ANALYSIS OF THE ACCOMMODATION RESPONSE AS A SUPPORTING TOOL DURING SUBJECTIVE REFRACTION

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PURPOSE

To study the relationship between the subjective refraction and the accommodative response by analyzing:

- The **transition between relaxed and activated accommodation** during the subjective refraction.
- The **relative accommodation** with the subjective refraction.

MATERIALS AND METHODS

Participants: 30 young healthy subjects between 18 and 30 years old.

Set-up: Hartmann-Shack aberrometer with a monitoring frequency of 10 Hz coupled to a phoropter working as an open-field system[1] (Figure 1).

Procedure:

1. Monocular subjective refraction in the right eye.
2. Presentation of a sweep of lenses of spherical power (ΔS) from +2.00 to -2.00 D in front of the eye wearing the subjective refraction while monitoring accommodation with the Hartmann-Shack system.
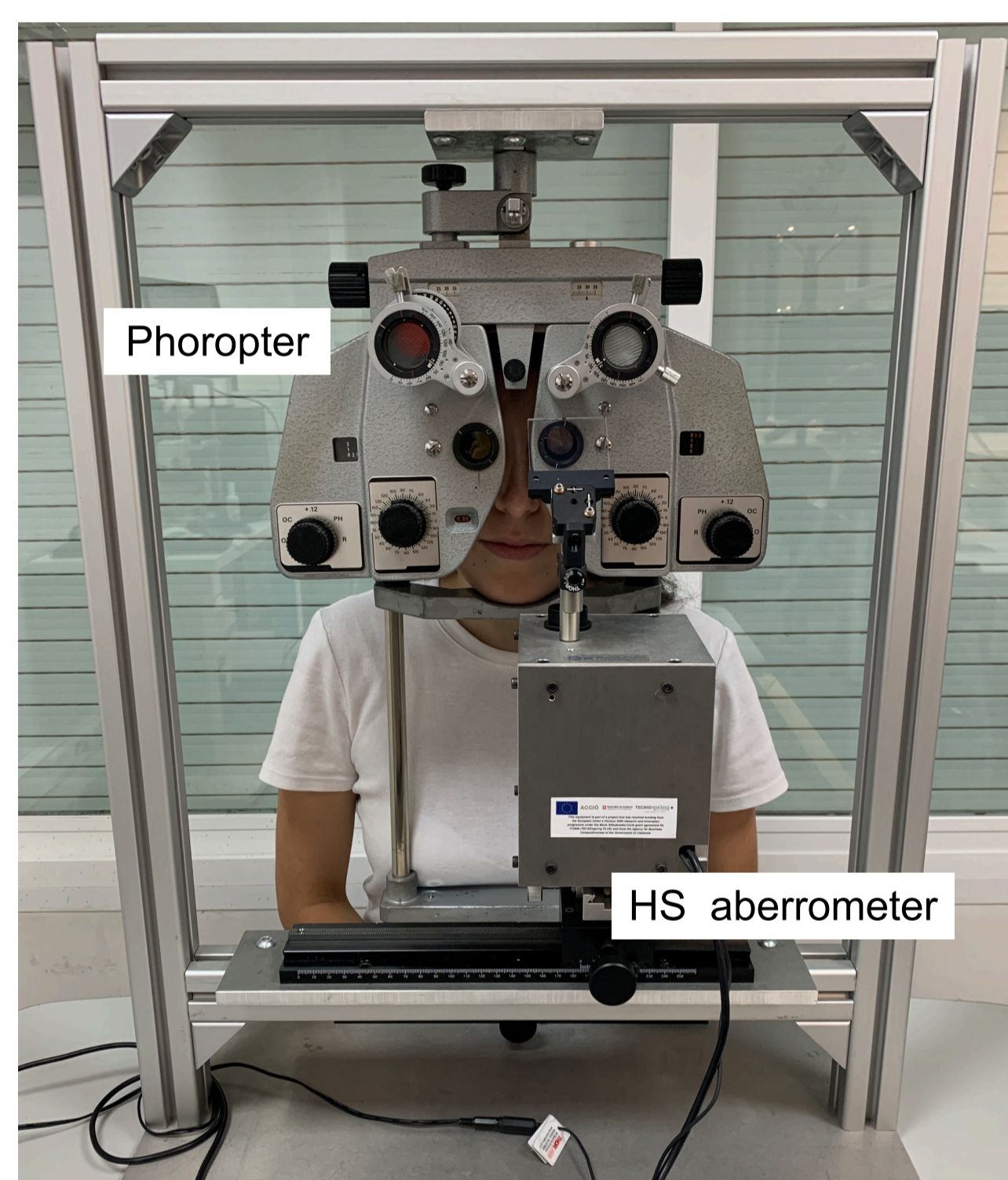

Phoropter

HS aberrometer

Figure 1. Measurement set-up.

