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INTRACORNEAL INLAYS FOR PRESBYOPIA

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INTRODUCTION

Historical Background

Intracorneal inlays have been used in refractive surgery for the corneal compensation of myopia, hyperopia, astigmatism, keratoconus, ectasia, and presbyopia.

The idea of the implantation of an inlay within the corneal stroma was first introduced in the early 1940s by Baraquer¹ who used the term *keratophakia* (from the Greek words “kerato=κερατο,” which means cornea and “phakia=φακος,” which means lens). The implant was a lens made from donor corneal stroma that was frozen and shaped by a cryolathe² or freshly harvested by a microkeratome.³

Later, the *alloplastic keratophakia* was introduced, which is the implantation of an artificial lens or device into the cornea. In the 1950s and 1960s, Stone and Herbert,⁴ Belau et al,⁵ and Choyce⁶ explored the use of various materials for corneal implantation, including poly(methyl methacrylate) (PMMA), polysulfone, polypropylene, and silicone oil. Polysulfone was first used because of its high refractive index.^{6,7} However, many clinical trials resulted in corneal haze and

degeneration with final necrosis of the stroma.^{8,9} PMMA also causes necrosis of the corneal stroma because it is an impermeable material and blocks the flow of water and metabolites through the cornea.¹⁰ Another material studied more recently was hydrogel (hydroxyethyl methacrylate).^{10,11} This material is well-tolerated by the human cornea because it is permeable to water, oxygen, glucose, and other metabolites.¹²

The Use of Intracorneal Inlays for Presbyopia

The physiopathology of presbyopia is multifactorial and is based on the insufficiency of the mechanism of accommodation, due to the aging of its anatomical constituents.

In contrast with the other ametropias, presbyopia is a dynamic process, and its successful compensation depends on various factors specific to the individual patient, such as preoperative refractive status, reading distance, professional requirements for far and near vision, lifestyle, night driving, etc. Consequently, the probability that surgery will lead to an unsuccessful outcome for the patient is high.

TABLE 23-1. SUMMARY TABLE WITH THE CHARACTERISTICS OF THE THREE CORNEAL INLAYS FOR PRESBYOPIA

	FLEXIVUE MICROLENS	KAMRA (FORMERLY ACI-7000)	VUE+ (FORMERLY PRESBYLENS)
Procedure	Modified monovision	Modified monovision	Modified monovision
Principles of action	Changes the refractive index	Increases the depth of focus	Changes the anterior corneal curvature
Surgery	Pocket (mechanical microkeratome or femtosecond laser)	Flap or pocket (mechanical microkeratome or femtosecond laser)	Flap (mechanical microkeratome or femtosecond laser)
Stromal depth (μm)	280 to 300	200	120
Biocompatible	Yes	Yes	Yes
Inlay thickness (μm)	15 to 20	10	20 to 40
Diameter	3.2 mm	3.8 mm	2 mm
Nutrient flow	Yes (hydrogel-based material and central hole)	Yes (central hole and micropores)	Yes (hydrogel permeable material)
Transparency	Yes	No	Yes
FDA Approved	No (in clinical trials)	No (in phase III)	No (in clinical trials)
CE Mark	Yes	Yes	Yes

During recent years, in the field of refractive surgery, there has been increasing interest in the treatment of presbyopia. This has led to the development of a variety of different approaches, which, if chosen according to the needs of the individual, provide a much greater chance of postoperative success (see Section VI chapters). However, the common denominator of most of these techniques is that they are invasive and are difficult or impossible to reverse.

Thus, there is a need for a minimally invasive and reversible surgical technique with an easy learning curve for patients aged between 45 and 60 years. This has led to the development of a new approach, based on the use of corneal inlays, which can easily be removed in cases where they do not satisfy the demands of the patient.

In the past, the implantation of inlays for presbyopia or hyperopia has been described using flaps^{13,14} or pockets^{15,16} created by mechanical microkeratomes. Recently, the femtosecond laser has been used for the

creation of pockets^{17,18} or flaps,^{19,20} thus increasing the precision and allowing the implantation depth and position of the inlay to be customized to the individual patient.

