New Excimer Laser Treatments for Presbyopia

New and innovative surgical options are being explored for the correction of presbyopia. Presbyopia is the eye’s natural aging process whereby it experiences a gradual reduction in the amplitude of accommodation. Affecting an estimated one billion people worldwide, presbyopic patients suffer from a reduced quality of life. Although the exact pathophysiology is not fully understood, changes to the ciliary body, zonules, lens capsule and lens are known to play a role. Even with treatment through the use of corrective lenses, the quality of life in presbyopic patients diminishes in comparison to their emmetropic counterparts, with many seeking better solutions than those currently available.

Corneal Procedures for Presbyopia

Monovision

Classic monovision correction with excimer-based corneal refractive surgery is a well-established technique whereby LASIK is used to treat the dominant eye for distance vision and the non-dominant eye for near vision. It is currently one of the most widely-used and accepted excimer laser treatments for presbyopia. With success rates ranging from 72% to 98%, the aim is to give functional near and distance vision and to minimize the use of reading glasses.

The main limitations for success are the inability to suppress the blurred image and adapt to it. Driving at night can be more difficult, and the lack of a third focal length may hamper computer screen viewing at intermediate distances. Contrast sensitivity and stereo acuity are decreased, but happy patients are able to perform many day-to-day tasks without scrambling for their reading glasses. Monovision can be enhanced to full correction at any point in time.

Multifocal Corneal Ablations

The concept of multifocal excimer laser ablation profiles to correct presbyopia has been in existence since 1992. The term PresbyLASIK refers to creating a multifocal surface able to correct distance vision while simultaneously correcting near vision. There are two primary techniques for a multifocal LASIK treatment, which are central PresbyLASIK and peripheral PresbyLASIK.

Central PresbyLASIK creates a small, steeper myopic corneal centre for near vision, surrounded by a flatter hyperopic periphery, for distance vision, in both eyes.
The central prolate “bump” has greater power and induces spherical aberration which, in turn, increases depth of focus. This type of ablation profile is dependent on pupil size. As the pupil constricts with convergence, the small central steep area is used for vision. 72% of patients received spectacle independence for most tasks in the first central PresbyLASIK trial.4

Peripheral PresbyLASIK uses the central flattened area for distance vision while the mid-peripheral steepened area is for near vision.2,4 The literature shows a trend towards better near vision and reduced distance vision in central PresbyLASIK and better far vision and reduced near vision in peripheral presbyLASIK.4 Multifocal ablations, however, are complex and not easily reversed. Patients can have secondary glare and haloes as well.

Aspheric Corneal Ablations

This technique utilizes an aspheric laser ablation profile to induce spherical aberration (SA), which increases the depth of focus, improving near vision without affecting far vision.5 Both eyes receive the treatment. The non-dominant eye also gets mini-monovision. This innovative procedure is an advanced form of monovision. This minor monovision treatment, combined with increased depth of focus, allows the patient’s dominant eye to see clearly from far to intermediate, while the non-dominant eye sees clearly from intermediate to near. This gives the patient an intermediate “blend zone” where both eyes share the same visual acuity with binocular fusion. This helps patients see objects that are near, intermediate and far without correction. It also delivers the added benefit of preserving depth perception and contrast sensitivity.

Presbyond (Carl Zeiss Meditec, Jena, Germany) induces a small amount of positive SA and PresbyVision (Wavelight Allegretto [Alcon, Fort Worth TX, USA]) induces negative SA. The right amount of either negative or positive SA must be induced so as to have an effect on depth perception but not too much as that would degrade the quality of distance vision. Reported results to date have ranged from good to excellent with over 90% of patients seeing 20/20 distance, J3 or better and reporting high levels of satisfaction. As expected, improved tolerance and satisfaction for this type of monovision has been reported.3,4

Of primary importance, the treatment can be completely reversed with a topography-guided excimer ablation re-treatment, resulting in full-distance correction. This is reserved for patients who are dissatisfied with the results or who find they have other requirements with age.
Conclusion

It is exciting to be able to offer our presbyopic patients solutions to help improve their presbyopia and increase their overall quality of life. Newer excimer laser-based treatments are showing excellent outcomes and are becoming a mainstay of treatment. As eye care professionals, we must be prepared to counsel our patients on their different surgical and non-surgical options and help guide them towards a choice that is tailored to their individual needs.
Reference List


