

PURPOSE

The AC/A ratio is the amount of accommodative convergence induced by a change in accommodative response (*response* AC/A ratio) or stimulus (*stimulus* AC/A ratio). This study compared the **gradient response and stimulus AC/A ratios between a group of adult emmetropes and low myopes.**

MATERIALS AND METHODS

Subjects: A total of 28 typical adults, mean±SD age of 21.45 ± 3.12 years, participated in this study, wearing their habitual correction. Sample was divided: **emmetropes** (-0.25D to +0.25D) (N=15) and **low myopes** (-0.50D to -1.75D) (N=13).

Procedure:

- The AC/A ratio was measured using the gradient method.
- The same accommodative stimulus of 2.50D was ensured by changing the distance of the target according to their habitual refractive correction and vertex distance [1].
- Phoria was measured using a Maddox rod in front of the left eye and a modified Thorington test, used as a target.
- Right eye's accommodative response (AR) was measured using the Grand Seiko WAM 5500 autorefractor.
- First, measures were done with participants' habitual correction (Phoria(1) and AR(1)), and then, the procedure was repeated with +2.00D lenses added binocularly (Phoria(2) and AR(2)).

$$\text{Gradient stimulus AC/A ratio} = \frac{\text{Phoria (1)} - \text{Phoria (2)}}{2}$$

$$\text{Gradient response AC/A ratio} = \frac{\text{Phoria (1)} - \text{Phoria (2)}}{\text{AR (1)} - \text{AR (2)}}$$

Accommodative response (AR) was determined using the following equation [1]:

$$AR = \frac{-R}{(1-d \cdot SR + F)[1-d(R+SR+F)]}$$

SR = spectacle refraction F = power of the added lens
d = vertex distance R = autorefractor reading

CONCLUSIONS

- Although emmetropes and low myopes exhibited significantly different changes in phoria and AR with +2D lenses, gradient response and stimulus AC/A ratios were not influenced by the range of refractive errors included in this study.
- The results of this study show the importance of measuring response rather than stimulus AC/A ratios and take into account the actual accommodative response instead of assuming it to be equal to the demand.

REFERENCES

[1]. Atchison, D. A., & Varnas, S. Accommodation stimulus and response determinations with autorefractors. *Ophthalmic and Physiological Optics*, 37(1), 96-104. R. (2017).

