

# Review of: "Ten-year longitudinal investigation of astigmatism: The Yamagata Study (Funagata)"

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This paper is a longitudinal study of the relationship between astigmatism and age, and deals with age-related changes in astigmatism in the same individuals. It is interesting and easy to understand. The authors must be congratulated for this well conducted research.

The authors performed vector analysis for astigmatism using the Alpins method. They stated that the findings were that (1) the magnitude of corneal astigmatism does not increase with age, but the magnitude of refractive astigmatism does, (2) astigmatic shift to against-the-rule astigmatism is seen from the 40s to the 60s, and (3) astigmatic shift to against-the-rule astigmatism does not accelerate with age. However, since there have been several similar reports, albeit cross-sectional studies, it's hard to be said that this paper has contributed to the latest findings. The following additional analyses should be performed.

1. The characteristics of corneal and refractive astigmatism differ between men and women [1-3]. However, since astigmatism changes with age, as shown in this study, gender differences in age-related changes in astigmatism in patients should be investigated. A previous study [4] may be helpful.
2. In this study, the polar values are treated as the primary endpoint. This paper states that the refractive axis changes with age, but it is insufficient to evaluate only by the change in the polar values. A mathematical and statistical analysis using torque [5] within the Alpins method should also be performed. A previous study [6] will also be helpful for this.
3. Since analysis techniques based on the polar values are suitable for dealing with the effects of steepening and flattening of astigmatic changes near the 0, 90, and 180 degree polar axes, when analyzing astigmatism away from these polar axes (especially oblique astigmatism), this technique has limitations [5]. Therefore, I would like to propose an analysis using the X-Y coordinate analysis [7] (or the power vector analysis [8]). That's because oblique astigmatism is still an issue, especially for refractive correction with toric intraocular lenses [9-11].

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