2.48	−4.93 to +4.8
Age > 3 years	−0.72	2.61	−5.83 to +4.39

SD: standard deviation; PCG: primary congenital glaucoma; IOP: intraocular pressure; LOA: limits of agreement.

Discussion

- **Before our study…….**
- **Large-scale studies** to compare the two tonometers in patients with **PCG** are **lacking** due to relative rarity of the condition.
- Many previous study results have been complicated by the use of a **general anesthetic**, which can alter the IOP.
- Previous studies have not included children younger than 3 years.

- Our results show that the LOA between both devices decreases with higher IOP measurements
- A similar report by Dahlmann-Noor (2013)
  - Compared GAT to RBT in 102 subjects with glaucoma (mean age 11 years),
  - **I-care Pro** gave higher readings than GAT.
  - The magnitude of disagreement increased with IOP
  - the LOA went from (−8.6, 3.9) in IOP < 21 mmHg to (−21.08, 10.04) in IOP > 21 mmHg.
- Our results may not be as profound, while
  - The majority of our cases had an IOP <15 mmHg (**68%**)
  - Only **38.5%** (62) of eyes were **glaucomatous**
  - **TA01 model**

In answer of our research questions:

- To detect the degree of **agreement** between IOP measurements by RBT and PAT **in children with and without PCG**
- Test devices' **agreement** with varying **age and IOP**
- Investigate whether there is an **IOP limit**, above which the degree of agreement changes.

Conclusion

- There is a good correlation between RBT (I-Care) and PAT in children with and without PCG.
- RBT overestimates IOP (usually)
- In IOPs >15 mmHg there is less agreement between the two devices.

Recommendations

- RBT is a good **screening** tool:
  - It tends to overestimate the IOP (not under diagnose glaucoma).
  - Less intimidating (no topical anesthesia/ sedation required)
  - Easier to use especially in infants with small palpebral fissures
- It is a suitable **follow-up** method
  - Detect IOP changes in glaucoma patients
- If **IOP ++** → **PERKINS** (diagnosing/initiating treatment).
- An assessment involving **corneal biomechanics** may add further understanding and explanation for age variations

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Thank You

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