Three different types of inlays with 3 different principles of action are currently available for the corneal compensation of presbyopia (Table 23-1). The Flexivue Microlens (Presbia, Los Angeles, CA) is a small, transparent, hydrophilic lens that acts by changing the refractive index of the central cornea (Figure 23-1). The KAMRA (formerly ACI-7000; Acufocus, Inc, Irvine, CA) is a small-diameter diaphragm with a central hole that increases the DOF (Figure 23-2). The Vue+ (formerly PresbyLens; Revision Optics, Lake Forest, CA) is a small, hydrogel inlay that changes the anterior curvature of the central cornea (Figure 23-3). All of these inlays are usually implanted monocularly in the nondominant eye of natural or postoperative emmetropic, presbyopes.

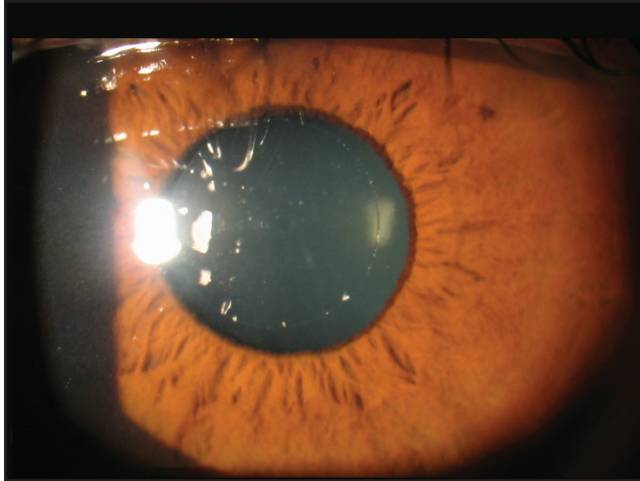


Figure 23-1. Slit-lamp photograph, using direct illumination, of the Flexivue Microlens inlay implanted into the cornea.

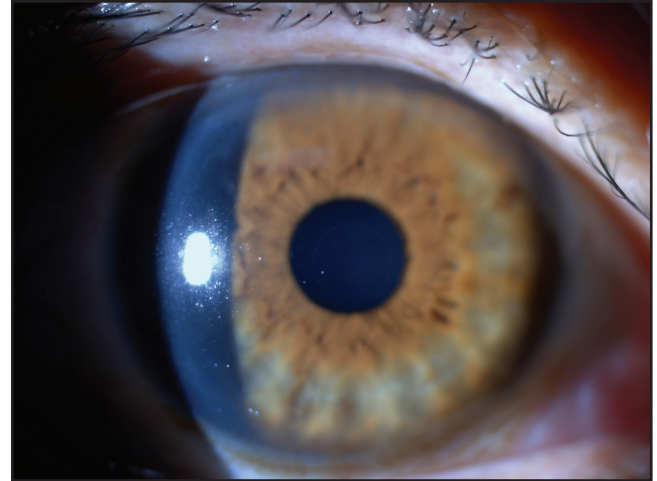


Figure 23-3. Slit-lamp photograph, using direct illumination, of the Vue+ inlay implanted into the cornea. (Reprinted with permission of Revision Optics, Inc.)

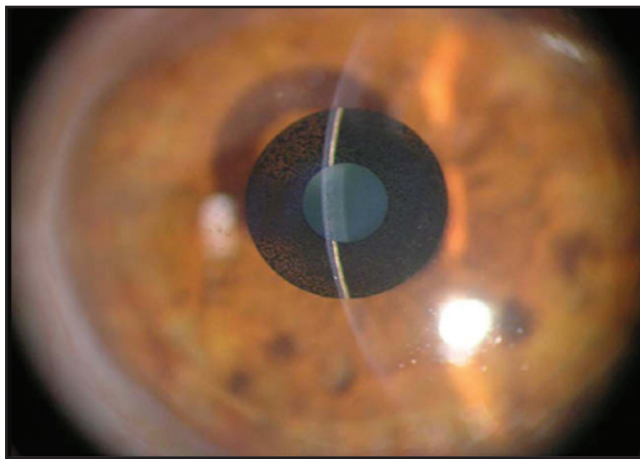


Figure 23-2. Slit-lamp photograph, using direct illumination, of the KAMRA inlay implanted into the cornea. (Reprinted from *J Cataract Refract Surg*, vol 34(11), Yilmaz OF, Bayraktar S, Agca A, et al. Intracorneal inlay for the surgical correction of presbyopia, pp 1921-1927, Copyright 2008, with permission from Elsevier.)

