Sequential versus Simultaneous Photorefractive Keratectomy

And

Corneal Collagen Cross Linking in Keratoconus Treatment

Keratoconus
Keratoconus is a corneal ectatic disease that results in bilateral corneal distortion, altered refractive powers, and reduced vision.

Pathophysiology:
- The corneal epithelium shows central thinning
- Irregular basement membrane
- Defects in Bowman’s layer.
Diagnostic evaluation:
- Corneal topography is one of the most important diagnostic tools for keratoconus.
- Newer devices such as optical coherence tomography (OCT) is useful in imaging early keratectasia.


TREATMENT

Visual rehabilitation

1. Contact lens fitting

2. Intrastromal corneal ring segments

3. PRK

4. Phakic intraocular lenses

Shape stabilization

Collagen cross-linking

CXL technique using riboflavin and ultraviolet-A (UVA) light is developed to counteract the progressive corneal thinning and progression of keratoconus.

Conventional keratoconus management

Penetrating keratoplasty

- Penetrating keratoplasty (PK) achieves good visual outcomes.
- But graft survival declines rapidly with age.


Corneal Crosslinking
Corneal collagen cross linking (CXL) with riboflavin and ultraviolet – A irradiation increase corneal rigidity and stability of keratoconic corneas.

The goal of CXL is to inhibit the progression of the ectatic disease and to increase the rigidity and resistance of the cornea.


Complications

(1) Postoperative infection

(2) Corneal haze

(3) Peripheral sterile infiltrates

(4) Herpes reactivation

(5) Endothelial damage

(6) Treatment failure
Photorefractive Keratectomy

Photorefractive keratectomy (PRK) is a procedure intended to correct refractive error reducing dependency on glasses.

**Technique**

- Ablate a small amount of tissue from the corneal stroma by excimer laser
- Produce stromal remodeling, and so inducing a change in corneal refraction.

![Diagram of the procedure]


**Complications:**

**Corneal haze**

Corneal haze reduces corneal transparency at variable degrees.

Corneal sensitivity and dry eye

Photoablation affects corneal nerves, disrupting the lacrimal function


Corneal reepithelialization after PRK

1. Bandage contact lenses

To ease off the postoperative pain and promote epithelial healing, bandage contact lenses are fitted for five days after surgery


2. Amniotic membrane transplantation

reduces the inflammation after PRK and stimulates corneal epithelialization


3. Mitomycin-C

The wound healing response may be altered by mitomycin-C (MMC) immediately after the laser ablation to minimize myofibroblast activation

4. Corticosteroids and non-steroidal anti-inflammatory agents (NSAIDs)

The most common treatment after PRK to avoid the corneal inflammation is the application of corticosteroids.


Combination of Photorefractive Keratectomy and Corneal Collagen Cross Linking in Keratoconus Treatment
Successful keratoconus treatment confronts two parameters:

1- Corneal biomechanical stability

2- Optical inefficiency of the irregular cornea.

So, CXL has been combined with topography-guided PRK with excellent results regarding safety and patient satisfaction.
Combined treatment of CXL/PRK normalize the cornea as much as possible to increase BSCVA.

VA before treatment show blurred vision

improved VA post TCAT treatment


Approaches of combination surgeries

1- Two-steps sequential approach in the form of CXL then after interval of stability PRK is done.

2- Simultaneous procedures done in the form of same day PRK followed by CXL

Corneal OCT demonstrates hyperreflective interacorneal stromal lines (arrows) corresponding with clinical presence of CXL demarcation line in patient with simultaneous PRK and CXL

**Limitations with the sequential approach**

First the stiffened crosslinked cornea is removed in a second step by the PRK so decreasing benefits of CXL

Second ablation rate could be different in cross-linked cornea than in the virgin cornea (this lead to unpredictable refractive results)

Third increased possibility of post-PRK haze

SO PRK followed by CXL simultaneously in a single surgical procedure is better for treating keratoconus

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Take Home Message

A comparison of sequential versus simultaneous PRK and CXL for treatment of keratoconus in terms of:

- Topography
  - Keratometry
  - Corneal haze
- Manifest refraction
  - Ectatic progression
  - Endothelial cell count
  - Central corneal thickness

shows that the same day procedure performs better in all parameters.