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Purpose:

The purpose of this study was to evaluate the effect of different levels of induction of spherical aberration (SA) on depth of focus (DoF) with multifocal fully scleral contact lenses (MFSL) (Figure 1)

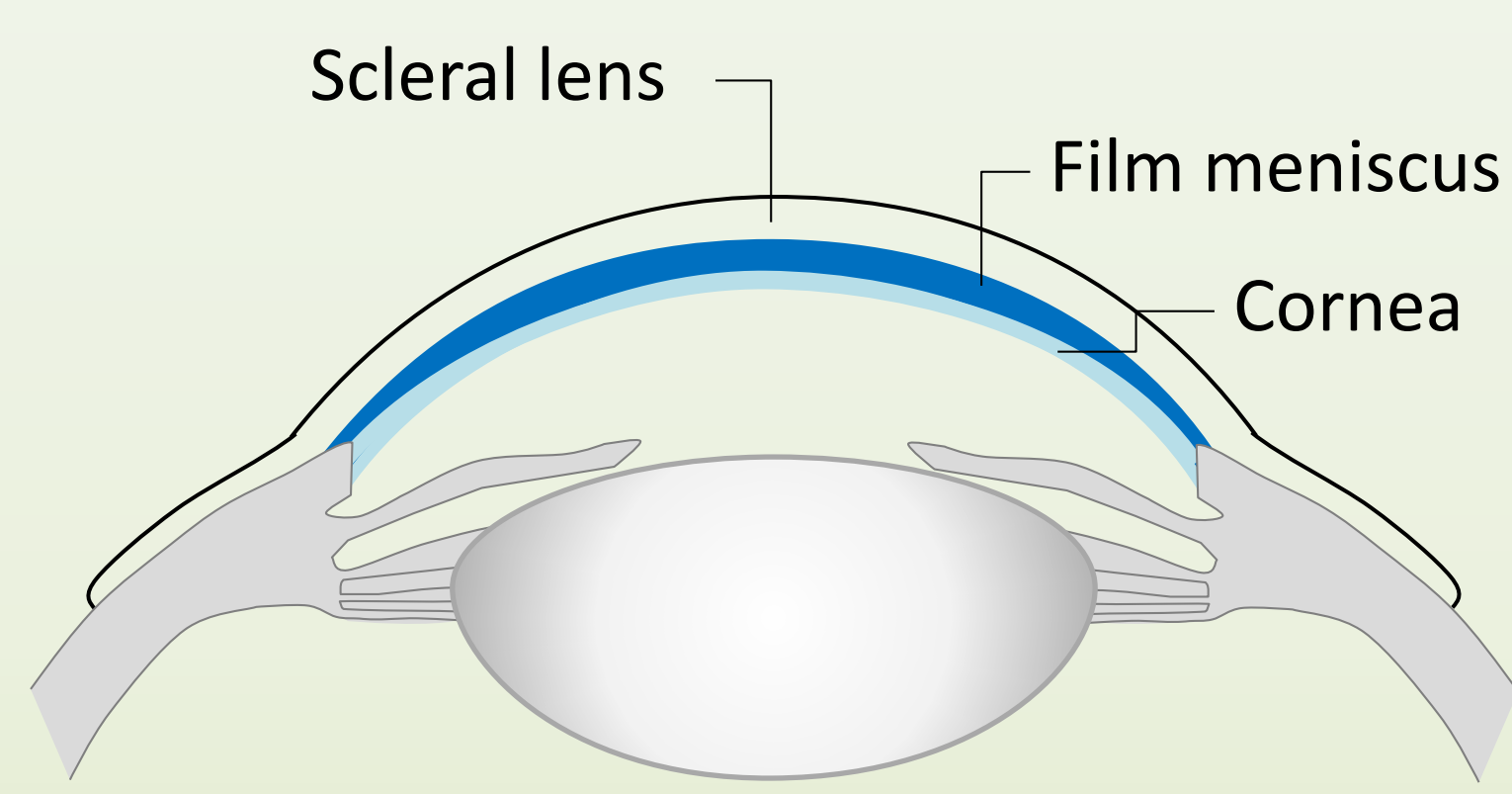


Figure 1.- Simulation of a fully scleral contact lens

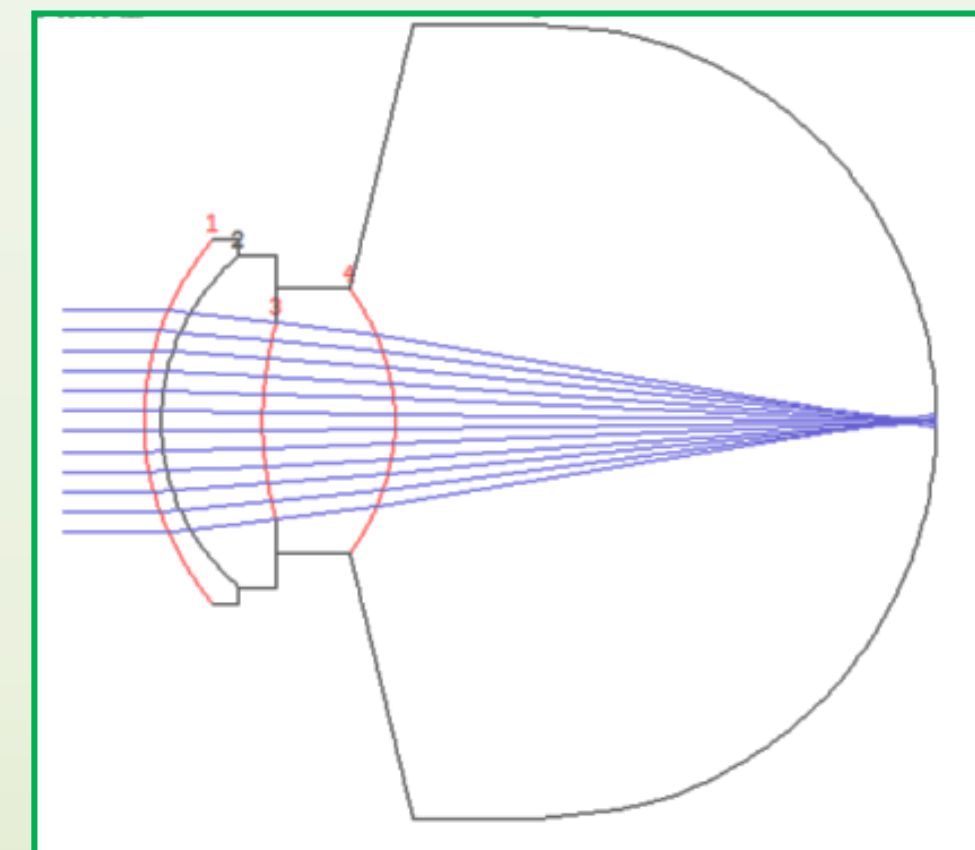


Figure 2.- Modified version of the Navarro eye model used for the simulations of the current study

Methods:

- Optical simulations were performed using the optical design software OPTALIX
- A modified version of the Navarro eye model was used inducing three different levels of SA, 0.40, 0.00 and -0.20 μm (Figure 2)
- MFSL were simulated considering fixed conic constants of -0.1 and -0.4 for the anterior and posterior lens surfaces
- The modulation transfer function (MTF) was calculated for each level of SA considering the following variables:
 - 6-mm pupil
 - Optotype equivalent to visual acuity of 0.20 logMAR at distance
 - A push-up test is performed for simulating the MTF for different vergence levels (change spatial frequency with increasing vergence): from 0 to 3 D
 - Variation of tear film meniscus between 50 and 250 μm

Conclusions:

The induction of negative SA for increasing the depth of focus with MFSL has a different optical impact depending on the meniscus thickness and therefore it should be considered in the fitting guides of this type of lenses

Results:

In the eye models with SA=0.4 μm (Figure 3) and SA=-0.2 μm (Figure 4), there was a decrease in the MTF factor with increasing meniscus thickness for vergence levels between 1 and 3 D, with the worst outcome for the meniscus of 250 μm