RESULTS

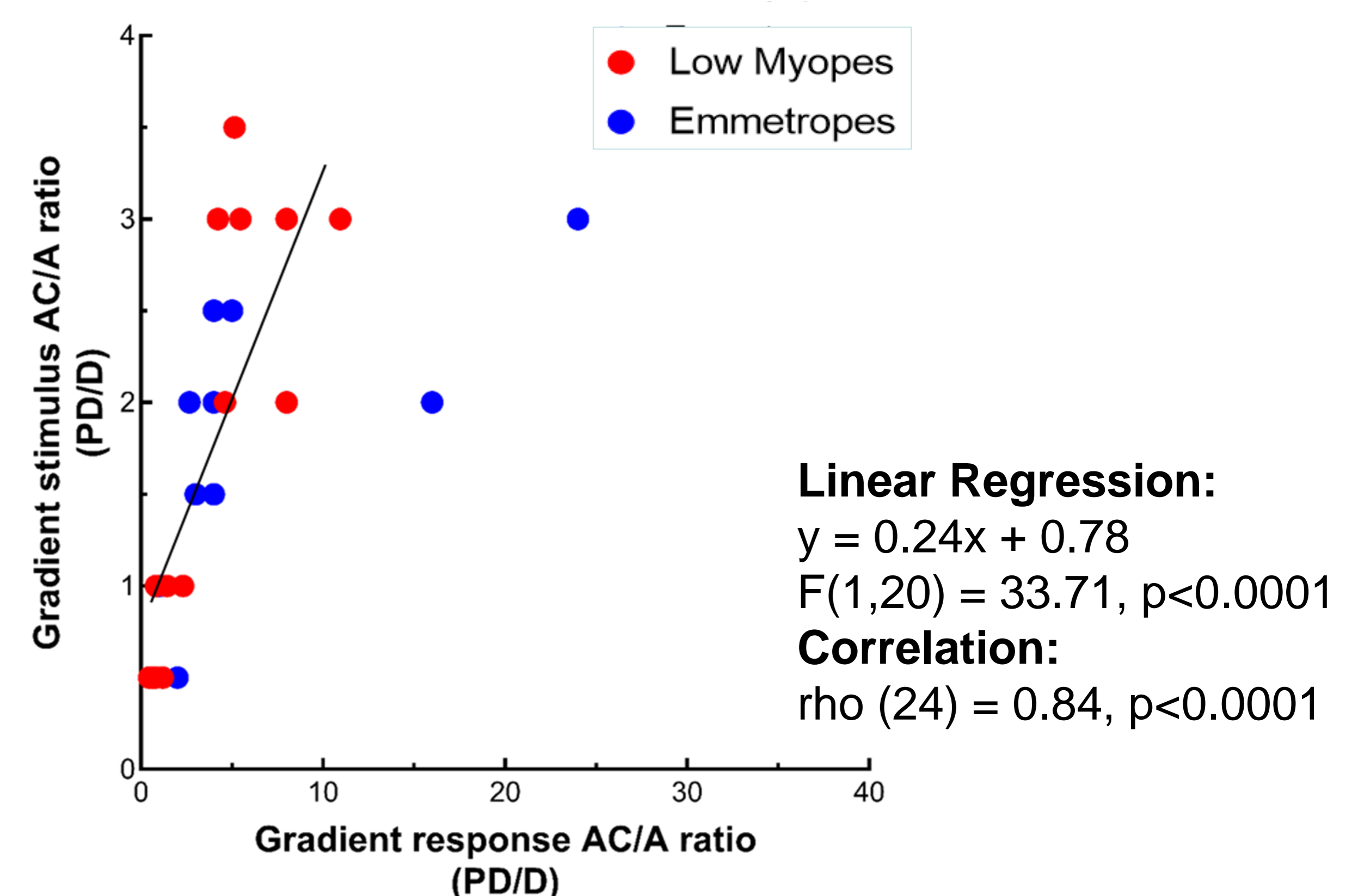
- The spherical equivalent refractive error of emmetropes (mean±SD: 0.02±0.16D) was significantly different from that of low myopes (1.05±0.52D) (**p<0.001**).
- The phoria and AR without and with +2.00D lenses were not significantly different between low myopes and emmetropes.

Test	Mean ± SD:	Unpaired t-test or Mann Whitney test
Phoria (1) low myopes	-2.73 ± 4.33 PD	U= -1.10, p=0.27
Phoria (1) emmetropes	-1.30 ± 4.49 PD	
Phoria (2) low myopes	-5.93 ± 5.25 PD	U= -0.69, p=0.48
Phoria (2) emmetropes	-4.53 ± 4.46 PD	
AR (1) low myopes	1.58 ± 0.34 D	t(26)= -0.77, p=0.319
AR (1) emmetropes	1.69 ± 0.42 D	
AR (2) low myopes	2.81 ± 0.45 D	t(26)= 1.75, p=0.366
AR (2) emmetropes	2.40 ± 0.75 D	

