StreamLight™.... The new twist in PRK

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Is Trans-Epithelial PRK better than PRK?

- Mechanical debridement of the epithelium leads to potential BM injury , Upregulation of keratocytes and irregular OZ exposure.
- This usually leads to stormy postoperative course in the first few days , irregular re-epithelialization , considerable pain..
- This picture has been always attributed to the removal of the epithelium and the time it takes to regenerate.
- Irregular removal of epithelium prevents proper monitoring of healing...
- This clinical scenario has always been the hallmark of surface ablation.....

How can we improve PRK postoperative course???

- AMIOL's brush… little improvement.
- Decreasing the mechanical force needed by loosening the basal hemidesmosomes ..
- **Alcohol …….**
- **GOOD……**

Alcohol…..

- **Used in manual PRK.**
- **Used even alone to separate a perfect epithelial disc without any trauma, and possible repositioning it …LASEK.**
- **Found to double the epithelialization time !!**
- **Induces apoptosis in keratocytes and increases the healing period.**
- **Epithelial repositioned disc acts as a dead cells plug *slowing* the regeneration of epithelium from periphery to the center.**

PubMed

suppressing proliferation, and inducing apoptosis. Also, expression of corneal epithelial cell-specific markers, both stem cell and differentiation markers, was significantly reduced by ethanol exposure. Expression of proinflammatory cytokines and chemokines was highly increased in corneal epithelial and stromal cells that were exposed to ethanol.

CONCLUSIONS: Together, data suggest that brief exposure of the corneal surface to ethanol may have long-term effects by disrupting the integrity of corneal epithelium and generating inflammation, both of which are precursors to a number of ocular surface diseases.

ophthalmology, effects of ethanol on the ocular surface have been poorly defined. Hence, we performed this study to investigate effects of ethanol on corneal epithelium from various aspects.

toxicity, survival, and expression of cell-specific markers and inflammatory cytokines at 24, 48, and 72 hours after ethanol exposure.

RESULTS: We found that ethanol markedly decreased the viability of cells in a concentration-dependent manner by causing cell lysis, suppressing proliferation, and inducing apoptosis. Also, expression of corneal epithelial cell-specific markers, both stem cell and differentiation markers, was significantly reduced by ethanol exposure. Expression of proinflammatory cytokines and chemokines was highly increased in corneal epithelial and stromal cells that were exposed to ethanol.

Alcohol

So again..How Can we improve PRK postoperative course???

- **Remove the Epithelium with the laser....**
- No mechanical trauma....
- No Alcohol.....
- Rounded disc removed , hence a decreasing rounded defect allowing observation of any irregularity....
- Faster healing time....
- Shorter "dangerous" period.
- Less PAIN.....

OBSERVATIONAL STUDY

ngle-Step Transepithelial PRK vs Alcohol-Assisted PRK in
yopia and Compound Myopic Astigmatism Correction