FLEXIVUE MICROLENS

Inlay Description

This refractive corneal inlay is a transparent, hydrophilic hydrogel-based disc manufactured from an optically clear copolymer of hydroxyethyl methacrylate and methyl methacrylate containing a UV-blocker with a diameter of 3 mm and a thickness of approximately 15 to 20 μm , depending on the add power. The central 1.8-mm diameter of the disc is plano, and the annular peripheral zone has an add power. The available inlay refractive add power ranges from

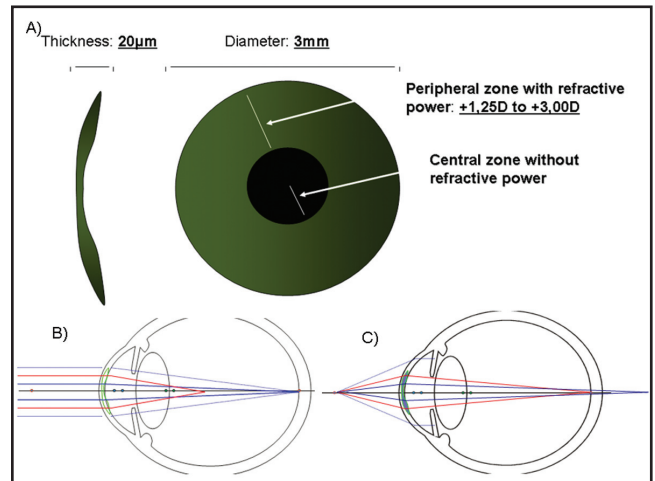


Figure 23-4. (A) Flexivue Microlens inlay design. (B) Distance vision of the Flexivue Microlens showing light rays passing through the central zone of the implant (blue lines), rays passing through the free peripheral corneal tissue (interrupted blue line), and rays passing through the refractive peripheral zone (red lines). (C) Near vision of the Flexivue Microlens showing rays passing through the central zone of the implant (blue line), rays passing through the peripheral clear cornea blocked by the pupil (interrupted blue line), and rays passing through the peripheral refractive zone (red lines).

+1.25 to +3.00 D in 0.25-D increments. At the center of the disc, there is a 0.15-mm diameter hole, which facilitates the transfer of oxygen and nutrients into the cornea through the lens (Figure 23-4A).¹⁵⁻¹⁷ The inlay is placed at three-fifths of the corneal depth because this depth (using computational methods) is considered the optimal implantation depth for nutrient flow and oxygen transport.²¹

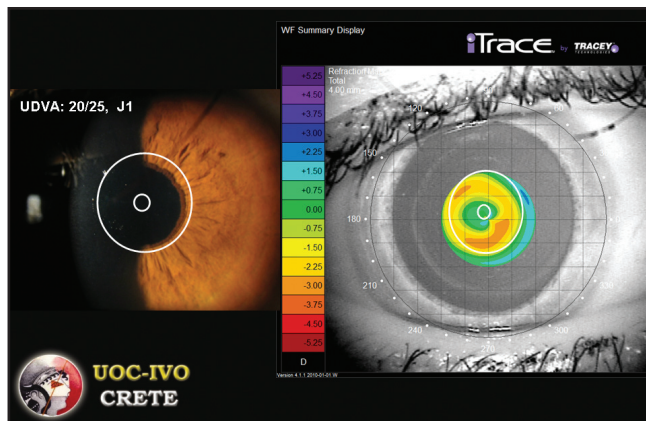


Figure 23-5. iTrace refractive map of total ocular aberrations in the area of the Flexivue Microlens. The inlay's annular peripheral zone creates a myopic effect while the central plano area remains emmetropic.

Principle of Action

The Flexivue Microlens inlay constitutes a bifocal optical system, which, in conjunction with the other unoperated eye, produces modified monovision (see Chapter 16). The optical effect depends not only on the design of the lens but also on the diameter of the pupil. During far vision, the rays that pass through the central (plano) zone of the implant and through the uncovered (not occupied by the inlay) outer part of the cornea will be sharply focused on the retina (Figure 23-4B). During near vision, the rays that pass through the annular peripheral refractive zone of the implant, which contains the add power, will be focused on the retina (Figure 23-4C). As a result, in emmetropic presbyopes, only the annular (inner and outer diameters 1.8 and 3.0 mm) peripheral zone of the lens implanted in the central part of the cornea provides the near-vision correction (and provides an out-of-focus image during far vision), whereas the central zone of the lens and the peripheral unaltered part of the cornea provide good far vision.²²⁻²⁵

Figure 23-5 shows the effect of the inlay to ocular aberrations, demonstrating the annular myopic shift that preserves the central plano zone.

