

## Author Response: Gravity Affects Amplitude of Accommodation

Our paper<sup>1</sup> referred to by the Augousti and Pierscionek letter<sup>2</sup> did not investigate the effect of gravity on amplitude of accommodation. Nevertheless, it is a logical conclusion of our results that gravity affects amplitude. The effect would be small, with a mean reduction in anterior chamber depth of 0.07 mm for the young group for the drug/maximum accommodation condition corresponding to 0.14 D if applied to the 10.9 D accommodating form of the Gullstrand exact eye. Stating “any change in accommodative amplitude induced by gravity is not clinically significant” is true but not relevant. Also not relevant is the claim about lack of effect of gravity being found in pilots and astronauts—one referenced study did not involve accommodation<sup>3</sup> and two referenced studies involved astronauts<sup>4,5</sup> who, from their ages, would have had real amplitudes less than 4 D.<sup>6</sup>

Augousti and Pierscionek argue that the Lenstar repeatability (given as twice the standard deviation of repeated measurements) is bigger than the effects we obtained, referencing the instrument manual as giving a standard deviation for repeatability of 0.04 mm.<sup>7</sup> This is an *intrasession* repeatability, rather than an *intersession* repeatability, which is the relevant repeatability when considering whether the effects found by us are real. Buckhurst et al.<sup>8</sup> found an intrasession standard deviation for anterior chamber depth of 0.051 mm, similar to that given in the manual, but a much smaller intersession standard deviation of 0.013 mm, which is small compared with the effects we found. Also relevant here is the point in our other author reply<sup>9</sup> that our results were always in the direction supporting the effect of gravity on anterior chamber depth.

While giving references that are intended to help refute our results, Augousti and Pierscionek disregard studies referenced by us that support the effect of gravity on amplitude of accommodation.

In summary, our study indicates that there should be small effects of gravity on amplitude of accommodation. It provides yet more support for the Helmholtz theory that accommodation is produced by ciliary muscle contraction relaxing zonular tension and enabling the lens to reduce in diameter and take up a more rounded form.

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