INTRODUCTION

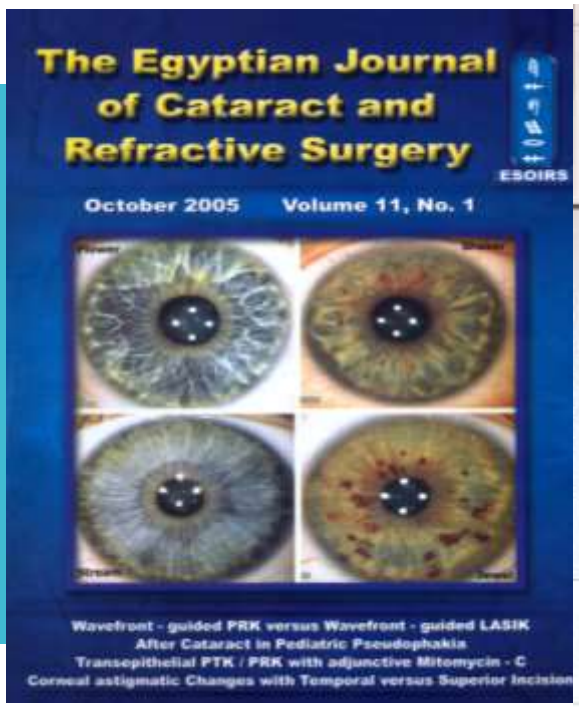
Trans-E

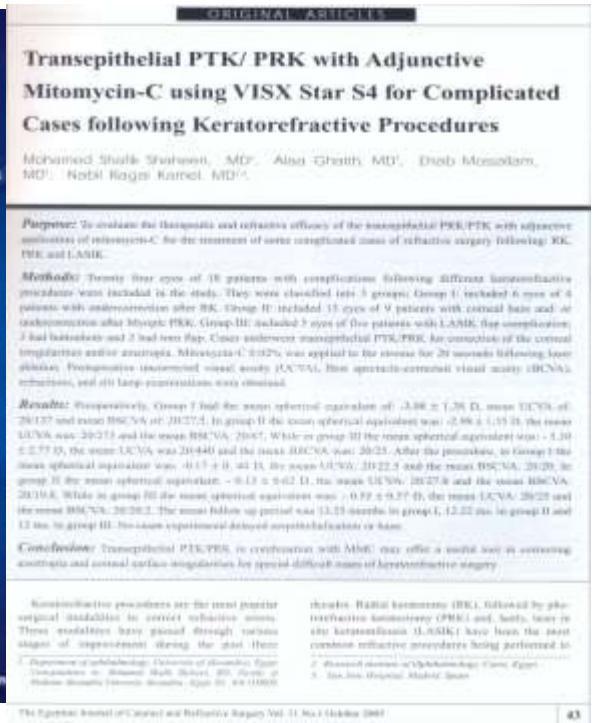
High-resolution spectral optical coherence tomography (OCT) with speckle contrast reduction also failed to detect differences in the corneal healing processes after tPRK and aaPRK, except for the shorter time to cover the stroma with epithelium in the tPRK group.[12] The main reason explaining this observation is that the diameter of epithelial removal matches the total ablation zone in transepithelial PRK treatments, decreasing the wound surface, and shortening the epithelial closure time.[10,12]

Another advantage of tPRK is reduced surgery time. In our study, the total surgery time was reduced by 35% in comparison to aaPRK. Surgery itself is less stressful for the patient and very comfortable for the surgeon. Aslanides et al[10] and Fadlallah et al[11] reported decreased postoperative pain after the single-step transepithelial PRK; however, our results failed to confirm these findings.

When does Trans-epithelial PRK stand out……

- In Irregular Corneas.
- Decentrations , minor irregularities and Forme Fruste KC…
- Corneal repair work.
- Epithelium acts as a masking agent leaving more regular surface.




ORIGINAL ARTICLES

Transepithelial PTK/ PRK with Adjunctive Mitomycin-C using VISX Star S4 for Complicated Cases following Keratorefractive Procedures

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Purpose: To evaluate the therapeutic and refractive efficacy of the transepithelial PRK/PTK with adjunctive application of mitomycin-C for the treatment of some complicated cases of refractive surgery following RK, PRK and LASIK.

Methods: Twenty four eyes of 18 patients with complications following different keratorefractive procedures were included in the study. They were classified into 3 groups; Group I: included 6 eyes of 4 patients with undercorrection after RK. Group II: included 15 eyes of 9 patients with corneal haze and /or undercorrection after Myopic PRK. Group III: included 3 eyes of five patients with LASIK flap complication; 2 had buttonhole and 2 had torn flap. Cases underwent transepithelial PTK/PRK for correction of the corneal irregularities and/or aneuropia. Mitomycin-C 0.02% was applied to the stroma for 20 seconds following laser ablation. Postoperative uncorrected visual acuity (UCVA), Best spectacle-corrected visual acuity (BCVA), refractions, and slit lamp examinations were obtained.

Results: Preoperatively, Group I had the mean spherical equivalent of: -3.00 ± 1.39 D, mean UCVA of: 20/137 and mean BSCVA of: 20/27.5. In group II the mean spherical equivalent was: -2.90 ± 1.55 D, the mean UCVA was: 20/273 and the mean BSCVA: 20/67. While in group III the mean spherical equivalent was: - 1.10 ± 2.77 D, the mean UCVA was 20/440 and the mean BSCVA was: 20/25. After the procedure, in Group I the mean spherical equivalent was: -0.17 ± 0. 44 D, the mean UCVA: 20/22.5 and the mean BSCVA: 20/20. In group II the mean spherical equivalent: - 0.13 ± 0.62 D., the mean UCVA: 20/27.8 and the mean BSCVA: 20/19.8. While in group III the mean spherical equivalent was: - 0.33 ± 0.57 D, the mean UCVA: 20/25 and the mean BSCVA: 20/20.2. The mean follow up period was 13.25 months in group I, 12.22 mo. in group II and 13 mo. in group III. No cases experienced delayed epithelialization or haze.