The effect of changes in the pupil diameter on the percentage of the pupil area occupied by the near addition when the inlay is accurately centered is shown in Figure 23-6; note that a near addition is fully provided when the pupil diameter is 3 mm, which corresponds to an average pupil diameter in near vision. For larger diameter, which usually corresponds to pupil diameters in far vision, the effect is decreased. Thus, the near addition is likely to be less effective under very bright or relatively dim conditions.

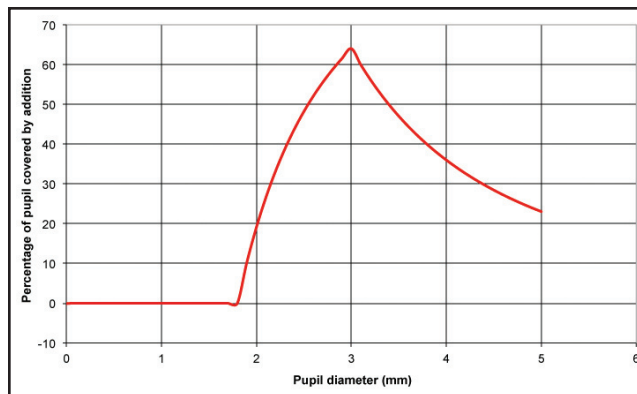


Figure 23-6. Percentage of pupil area covered by a well-centered Flexivue inlay as a function of the natural pupil diameter. Note that a near addition is fully provided when the pupil diameter is 3 mm. For larger diameters the effect decreases. (Reprinted with permission of Dr. Neil Charman.)

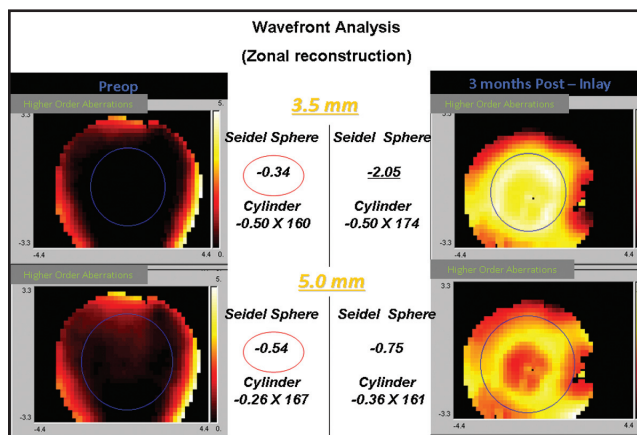


Figure 23-7. Smart Monovision. Wavefront analysis (WASA) COAS Wavefront Analyzer, Carl Zeiss Meditec, Jena, Germany), using zonal reconstruction, preoperatively and 3 months after surgery in 3.5 and 5.0 mm diameter of optical zone. The optical effect of the inlay, from the Seidel sphere calculation, is increased for diameters similar to 3.5.

Pallikaris¹⁸ described the effect of the inlay by the term “smart monovision.” Using wavefront analysis with zonal reconstruction, they confirmed that the effect in the operated nondominant eye was pupil-dependent and that the major optical effect of the inlay, from the Seidel sphere calculation, was observed in optical zones similar to the 3.0- to 3.5-mm diameter of the inlay. The effect was decreased in larger optical zones of 5.0 to 6.5 mm (Figure 23-7). Taking into consideration the fact that pupil diameter decreases during near vision and increases during far vision, this observation probably explains why the effect of the inlay on far vision is less important than that found in normal monovision.

Surgical Technique

The Flexivue inlay is inserted into an intrastromal corneal pocket. Originally, the pocket was created using a mechanical microkeratome (Visitome 20-10, Biovision AG, Bern, Switzerland) with a cartridge and a suction ring. The cornea was marked with a 5 radial marker centered to the line of sight, which was located using the microscope and centration system of an excimer laser. The suction ring was then applied in the cornea, aligning the radial marks on the surface of the ring with the radial marks on the periphery of the cornea, and the vacuum was turned on. After the vacuum was increased to 280 mm Hg, the microkeratome was moved forward, creating the intrastromal tunnel temporonasally. The forward-oscillated movement of the blade was visible and was discontinued as soon as the lead part of the blade passed the far end of the marked center of the visual axis on the cornea. After stopping at the desired point and maintaining the vacuum, the blade was retracted back, and when the blade was outside the tunnel, the vacuum was turned off. The depth of the tunnel was set to approximately three-fifths of the total corneal thickness and was dependent on the corneal curvature.

