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TexMed 2017 Clinical Abstract

Please complete all of the following sections and include supporting charts and graphs in this document. Submit a total of two documents - this document and the Biographical Data and Disclosure Form to posters@texmed.org by midnight March 17, 2017.

Procedure and Selection Criteria

- Submissions not directly related to quality improvement or research may be accepted and should follow the standardized format outlined below. Content should enhance knowledge in the field of clinical care and be relevant to a given patient population.

PROJECT NAME: Comparison of Horizontal and Vertical Positioning of the Icare Rebound Tonometer

Institution or Practice Name: McGovern Medical School**,** Robert Cizik Eye Clinic

Setting of Care: Ophthalmology Clinic, potentially ER

Primary Author: Iyza Baig

Secondary Author: Badar Patel

Other Members of Project Team: Alice Chuang, PhD; Lauren Blieden, MD; Theodore Baker; Robert Feldman, MD.

Is the Primary Author, Secondary Author or Member of Project Team a TMA member (required)?

☐ ✓Yes ☐ No

Please provide name(s) and their role in the project:

TMA Member Name:

Badar Patel – second author

Iyza Baig – first author

TexMed Poster Session Specialty Subject Area: Please check if these apply.

☐ **Enhanced Perioperative Recovery**

☐ **Disaster Medicine and Emergency Preparedness**

Clinical

Background (15 points max): *Describe the purpose for sharing the content. What caused this subject matter to be approached? Why is this content important to share? What is the potential impact if this content is not shared?*

Unlike other intraocular pressure (IOP) measuring devices, such as Goldmann Applanation Tonometery (GAT) and pneumotonometry (PT), the Icare rebound tonometer has the potential for positional flexibility since it does not require a patient to be in an upright, seated position. In infants or bedridden patients, or patients with orbital trauma, obtaining IOP can be extremely cumbersome, especially in emergency cases that require rapid IOP evaluation. Our research shows that measuring IOP while holding the Icare in a rotated, horizontal position is as accurate as holding it in the standard, vertical position; therefore, Icare can be used in this new position to assure faster and less invasive IOP measurement in these previously difficult patients. If we are not able to share our findings, obtaining IOP measurements will continue to be an uncomfortable process for patients

unable to remain upright or tolerate vertical Icare measurements. We are eager to share our findings in order to improve Icare usage, and to raise awareness of its possible applications in these patient populations. Furthermore, our project assessed Icare agreement with PT, and evaluated the effect of central corneal thickness (CCT) on IOP readings. These additional findings will allow clinicians to better interpret Icare readings with respect to PT, as well as adjust Icare IOP readings for patients' CCT.

Intended Stakeholders (15 points max): *Identify those individuals, organizations, or interest groups that could be potentially impacted by this information or benefit by obtaining this information.*

Our research would benefit patient populations who cannot assume the usual upright, seated position required by traditional tonometers, making IOP measurement a more comfortable process. By holding Icare horizontally, clinicians will be able to obtain IOP readings as these patients lie on their side (lateral decubitus position), rather than force bedridden patients to sit up. Ophthalmologists as well as ER physicians who use Icare routinely would especially benefit from this information as they would have more flexibility in using the device and evaluating IOP in patients that are traditionally considered difficult. Furthermore, our data provides clinicians with a measure of how to interpret Icare IOP readings in comparison to PT, while taking into account CCT.

Description of Accomplished Work (25 points max): *Provide an overview of the work that was accomplished, including any specific methods, tools or techniques. Also, include any milestones or key accomplishments. Note charts, graphs and tables here and send as addendum with abstract form.*

Participants with clear, healthy corneas were recruited. Central corneal thickness (CCT) was determined by anterior segment optical coherence tomography (ASOCT; CASIA SS-1000, Tomey, Nagoya, Japan), and IOPs were measured with the Icare held in both positions (Figure 1) and with a pneumotonometer (PT). Bland-Altman analysis was used to determine agreements between the 2 positions and PT (Figures 2, 3). Correlation between IOP readings and CCT was estimated for each method using regression analysis (Figure 4).