The reduction of the MTF with increasing meniscus thickness was minimal in the model with SA = 0.00 μm (Figure 5)

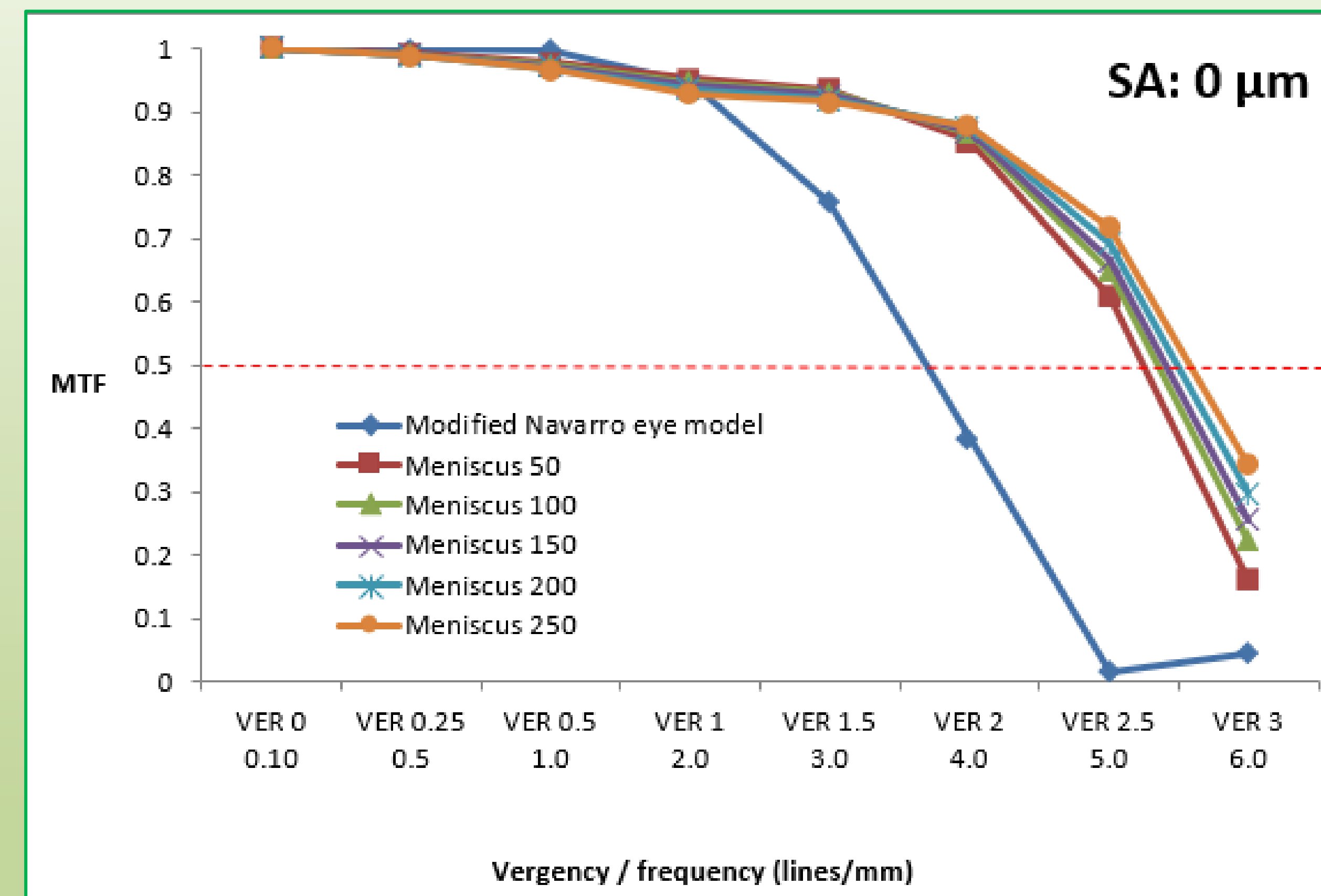


Figure 5.- MTF simulated for different levels of vergence and meniscus thickness in the eye with SA of 0.0 μm

