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Purpose: To determine the dispensed volume change for seven medications with and without the Nanodropper adaptor.

Methods: Sequentially, 100 μL of each medication was dispensed by micropipette into a 1.5 mL Eppendorf tube, and mass without the tube was determined with a precision balance (Practum, Germany). The mean mass was calculated following five serial measurements of 100 μL, and density was calculated by dividing mean mass (mg) by 100 μL. This procedure was repeated with and without the Nanodropper adaptor to provide the mean volume per drop. The means and standard deviations were calculated, with and without the adaptor. An unpaired student T-test was used for statistical analysis. Tested medications included brimonidine tartrate 0.2% (Alphagan P, Allergan), dorzolamide HCL (Hi-Tech), travoprost (Travatan Z, Alcon) timolol malate (Sandoz), netarsudil/latanoprost (Rocklatan, Aerie), netarsudil (Rhopressa, Aerie), and pilocarpine 1.25% (Vuity, Allergan).

Results: The mean volume reduction across all medications was 62.3% (range 55.2% - 69.7%). The volume of Alphagan P decreased from 43.2 ±1.6 μL to 17.1 ±1.8 μL (60.4% reduction) with the adaptor. The volume of dorzolamide HCL decreased from 39.9 ±1.6 μL to 14.2 ±1.1 μL (64.4% reduction). The volume of Travatan Z decreased from 30.8 ±1.6 μL to 12.3 ±1.4 μL (60.1% reduction). The volume of timolol malate decreased from 28.6 ±2.2 μL to 12.8 ±1.6 μL (55.2% reduction). The volume of Rocklatan decreased from 40.2 ±2.2 μL to 12.2 ±1.1 μL (69.7% reduction). The volume of Rhopressa decreased from 33.5 ±1.4 μL to 12.2 ±1.3 μL (63.6% reduction). The volume of Vuity decreased from 32.1±1.08 μL to 11.9 ± 0.9 μL (62.9% reduction). All p-values were less than 0.0001.

Discussion: It is reported that the optimal eye drop volume is between 5-15 μL.[1] The Nanodropper adaptor produced statistically significant volume reductions near this range for all tested medications with excellent reproducibility. All drop volumes measured between 10-20 μL with the adaptor.

Conclusions: The novel eye drop adaptor reliably reduced eye drop volumes to a level between 10.0-20.0 μL. The mean volume reduction across all medications was 62.3% (range 55.2% - 69.7%). This may decrease the financial burden on patients and reduce the risk of systemic side effects, as long as efficacy is maintained. Future studies could target differences in the reduced final volumes and the clinical efficacy of volume reduction for various medications.

References:

1. Van Santvliet, L., & Ludwig, A. (2004). Determinants of eye drop size. *Survey of ophthalmology*, *49*(2), 197-213.