107 subjects were included. Mean age was 25.5 ± 8.5 years. Overall, mean IOP was 15.9 ± 4.1 mm Hg in the standard position and 16.2 ± 4.2 mm Hg in the rotated position. The mean difference in IOP readings between Icare positions was 0.33 mm Hg with limits of agreement (LOAs) = [-2.77, 3.43]. The mean difference in IOP readings between Icare positions and PT was -1.92 mm Hg with LOAs = [-8.06, 4.22] and 0.59 mm Hg with LOAs = [-7.85, 4.67] for standard and rotated positions, respectively. IOP readings increased as the CCT increased for all 3 methods (P<0.001, Figure 2). PT IOP increased 0.24 mm Hg, rotated Icare readings increased 0.69 mm Hg, and standard Icare readings increased 0.72 mm Hg per 10 μm increase of CCT, respectively. Icare underestimated IOP in thin and normal corneas and overestimated in thick corneas, compared to PT.

I have already presented this research at the annual American Glaucoma Society (AGS) conference, which was held in San Diego from March 3-5, 2017. The project was very well received, and many ophthalmologists informed us that because of our project, they would now be able to use the Icare with greater flexibility on patients that were previously considered 'difficult'.

Timeframe and Budget (20 points max): *Provide the start and end dates for the work along with any financial implications that were incurred due to the work accomplished. Note charts, graphs and tables here and send as addendum with abstract form.*

The project began after obtaining IRB approval on June 23, 2016, and officially ended February 21, 2017. The project was supported in part by the Hermann Eye Fund, and the CASIA SS-1000 was loaned to Dr. Feldman by the Tomey Corporation.

Intended Use (25 points max): *Describe how this information could be used moving forward to impact patient care.*

For patients that are bed-ridden, pediatric patients, or patients with orbital trauma, measuring IOP can be a cumbersome task. Traditional methods to measure IOP require patients to be in upright, seated positions in

front of a slit lamp, or require the use of topical anesthesia due to extended corneal contact. For this reason, these methods, namely GAT and PT, are invasive and uncomfortable for patients that can not assume a upright position easily. Icare was developed as an alternative to these methods, and overcomes many of the difficulties that accompany GAT and PT. While Icare overcomes some of the challenges of GAT and PT, to our knowledge, no study exists that evaluated whether Icare itself can be rotated to allow for IOP readings in bedridden, pediatric, and orbital trauma patients. Our study shows that there is good agreement between holding Icare vertically (standard position) and horizontally. By explaining to clinicians that Icare can be held horizontally as well, obtaining IOP measurements will not only be more efficient for clinicians, but also a more comfortable process in patients for whom IOP measurement was previously considered difficult. With this research, we hope to positively impact future ER and clinical practice by broadening the scope of Icare usage, easing the process of IOP measurement in bedridden patients, as well as providing a context in which Icare IOP measurements should interpreted against PT and CCT.

Figure 1. Illustration of Icare Positioning. A,B: Standard (Vertical) Position; C,D: Rotated (Horizontal) Position

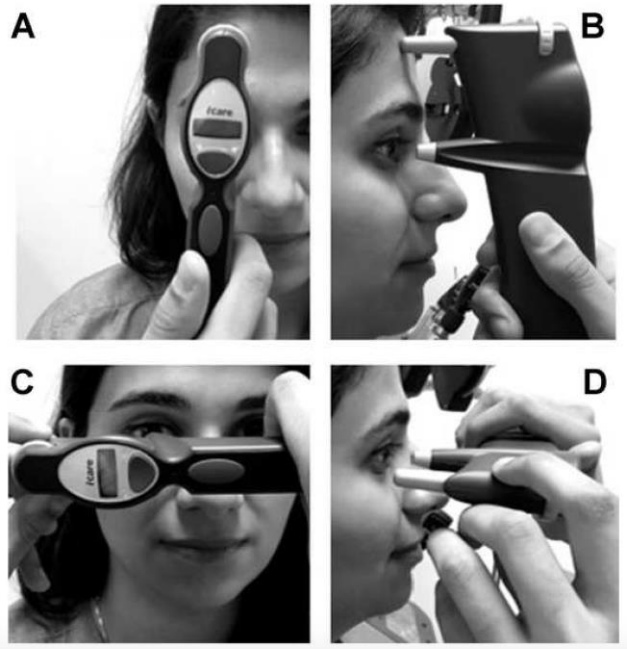

Figure 2. Bland-Altman Plots. Red line: zero difference; **Thick blue line:** mean difference (or bias); Thin blue lines: 95% agreement limits.