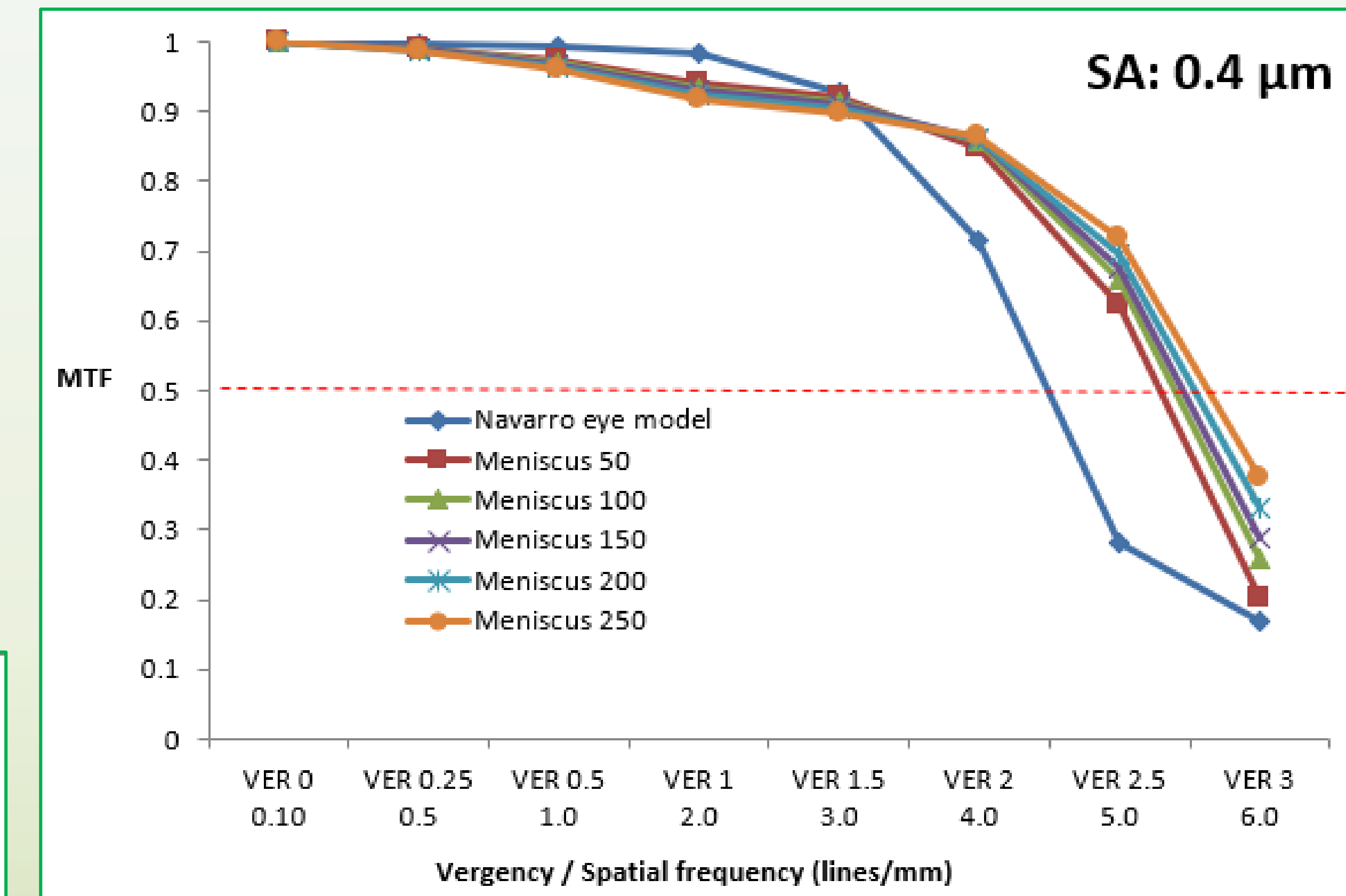


Figure 3.- MTF simulated for different levels of vergence and meniscus thickness in the eye with SA of 0.4 μm