After the tunnel was created, the inlay was implanted using the appropriate injector.¹⁵

During recent years, the femtosecond laser has been substituted for the mechanical microkeratome. Initially, a variation of the usual parameters of the flap software was used in combination with a metal cover mask. A full lamellar cut was created at 280- μ m depth with a 8.65-mm diameter and spot-line separation of 2 μ m. A special mask was placed at the internal part of the glass of the applanation cone to limit the stromal separation at the desired area and the side cut at the desired entrance of the pocket. The mask had a keyhole-shaped uncovered area.¹⁷

More recently, special software for pocket creation has been introduced with the IntraLase (Abbott Medical Optics [AMO], Abbott Park, IL; Figure 23-8), the FemTec (20/10 Perfect Vision, Heidelberg, Germany), and the Technolas (München, Germany) femtosecond lasers. The advantage is that the procedure becomes easier. The direction, length, diameter, or shape of pocket can be changed easily, optimizing the final outcomes for each patient. After the lamellar cut, the tunnel is opened in the direction from the incision to the center of the cornea using a special separator. After the tunnel is created, the refractive inlay is implanted using an injector. The inlay is

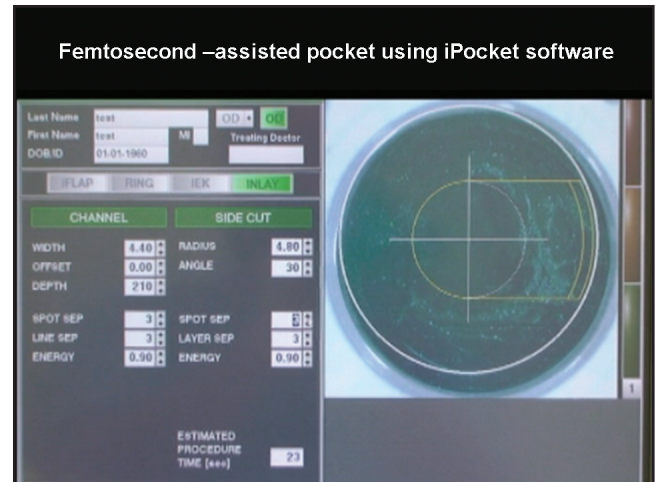


Figure 23-8. Femtosecond laser-assisted intracorneal pocket using a special software with IntraLase FS 150 (AMO).

placed at the point of the cornea corresponding to the line of sight. Exactly the same procedure is followed as in LASIK for the determination of the line of sight; the patient is asked to look at the fixation light, and the cornea is marked on the corresponding Purkinje reflex. To limit the fact that coaxiality of the microscope could influence the detection of the Purkinje reflex, the surgeon uses only one eye (the eye that is opposite to the operated eye of the patient), ensuring that the microscope is aligned as well as possible with the reflex.¹⁵⁻¹⁸

Studies

In 2009, at the American Academy of Ophthalmology (AAO) Refractive Surgery Subspecialty Day, Pallikaris presented the results of 43 operated patients with intracorneal refractive inlays for presbyopia using a mechanical microkeratome for the creation of the pocket.¹⁶ After 1 year, 93% of the patients had an uncorrected near visual acuity of J2 or better, and 7% had J4 or better and an uncorrected distance visual acuity of 20/30 in the operated eye and 20/20 binocularly. In a further study, at the 2010 AAO meeting, Pallikaris¹⁸ presented the preliminary results of 15 emmetropic presbyopes operated with a femtosecond laser for the implantation of the Flexivue Microlens. Uncorrected near visual acuity improved from 20/100 preoperatively to 20/25 at last follow-up. At the same time, mean distance uncorrected visual acuity in the operated eye had decreased from 20/20 to 20/40, but binocular visual acuity remained 20/20. No intra- or postoperative complications were found.