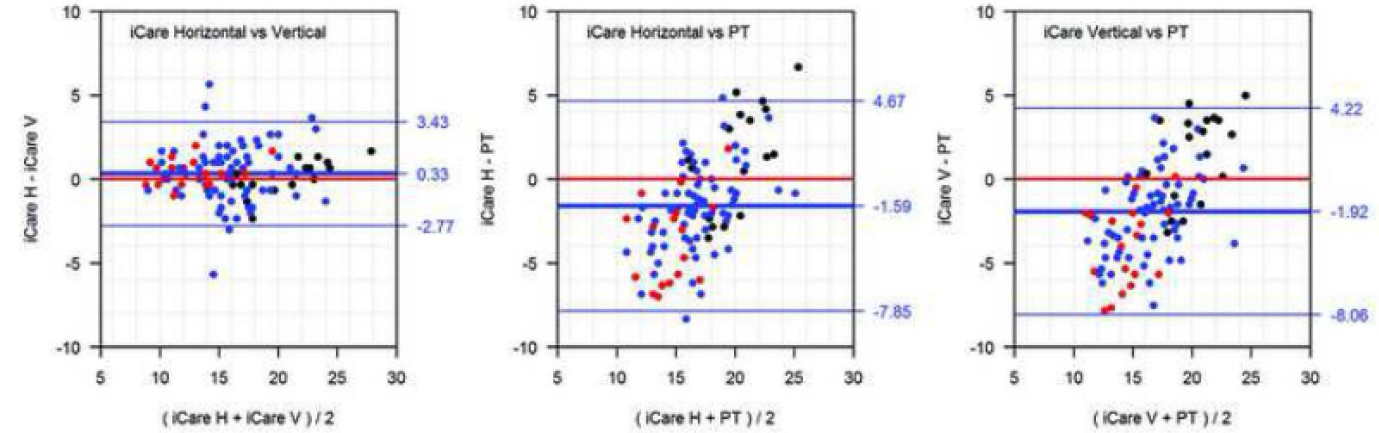

Figure 3. Within Participant SD Plots. Scatter plot of within participant SD vs within participant mean IOP for each measurement method. Red line: within participant SD = 1 mmHg.