Analysis:

- The **transition between relaxed and activated accommodation** was obtained as follows:

  1. Obtention of two linear fitting for each spherical power ΔS for the curves between -1.50 D and ΔS, and between ΔS and +1.50 D. (See dashed line in Figure 2, where curve fitting is shown for ΔS = -0.50 D)
  2. The spherical lens ΔS producing the linear fittings with the best cumulative coefficient of determination was selected as the transition point between relaxed and activated accommodation. (See red circle in Figure 2)

- The **relative accommodation** with the subjective refraction was obtained as the difference between the measured value of accommodation with ΔS=0D and the minimum measured accommodation in the sweep of lenses.
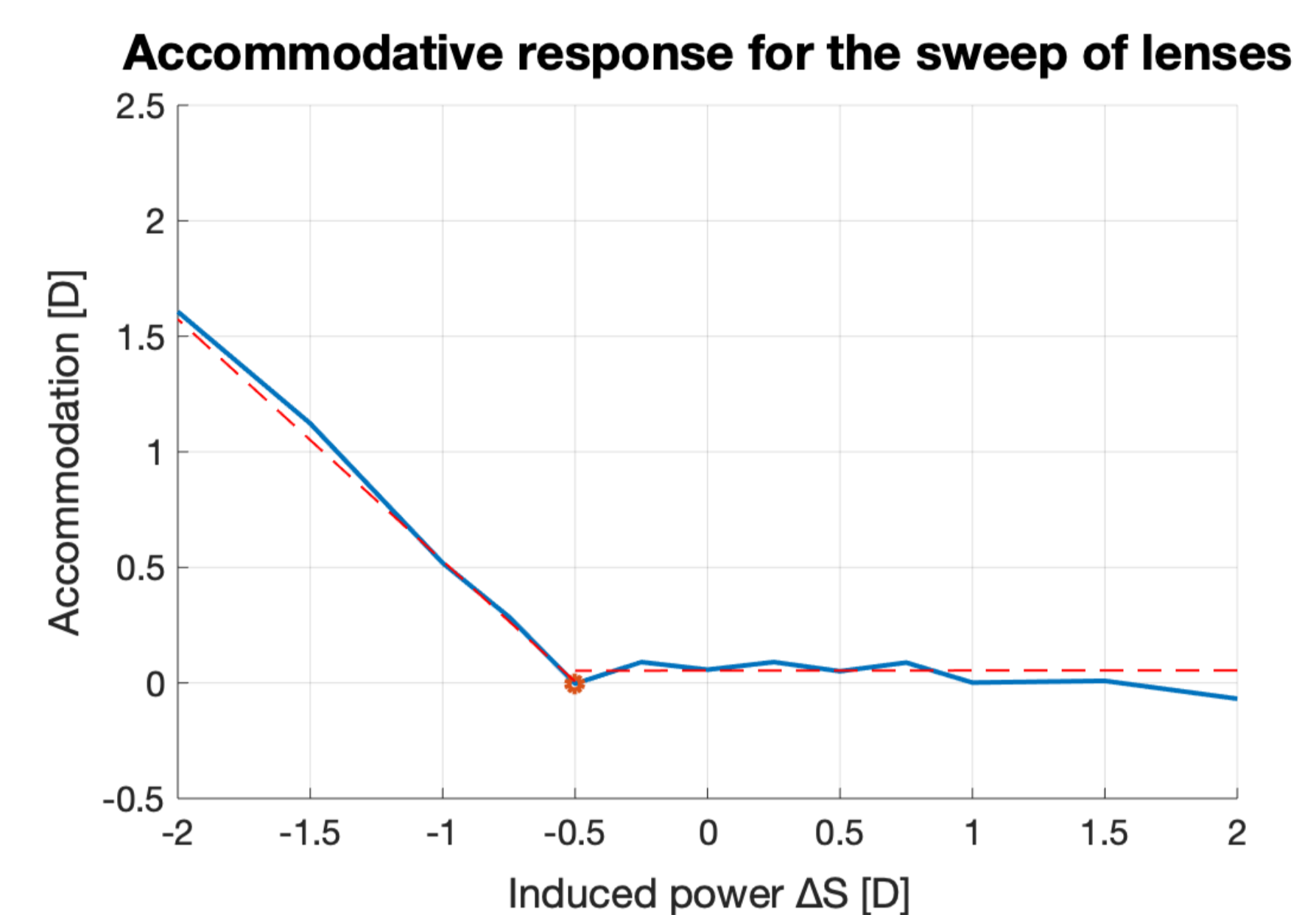
RESULTS

Accommodative response for the sweep of lenses

Figure 2. Example of a measured accommodative response for a sweep of lenses.

Bland and Altman plot

Figure 3. Bland and Altman analysis.

- The agreement between the subjective refraction (SR) and the transition point of accommodation (TPA) is shown in the Bland and Altman plot, figure 3. The mean $\pm$ SD of the differences between methods and 95% limits of agreement were 0.041 $\pm$ 0.41 D (0.84 D, -0.76 D).
- The mean relative accommodation $\pm$ SD with the subjective refraction was 0.38 $\pm$ 0.20 D.

CONCLUSIONS

- Considering the values of relative accommodation with the subjective refraction a tendency to have a residual activated accommodation can be observed.
- The transition between relaxed and activated accommodation may be a significant information and could be a useful supporting tool during subjective refraction

REFERENCES

1. C. E. García-Guerra, J. Martínez-Roda, M. Aldaba, S. Galera, C. Aransay, F. Díaz-Doutón, J. Pujol, M. Vilaseca; Real-time monitoring of accommodation during subjective refraction. *Invest. Ophthalmol. Vis. Sci.* 2020;61(7):1716.

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