KAMRA INLAY

Inlay Description

The KAMRA (formerly ACI-7000) is an artificial aperture made of polyvinylidene fluoride (PVDF), which is pigmented with nanoparticles of carbon to make the inlay opaque. The inlay has a thickness of 10 μm , and the annular opaque area has an outer diameter of 3.8 mm and a central aperture of 1.6 mm. The surface of the KAMRA is perforated with 1600 holes (each 25 μm diameter) arranged in a randomized pattern to allow nutritional flow through the corneal tissue. These holes also allow some light to pass. The average light transmission is 7.5% with a 1600 random-hole pattern.^{13,19}

Principle of Action

The KAMRA inlay is placed on the visual axes of the nondominant eye and utilizes the principle of small-aperture optics to increase DOF by reducing the diameter of the out-of-focus retinal blur circles, thus improving near and intermediate vision.^{13,19} The consequence is a reduction in retinal illuminance, which may make reading difficult under poor lighting conditions.

Surgical Technique

The KAMRA is centered on the visual axis of the nondominant eye after the creation of a corneal flap 170- μm thick using a microkeratome¹³ or femtosecond laser.¹⁹ The target groups of patients are natural or post-LASIK presbyopic emmetropes.

Preoperatively, miosis allows the pupil to become visible through the inner diameter of the inlay to facilitate centration in the first Purkinje image during implantation.^{13,19}

Studies

Yilmaz et al¹³ reported the results of 39 patients who were implanted with the ACI-7000 inlay for presbyopia and followed for 12 months. The flap was created either using a mechanical pendular microkeratome or by relifting an existing LASIK flap. Mean uncorrected near visual acuity improved from J6 to J3 or better (J1, 85.3%). Uncorrected intermediate visual acuity improved from 20/32 to 20/20 and remained

at 20/20 for distance. More recently, Yilmaz et al²² also presented the long-term results (4 years) of the same group of patients and reported that all patients retained an improvement in near vision of 2 or more lines with no significant loss in distance vision.

In 2010, Seyeddain et al¹⁹ reported the results of KAMRA implantation in 32 patients using the femtosecond laser with 24-month follow-up. Mean uncorrected near visual acuity in the implanted eye improved from J6 preoperatively to J3 or better (J1 56%) and remained stable during the 2 years of the study. Uncorrected intermediate visual acuity improved from 20/40 preoperatively to 20/25 and remained at 20/20 for distance.

At the 2010 AAO meeting, Grabner²³ presented data on the 3-year postoperative performance of the AcuFocus KAMRA inlay. At 3 years, patients with the AcuFocus inlay reported significant improvement from preoperative levels in both near and intermediate uncorrected visual acuity, according to AcuFocus. In addition, 97% of patients achieved J3 or better with a mean near uncorrected visual acuity of J1, and 91% achieved uncorrected intermediate visual acuity of 20/32 or better. Grabner²³ also reported that the inlay did not influence fundus examination, visual field tests, and optical coherence tomography in these patients.

In all studies, the patients were either natural or post-LASIK emmetropic presbyopes aged between 45 and 60 years. Recently, unpublished data (November 2011) reported the creation of corneal pockets using the femtosecond laser for implantation of the inlay.

VUE+ INLAY

Inlay Description

The Vue+ (formerly PresbyLens) is an intracorneal inlay made of a high water content (more than 70%) hydrogel with a similar refractive index to that of normal corneas. Hydrogel is a highly biocompatible material, permeable to water, oxygen, glucose, and other metabolites.¹² The material is fenestrated to facilitate nutrient and fluid transfer. It measures 10- μm thick at the edge and varies from 24- to 40- μm thick at the center, depending on the degree of the intended correction.²¹ The inlay diameter is 2 mm. The inlay creates a multifocal cornea.

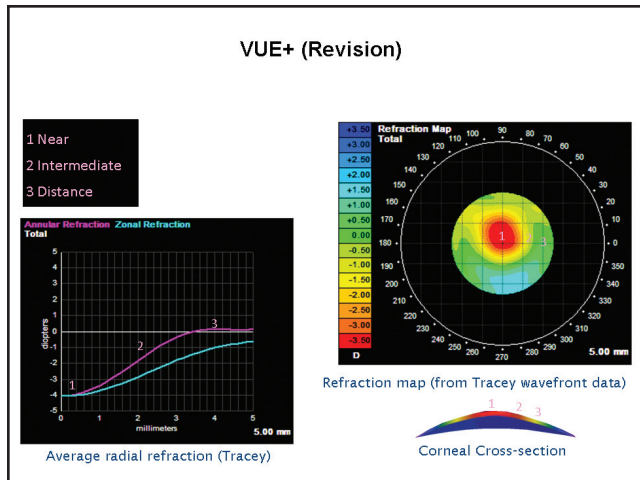


Figure 23-9. Vue+ reshapes the anterior curvature of the cornea creating 3 concentric zones for near, intermediate, and far vision. (Reprinted with permission of Dr. Stephen Slade.)