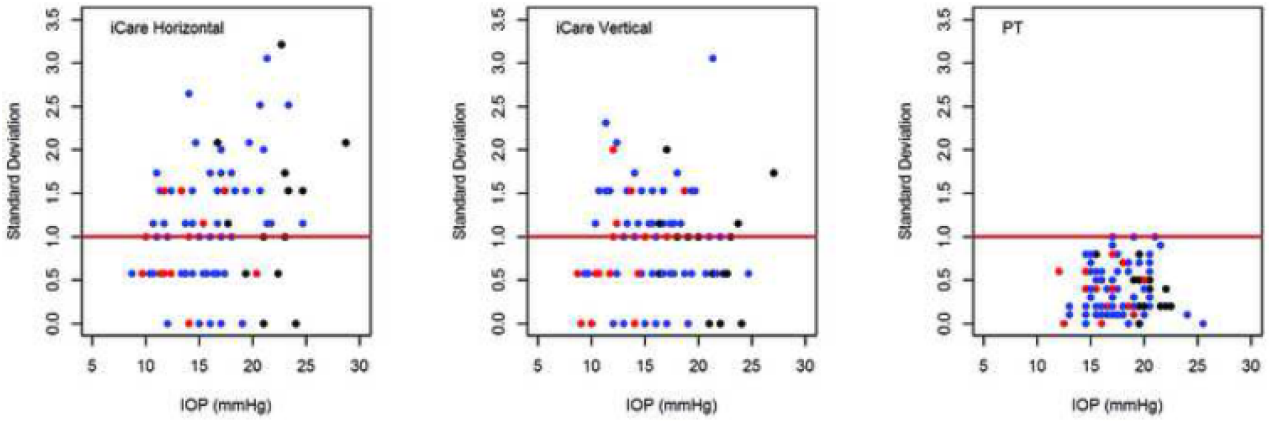

Figure 4. Scatter Plot with fitted regression line. IOP vs CCT by each measurement method.

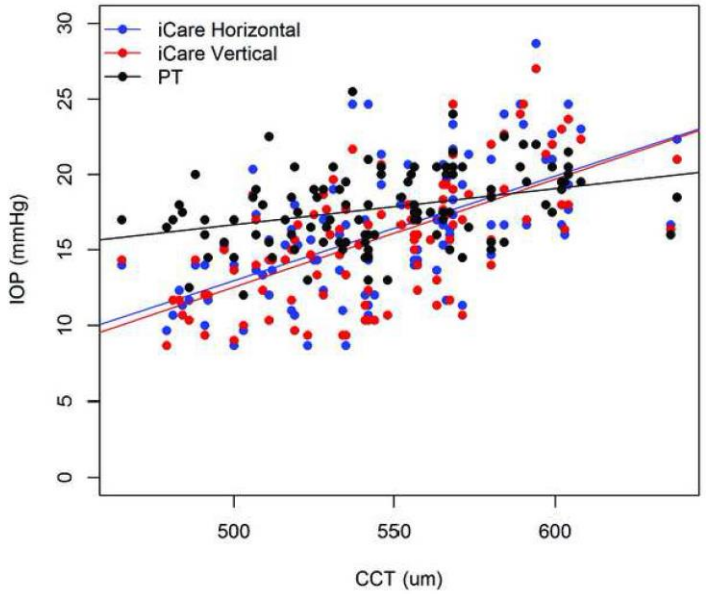

TABLE 1: Demographics and Ocular Characteristics

	Overall (N=107)	Normal (N=71)	Thick (N=18)	Thin (N=18)	*P*
Age (years, SD)	25.5 (8.5)	25.2 (8.1)	26.1 (7.8)	25.9 (10.8)	0.90
Sex (Males, %)	53 (50%)	35 (49%)	9 (50%)	9 (50%)	1.00
Race/Ethnicity (%)					0.064
White	32 (30%)	15 (21%)	11 (61%)	6 (33%)	
Black	10 (9%)	7 (10%)	1 (6%)	2 (11%)	
Hispanic	10 (9%)	9 (13%)	0 (0%)	1 (6%)	
Asian	55 (52%)	40 (56%)	6 (33%)	9 (50%)	
Refraction Correction (%)					0.28
None	27 (25%)	21 (30%)	3 (17%)	3 (17%)	
Contact Lens	27 (25%)	15 (21%)	4 (22%)	8 (44%)	
Glasses	53 (50%)	35 (49%)	11 (61%)	7 (39%)	
CCT (um, SD)	547 (36)	546 (19)	602 (15)	493 (12)	<0.001

CCT=central corneal thickness; SD=standard deviation

TABLE 2: Intraocular Pressure Results

Intraocular Pressure (mmHg, SD)					
	Overall (N=107)	**Normal (N=71)**	**Thick (N=18)**	**Thin (N=18)**	***P***
iCare - Vertical	15.9 (4.1)	15.4 (3.6)	21.0 (3.1)	12.5 (2.7)	<0.001
iCare - Horizontal	16.2 (4.2)	15.8 (3.6)	21.0 (3.7)	12.9 (2.9)	<0.001
Pneumotonometer	17.8 (2.5)	17.7 (2.5)	19.6 (2.0)	16.5 (2.1)	0.001

SD=standard deviation