Peep Into Visual Acuity Chart Through an Opening: A New Concept of Binocular Open-view Visual Acuity Test

To the Editor:

For some time we have used a clinical visual acuity test (subjective refraction) only for monocular testing. However, we believe that visual acuity measurements need to be performed under binocular open-view conditions as close to natural viewing conditions as possible.

Subjective refractions without cycloplegia were examined with the Occlupad (Japan Focus Co., Ltd., Tokyo, Japan), which modified an iPad Air (Apple Inc., Cupertino, CA) to create a binocular open-view visual acuity test device that would only display images that can be seen by one eye with a polarized lens. The Occlupad can display the Landolt-C chart on the monitor (Figures 1A-1B). To create the Occlupad, we removed only the polarizing film layer from the liquid crystal display (LCD) screen of an iPad Air. Thus, unless a subject viewed the screen using a circular polarizing lens, the LCD screen only appeared to produce a white backlight. Designing the polarizing filter to exactly match the polarization meant visual information could only be perceived by a human eye.

Thirty-five healthy individuals aged 20 to 23 years (mean age: 20.9 ± 0.8 years) were tested with binocular conditions (a tested eye shield that contained a polarizing lens in the occluder and the other untested eye not covered; Figure 1) and with monocular conditions (a tested eye shield that contained a polarizing lens in the occluder and an untested eye shield that completely covered the eye). The research conformed to the tenets of the Declaration of Helsinki and was approved by the Kitasato University Human Sciences Ethics Committee.

Subjective spherical refraction under monocular conditions with one eye completely covered was significantly more highly myopic than that under binocular open-view conditions that contained a polarizing lens in the occluder ($P < .001$, Wilcoxon signed rank sum test). In the current study, the mean difference in spherical refraction measured by monocular and binocular conditions was not a negligible value (-0.29 ± 0.21 diopters).

Several studies have advocated the importance of evaluating the binocular state in patients after refractive surgery.\textsuperscript{1-3} We recently showed that increased pupil diameter under monocular conditions produces shallower depth of focus than under binocular open-view conditions.\textsuperscript{4} Thus, when planning for refractive surgery, visual acuity measurements need to be performed under the new concept binocular visual acuity test.

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Figure 1. New concept binocular visual acuity test (Occlupad; Japan Focus Co., Ltd., Tokyo, Japan). The polarizing lens designed for viewing the device (A) was made with a white screen displayed to the untested eye and (B) the Landolt-C chart was displayed only to the tested eye. (C) A difference of subjective spherical refraction between binocular open-viewing and monocular viewing condition. (D) The subjective spherical refraction values are from a right eye. *$P < .001$ (Wilcoxon signed rank sum test).
test as close to natural viewing conditions as possible. Further study is needed to clarify the source in the differences of subjective refraction under binocular and monocular conditions.

REFERENCES


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