Principle of Action

The effect of the inlay is achieved through alteration of the corneal shape in the nondominant eye, creating a steepened central cornea for near vision and leaving the curvature of the more peripheral cornea unchanged for intermediate and distance vision (Figure 23-9).^{14,20}

Surgical Technique

The lens is placed under a 120- μ m flap created by using either a mechanical microkeratome or femtosecond laser, in natural or post-LASIK emmetropic presbyopes. The inlay is implanted using a special injector made of titanium and is centered on the pupil. The flap is gently returned over the inlay and the interface liquids are absorbed using a Merocel sponge; care is taken to not move the inlay.^{14,20}

Studies

In a study presented at the 2008 Association for Research in Vision and Ophthalmology meeting, 33 emmetropic presbyopes received the PresbyLens inlay. Patients achieved 20/25 uncorrected near visual acuity, whereas distance visual acuity was decreased to 20/25 in the operated eye.²⁴ No patients reported marked or severe glare or halos 6 months postoperatively.

In 2010, at the European Society of Cataract and Refractive Surgeons meeting, Slade²⁵ presented the visual performance of 30 emmetropic presbyopes

treated with the PresbyLens corneal inlay under a corneal flap created in the nondominant eye. At 6 months, mean uncorrected near visual acuity of the treated eye was 20/25 (J1), corresponding to 4 lines of improvement. Uncorrected intermediate visual acuity in the treated eye improved to 20/25, corresponding to 2 lines of improvement. No patient lost 2 or more lines of corrected near or distance visual acuity.

SUMMARY

The treatment of presbyopia in natural or post-LASIK emmetropic presbyopic patients, aged between 45 and 60 years and without any other ocular pathology, must preserve their uncorrected distance vision and meet the high expectations of these possible candidates. The treatment must also be reversible, in the event it fails to satisfy the patient's expectations, creates visual acuity or visual quality problems, or must be removed for effecting another intraocular surgery, such as cataract extraction.

Intracorneal inlays appear to meet these criteria as they are considered to be minimally invasive and reversible surgical techniques for the corneal compensation of presbyopia. They are very easily implanted into the cornea using laser settings that are similar to those of a routine keratorefractive surgical procedure, and they can be easily removed if the patient is dissatisfied. The 3 available inlays have different mechanisms of action but all act as a modified monovision approach. They are currently implanted using a femtosecond laser, either under flaps or in pockets. Far vision is less influenced than in the classic monovision approaches, and all the inlays present reasonable outcomes for near vision. They may, however, be unsuitable for patients who wish to carry out more challenging near tasks. As with all bifocal or multifocal corrections, retinal image contrast could be reduced at both distance and near in eyes implanted with the Flexivue and Vue+ devices, and retinal illuminance could be markedly reduced with the KAMRA implant. Effects on contrast sensitivity and stereopsis have yet to be adequately explored. To date, there are no reported long-term biocompatibility issues even if the inlays are made of different materials.

All of the inlays have the European Conformity (CE) mark. The KAMRA inlay is in Phase III of US Food and Drug Administration (FDA) trials, the Vue+ and the Flexivue Microlens are in the clinical FDA trials phase. The results of the FDA trials will give

more detailed insights into the utility of these inlays and will help surgeons to select the inlay that best satisfies the patient's expectations. Future developments may produce inlays that have less effect on distance visual acuity and visual quality and yield better contrast sensitivity and stereopsis.