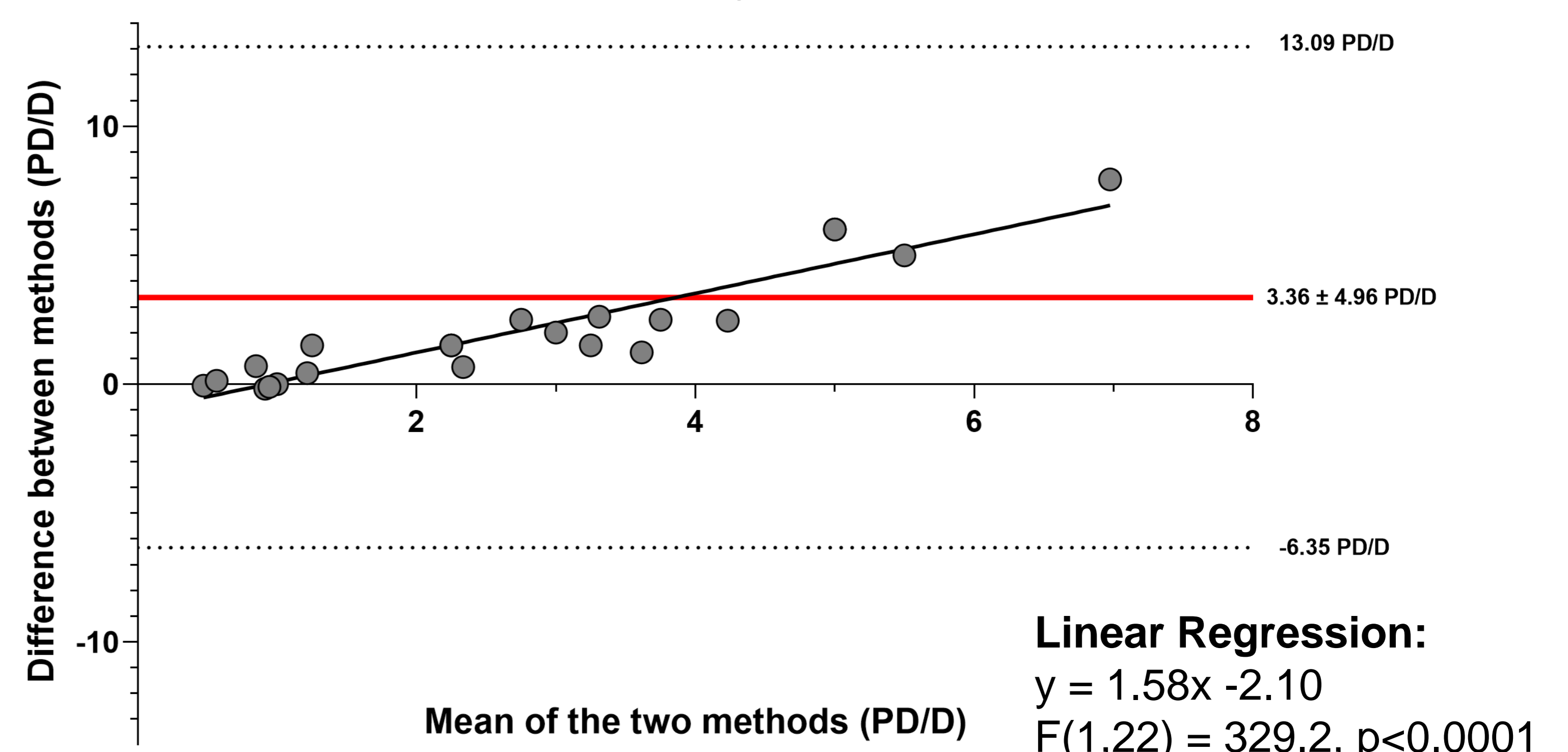
- The AR and phoria changes caused by the +2.00D lenses were significantly different for low myopes and emmetropes.

Test	Mean ± SD:	Mann Whitney test
Phoria (Phoria 1-Phoria 2) Low myopes	+3.20 ± 2.45 PD	U= -3.13, p=0.002
Phoria (Phoria 1-Phoria 2) Emmetropes	+3.30 ± 2.21 PD	
AR (AR1-AR2) Low myopes	-1.23 ± 0.55 D	U= -4.50, p<0.001
AR (AR1-AR2) Emmetropes	-0.71 ± 0.78 D	

- The mean ± SD gradient response AC/A ratios of emmetropes (2.53±1.42PD/D) and low myopes (2.78±1.96 PD/D) were not significantly different (**p = 0.683**), nor the gradient stimulus AC/A ratios for emmetropes (1.50±0.70 PD/D) and low myopes (1.59±1.03 PD/D) (**p = 0.759**).



- The gradient response (4.72±5.19PD/D) and stimulus (1.71±0.96PD/D) AC/A ratios of all participants were significantly different (**p< 0.001**)



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