Contact Lens Update
CLINICAL INSIGHTS BASED IN CURRENT RESEARCH

Article Review: Visual performance with multifocal contact lenses and progressive addition spectacles

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Fogt, J.S., Weisenberger, K. and Fogt, N., 2022. Visual performance with multifocal contact lenses and progressive addition spectacles. Cont Lens Anterior Eye, 45(4), p.101472.

Presbyopia introduces new visual challenges to patients who previously wore a single vision correction. Transitioning from single vision spectacle lenses to progressive addition lenses (PAL) involves adapting to a vertical corridor of clear vision that transitions from distance to near focus with down gaze. Soft contact lenses for presbyopia involve optics that allow focus at distance, intermediate and near distances simultaneously. Both these methods of correcting vision in presbyopia require initial patient adaptation. While PAL spectacles are widely prescribed for presbyopic patients, multifocal contact lenses (MF CL) are fit less frequently. Both MF CLs and PAL spectacles typically provide clear vision in the exam lane. However, little has been studied regarding performance in everyday tasks with presbyopic vision correction. Clinicians know that vision demands can differ between patients, and that satisfied patients are those who can see well during all their daily activities. A previous study of non-presbyopes found improved peripheral detection and the ability to localize targets when wearing single vision contact lenses compared to single vision glasses.[1] Because presbyopes can have the same visual demands as non-presbyopes, it would be valuable to know whether MF CLs can provide visual performance that meets or surpasses the vision provided by PAL spectacles. The manuscript "Visual performance with multifocal contact lenses and progressive addition spectacles" describes various tests of visual function in presbyopic patients while wearing both types of correction.

In this study, enrolled participants were already successful wearers of PAL spectacles. While wearing their PAL spectacles, consented participants completed visual function tasks, including coincidence-anticipation timing, peripheral search and hand-eye coordination, and dynamic visual acuity. All of these tasks require rapid detection and rapid response to a visual stimulus and represent situations that can occur in everyday life. Because spectacles can induce prismatic effects and viewing through PAL lenses outside the progressive corridor may induce distortion, it was hypothesized that these tasks would be adversely affected with PAL wear. Participants were subsequently fit with multifocal contact lenses (Dailies TOTAL1 Multifocal Lenses, Alcon Inc., Fort Worth, TX, USA) and wore them for 2-4 weeks before completing the functional vision tasks while wearing the lenses. Mean ± standard deviation binocular high contrast distance acuity with PAL spectacles (-0.1±0.07 logMAR) and multifocal contact lenses (-0.02±0.07) were better than 20/20 Snellen. Mean binocular near acuity with PAL spectacles (0.08±0.09 logMAR) and with multifocal contact lenses (0.1±0.1) were better than 20/25 and not quite 20/20 Snellen with both types of vision correction. Mean binocular low contrast acuity with PAL spectacles was 0.01±0.09 logMAR and 0.09±0.09 with multifocal contact lenses.

Peripheral search and hand-eye coordination were examined for all participants during wear of both correction types. A previous study showed that non-presbyopic people had greater accuracy and speed with a hand-eye

coordination test when wearing single vision contact lenses compared to single vision spectacles. [1] The same device used in that previous study (AcuVision 1000, Acuvision Systems) was used in this presbyopic study. The AcuVision 1000 is a board hung on a wall in front of the subject that presents flashing lights one at a time over an angular range of 105 degrees horizontally and 82 degrees vertically. The participants had a very short time interval to tap the lights prior to another light appearing at a new location, and a quick response could decrease the overall time of the task. The speed required to complete the task and the accuracy of the responses (that is, the number of targets pressed by the subject in the allotted time) were recorded. The mean speed for completing the task favored multifocal contact lenses by about 1.5 seconds, a difference that was not statistically significant. Similarly, the total number of targets pressed correctly and the total number of targets missed favored multifocal contact lens wear slightly, but not significantly. The only metric that was statistically significant was the difference in the number of targets missed centrally: Multifocal contact lens wearers missed an average of 11.24±5.90 lit targets, while PAL spectacle wearers missed 14.41±7.46 targets (P=0.03).

Coincidence anticipation timing requires the subject to execute a response such as a button press at the same time that an approaching visual stimulus arrives at a particular location. Coincidence anticipation timing is important in tasks such as sports (for example, baseball batting) or driving, where target interception or target avoidance is necessary. A Bassin Anticipation Timer (Lafayette Instrument Company, Lafayette, Indiana, USA) was used in the study to measure anticipation time. This instrument consists of a track of LED lights that illuminate sequentially to simulate a target traveling toward the viewer at various speeds. The light track was aligned in front of and along the midline of the study participant. The participant pushed a hand-held button to coincide with the time at which the light at the end of the track, and closest to the subject, was illuminated. The timing errors for the participants were similar between PAL spectacles and the multifocal contact lenses.

Dynamic visual acuity as defined in this manuscript is the ability to resolve moving objects. Dynamic visual acuity was assessed by presenting a target with multiple lines of horizontal letters like those of a Snellen acuity chart. This miniaturized acuity chart was moved horizontally in a sinusoidal pattern across a cylindrical screen at a distance of about 116cm in front of the eyes. The range of letter sizes was equivalent to Snellen letters of 20/36 to 20/12.

In this study, the participant was given 10 seconds to read as many letters as possible on the moving chart while wearing each from of vision correction. The letters were to be read starting at the top of the chart (largest letters) and then proceeding to the next line down. All of the letters in a particular row must have been read before moving on to the next line. When wearing PAL spectacles, the mean number of letters read was 4.60±3.25, and while wearing multifocal contact lenses the letter score was 5.20± 3.69 (P=0.40).

Participants also completed the National Eye Institute's 25-item visual function questionnaire (VFQ-25). No statistical difference was found on the survey when comparing vision with PAL spectacles (91.9±1.1) to that with multifocal contact lenses (92.7±1.1).

At the end of the study, participants completed a survey about the type of vision correction that they preferred for various tasks of everyday living. The results demonstrated that participants clearly preferred multifocal contact lenses for dining out, playing sports, and when working out. Driving and computer use had similar responses between PAL spectacles and multifocal contact lenses. Most participants had no preference between the two types of correction when watching TV. PAL spectacles were preferred more often for reading a book or newspaper. When asked their overall preference, 14 participants (70%) preferred multifocal contact lenses, 4 (20%) preferred PAL spectacles and 2 (10%) had no preference.

In summary, performance on tasks that required rapid eye-hand responses, coincidence anticipation timing responses, and rapid target detection and resolution was at least equivalent for multifocal contact lens wear compared to progressive addition spectacle wear. Surveys indicated that multifocal contact lenses were

preferable for several tasks of everyday living. Practitioners should note that the study participants were given at least 2 weeks of wear to adapt to the multifocal contact lenses, just as new PAL wearers are often told to try their new glasses for about two weeks to adapt to them in clinical practice. Those practitioners who regularly prescribe PAL spectacles can feel confident that fitting multifocal contact lenses can provide patients with functional vision that equals or exceeds PAL wear. Finally, multifocal contact lenses may also be preferable for many activities of everyday life.

REFERENCES

1. Fogt, N. Yaquinto, F. A rapid pointing performance comparison between spectacle and contact lens wear. *Contact Lens Spectrum* 2020; 35 (February 2020). 32, 4-6, 8.