REFERENCES

1. Barraquer JI. Modifications of refraction by means of intraocular inclusions. *Int Ophthalmol Clin*. 1966;1:53-78.
2. Friedlander MH, Rich LF, Werblin TP, et al. Keratophakia using preserved lenticules. *Ophthalmology*. 1980;87:687-692.
3. Krumeich JH, Swinger CA. Non-freeze keratophakia for the correction of myopia. *Am J Ophthalmol*. 1987;103:397-403.
4. Stone W, Herbert E. Experimental study of plastic material as a replacement for the cornea: preliminary report. *Am J Ophthalmol*. 1953;36:168-173.
5. Belau PG, Dyer JA, Ogle KN, Hernderson JW. Correction of ametropia with intracorneal lenses: an experimental study. *Arch Ophthalmol*. 1964;72(4):541-549.
6. Choyce DP. The correction of the refractive errors with polysulfone corneal inlays. *Trans Ophthalmol Soc UK*. 1985;104:332-342.
7. Deg JK, Binder PS. Histopathology and clinical behaviour of polysulfone intracorneal implants in the baboon model. Polysulfone lens implants. *Ophthalmology*. 1988;95(4):506-514.
8. Horgan SE, Fraser SG, Choyce DP, et al. Twelve years follow-up of unfenestrated polysulfone intracorneal lenses in human sighted eyes. *J Cataract Refract Surg*. 1996;22(8):1045-1051.
9. Lane SI, Lindstrom RI, Cameron JD, et al. Polysulfone corneal lenses. *J Cataract Refract Surg*. 1986;12(1):50-60.
10. Werblin TP, Patel AS, Barraquer JI. Initial human experience with hydrogel intracorneal lens implants. *Refractive Corneal Surg*. 1992;8(1):23-26.
11. McCarey BE, Andrews DM. Refractive keratoplasty with intrastromal hydrogel lenticular implants. *Invest Ophthalmol Vis Sci*. 1981;21:107-115.
12. Barraquer JI, Gomez MI. Permalens hydrogel intracorneal lenses for spherical ametropia. *J Refract Surg*. 1997;13(4):342-348.
13. Yilmaz OF, Bayraktar S, Agca A, Yilmaz B, McDonald MB, van de Pol C. Intracorneal inlay for the surgical correction of presbyopia. *J Cataract Refract Surg*. 2008;34:1921-1927.
14. Mulet ME, Alio JL, Knorz MC. Hydrogel intracorneal inlays for the correction of hyperopia: outcomes and complications after 5 years of follow-up. *Ophthalmology*. 2009;116(8):1455-1466.
15. Bouzoukis DI, Kymionis GD, Panagopoulou SI, et al. Visual outcomes and safety of a small diameter intrastromal refractive inlay for the corneal compensation of presbyopia. *J Refract Surg*. 2012;28(3):168-73.
16. Pallikaris IG. Intracorneal refractive inlays for the treatment of presbyopia: visual outcomes and safety. Paper presented at: American Academy of Ophthalmology annual meeting; October 23, 2009; San Francisco, CA.
17. Bouzoukis D, Kymionis G, Limnopoulou A, Kounis G, Pallikaris I. Femtosecond laser-assisted corneal pocket creation using a mask for inlay implantation. *J Refract Surg*. 2011;27(11):818-820.
18. Pallikaris IG. Intracorneal lenses for the treatment of presbyopia using femtosecond laser: visual outcomes and safety. Paper presented at: American Academy of Ophthalmology annual meeting; October 17, 2010; Chicago, IL.
19. Seyeddain O, Riha W, Hohensinn M, Nix G, Dexi AK, Grabner G. Refractive surgical correction of presbyopia with the Acufocus small aperture corneal inlay: Two year follow-up. *J Refract Surg*. 2010;28:1-9.
20. Verity SM, McCulley JP, Bowman RW, Cavanagh HD, Petroll WM. Outcomes of PermaVision intracorneal implants for the correction of hyperopia. *Am J Ophthalmol*. 2009;147(6):973-977.
21. Larrea X, De Courten C, Feingold V, Burger J, Buchler P. Oxygen and glucose distribution after intracorneal lens implantation. *Optom Vis Sci*. 2007;84(12):1074-1081.
22. Yilmaz OF, Alagoz N, Pekel G, et al. Intracorneal inlay to correct presbyopia: long term results. *J Cataract Refract Surg*. 2011;37:1275-1281.
23. Grabner G. Presbyopia in Europe. Paper presented at: American Academy of Ophthalmology annual meeting; October 18, 2010; Chicago, IL.
24. Lang AJ, Icenogle T, Franz S, et al. Clinical efficacy of the PresbyLens intracorneal inlay for the correction of presbyopia. Presented at: Association of Research in Vision and Ophthalmology annual meeting; April 29, 2008; Fort Lauderdale, FL.
25. Slade ST. Early results using the PresbyLens corneal inlay to improve near and intermediate vision in emmetropic presbyopes. Paper presented at: European Society of Cataract & Refractive Surgery annual meeting; September 2010, Paris, France.