

Section 8

2001-2002

External Disease and Cornea



Basic and Clinical Science Course

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and Cornea

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Basic Science of Keratorefractive Surgery

Refractive surgery encompasses a broad range of procedures to change the refraction of the eye. BCSC Section 3, *Optics, Refraction, and Contact Lenses*, discusses the optical considerations for these procedures. Such procedures include techniques to alter the basic shape of the cornea or its ability to refract light. A classification of terms used in “keratospeak” is summarized in Table XXV-1.

Currently, the most prevalent refractive surgery is cataract removal with intraocular lens implantation, which is covered in BCSC Section 11, *Lens and Cataract*. Other related techniques include removal of the natural lens to treat myopia (clear lens extraction), removal and replacement of the natural lens with IOLs to treat both hyperopia or myopia, or insertion of an artificial lens without natural lens removal (phakic IOL). All are effective methods for correcting refractive errors, but safety has not been established; the rate of complications including retinal detachment and loss of corneal endothelial cells is undetermined.

Refractive surgery involving the cornea is rapidly changing with advances in technology. Chapter XXVI discusses the clinical aspects of keratorefractive surgery, and chapter XXVII covers laser techniques. Schematic illustrations of the more frequent procedures are shown later in this chapter.

Corneal Optics

Zones of the Cornea

For more than 100 years the *corneal shape* has been recognized as aspheric. Typically, the central cornea is about 3 D steeper than the periphery, a positive shape factor. Clinically, the cornea is divided into zones that surround fixation and blend into each other. The *central zone* of 1–2 mm closely fits a spherical surface. Adjacent to the central zone is a 3–4 mm doughnut with an outer diameter of 7–8 mm. Termed the *paracentral zone*, this doughnut represents an area of progressive flattening from the center. Adjacent to the paracentral zone is the *peripheral zone* with an outer diameter of approximately 11 mm, and adjoining this is the *limbus* with an outer diameter on average of 12 mm. The central and paracentral zones are primarily responsible for the refractive power of the cornea (Fig XXV-1, see p 442).

Together, the paracentral and central zones constitute the *apical zone* as used in contact lens fitting. The peripheral zone is also known as the *transitional zone*, as this is the area of greatest flattening and asphericity of the normal cornea. The limbal zone sits adjacent to the sclera and represents an area of steepening of the cornea prior to joining the sclera at the limbal sulcus.

TABLE XXV-1
CLASSIFICATION OF CORNEAL REFRACTIVE SURGERY

TYPE OF REFRACTIVE KERATOPLASTY	BASIC SURGICAL TECHNIQUE	VARIATIONS OF SURGICAL TECHNIQUE OR MATERIAL	REFRACTIVE ERROR TREATED	COMMENT
Lamellar	Keratotomy (KM, cutting corneal disc with microkeratome)	<ul style="list-style-type: none"> Microkeratome techniques <ul style="list-style-type: none"> ▪ Manual or mechanical advance ▪ Oscillating or rotating blade Methods of making refractive stromal cut <ul style="list-style-type: none"> ▪ Barraquer's cryolathe ▪ Nonfreeze—microkeratome with suction mold (BKS) ▪ Excimer laser (ArF, 193 nm) Source of tissue for disc <ul style="list-style-type: none"> ▪ Patient (autoplastic) ▪ Donor (homoplastic) 	Myopia (MKM) hyperopia, aphakia Myopia, hyperopia, aphakia Myopia	Suture techniques: Appositional, overlay, no suture Computerized calculations and control Early clinical trials
	KM in situ (carving corneal bed)	<ul style="list-style-type: none"> Microkeratome (plano excision) Keratophysis (refractive mold in microkeratome) <ul style="list-style-type: none"> ▪ Excimer laser (ArF, 193 nm) ▪ Complete disc ▪ Flap disc (LASIK) Autokeratophakia (same as KM in situ, except stromal button is cut smaller with trephine and left in place) 	Myopia Myopia Myopia, astigmatism Hyperopia Hyperopia	In laboratory development Phase III FDA trials in U.S. Early clinical trials In development in Moscow
	Epikeratoplasty (Epi)	<ul style="list-style-type: none"> Human donor lenticule <ul style="list-style-type: none"> ▪ Cryolathe ▪ Suction mold (BKS) ▪ Excimer laser ▪ Lyophilized Synthetic (e.g., collagen and coated hydrogel) Plano lenticule 	Aphakia, hyperopia Myopia	If contact lens and IOL contraindicated, e.g., infant aphakia FDA core study; in laboratory development
			Astigmatism and myopia in keratoconus	If penetrating keratoplasty contraindicated

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