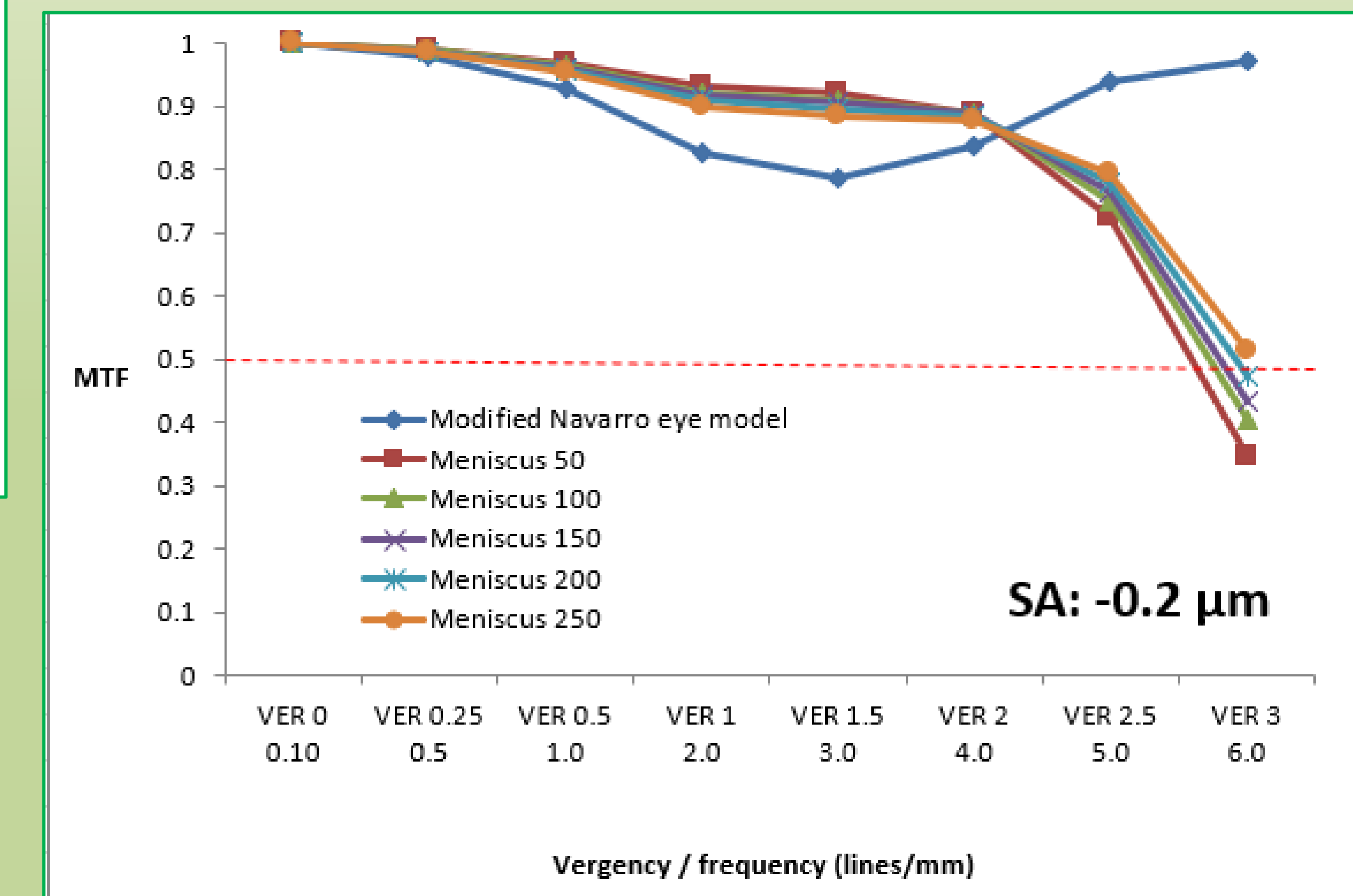


Figure 4.- MTF simulated for different levels of vergence and meniscus thickness in the eye with SA of -0.2 μm



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