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AuthorBlock: Zoltan Namenyi¹, Carol B. Toris¹, Alessandra C. Derick¹, Alyson Kishi¹, Nadine Helmy¹, Shan Fan³, David M. Reed¹, Arthur J. Sit², Arash Kazem², Vikas Gulati³, Sayoko E. Moroi¹

¹Ophthalmology and Visual Sciences, The Ohio State University, Columbus, Ohio, United States; ²Ophthalmology and Visual Sciences, Mayo Clinic Minnesota, Rochester, Minnesota, United States; ³Ophthalmology and Visual Sciences, University of Nebraska Medical Center, Omaha, Nebraska, United States;

DisclosureBlock: Zoltan Namenyi, None; Carol B. Toris, None; Alessandra C. Derick, None; Alyson Kishi, None; Nadine Helmy, None; Shan Fan, None; David M. Reed, None; Arthur J. Sit, None; Arash Kazemi, None; Vikas Gulati, None; Sayoko E. Moroi, None;

Purpose

Aqueous flow (Fa) is a pharmacological target to reduce IOP and treat glaucoma. The current method of measurement is fluorophotometry (Fa_{FI}) which takes two or more hours to complete. A quicker method was proposed in 1950 by W. Morton Grant, who calculated Fa via a Schiøtz tonometer to collect steady state pressure (P₀) and tonographic outflow facility (C). This method has not been applied to pneumatography nor to eyes with glaucoma or ocular hypertension. We hypothesize that Fa calculated by Grant's method (Fa_{Gr} = CxP₀) via pneumatography will align with Fa_{FI} in patients under baseline and with timolol treatment.

Methods

Subjects with either ocular hypertension (OHT) or open-angle glaucoma (OAG) were enrolled in a multicenter, prospective, randomized crossover trial of latanoprost and timolol (ClinicalTrials.gov Identifier NCT04412096) as part of Eye Dynamics and Engineering Network 2 (EDEN2). Fa_{FI} was measured twice, at baseline and after one week treatment with timolol. At each visit, fluorophotometry, pneumatography and tonometry were performed on the study eye. This yielded Fa_{FI}, C and P₀, with Fa_{Gr} = CxP₀. Fa_{Gr} values were first compared to each other, to observe effects of timolol, and then to Fa_{FI} values to determine any correlation. Values were analyzed using paired t-tests and Gardner-Altman plots.

Results

Preliminary results from 16 subjects (8 OHT, 8 OAG; 11 males, 5 females; 2 Asian, 4 African American, 10 White) ages 38-79 years (58 ± 11 years) are reported. Different sample sizes were analyzed based on quality of Fa_{FI} and Fa_{Gr} . Timolol lowered Fa_{FI} significantly compared to baseline (paired mean difference = -1.17, P value = 0.0004, Fig. 1a). There was not a similar timolol treatment effect using Fa_{Gr} calculation (paired mean difference = 0.543, P value = 0.464, Fig. 1b). Fa_{Gr} and Fa_{FI} both at baseline were compared and are not similar (paired mean difference = -1.52, P value = 0.0164, Fig. 2).

Conclusions

In this preliminary finding, pneumatonography method is not an accurate tool to measure Fa compared to fluorophotometry nor to measure timolol induced changes in Fa . Further investigation and improvement of this outflow facility approach would enable assessment of aqueous flow in eyes that currently cannot be studied by fluorophotometry (e.g., eyes with uveitis, pseudophakia, or aphakia).