Conclusion: Transepithelial PTK/PRK in combination with MMC may offer a useful tool in removing ametropia and corneal surface irregularities for special difficult cases of keratorefractive surgery

Keratorefractive procedures are the most popular surgical modalities to correct refractive errors. These modalities have passed through various stages of improvement during the past three decades. Radial keratotomy (RK), followed by photorefractive keratectomy (PRK) and, lately, laser in situ keratomileusis (LASIK) have been the most common refractive procedures being performed to

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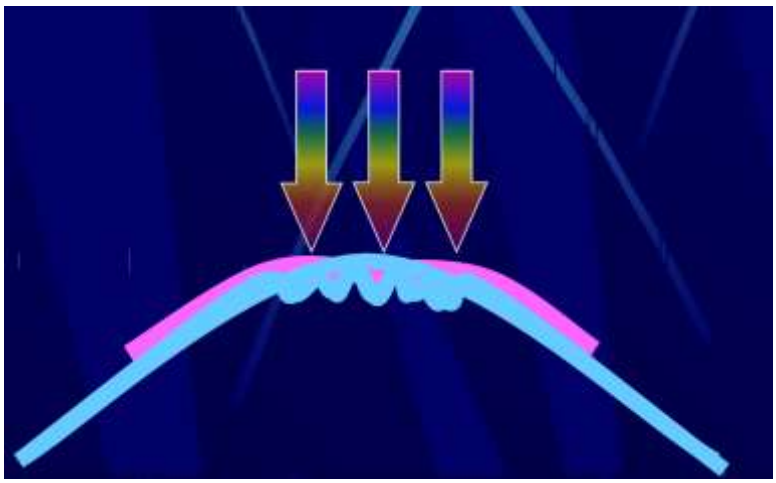
Epithelium as a masking agent in PRK



When does Trans-PRK stand out (2) …..

- In Enhancemets …
- Whether post LASIK , PRK or SMILE.
- In Lasik , to avoid flap dislocation during mechanical debridement of epithelium.
- In PRK , as mechanical removal of epithelium can lead to upregulation of inflammation in a previously sensitized cornea and may trigger postoperative haze.
- In SMILE it is the standard procedure for low touch ups between 0-2 diopters , over 2 diopters the manufacturer recommends CIRCLE mode …

When does Trans-PRK stand out (3).....

- TransPRK treatment of irregular and incomplete LASIK flaps can be done at the time of surgery.
- Delayed Trans PTK/PRK: 2 advantages:
  - Allow the inflammatory component of the wound healing process to diminish → reducing the incidence of late onset corneal haze
  - Allow the epithelium time to remodel → "smoothen" the corneal surface.
- Can be Topography guided → improve HOA

The ***FOUR*** Disadvantages of Classic Trans-PRK.....

- Limited diameter of epithelial ablation:
  - VisX 6mm.
  - Wavelight 5.5mm if depth is more than 50m.
  - This interferes with ablation zone unless more epithelium is removed manually (losing the circular ablation advantage).
- Shallower ablation outside the 4mm central zone due to cosine effect , hence leaving a thin skirt of epithelium from 4mm to 6mm zone.... (Wavelight , VisX).
- OVER-ESTIMATION of peripheral epithelial thickness outside the 4mm central zone leading to more peripheral ablation and hence a myopic shift.....(SHWIND).....
- Non- Perfect match of the two ablation circles (Epithelial & Refractive).....

StreamLight™ - Optic Zones (OZ) and Depth

addressing #1

Setting	Myopia	Myopic Astig	Hyperopia	Hyperopic Astig	MIxed Astig
(WFO) OZ	6.0mm 6.5mm 7.0mm	6.0mm 6.5mm 7.0mm	6.0mm 6.5mm 7.0mm	6.0mm 6.5mm 7.0mm	6.0mm 6.5mm 7.0mm
EPI OZ	= WFO OZ + 0.5mm 6.0mm => 6.5mm 6.5mm => 7.0mm 7.0mm => 7.5mm	8.0mm	8.0mm	8.0mm	8.0mm
EPI Depth	45µm 50µm 55µm 60µm 65µm	45µm 50µm 55µm 60µm 65µm	45µm 50µm 55µm 60µm 65µm	45µm 50µm 55µm 60µm 65µm	45µm 50µm 55µm 60µm 65µm

EPI OZ (PTK Diameter) = WFO OZ + 0.5mm

Peripheral Over-ablation of epithelium…

DISCUSSION

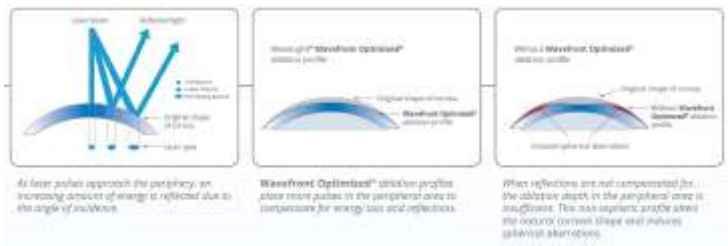
Aspheric aberration-free ablation profile of single-step transepithelial PRK (TransPRK) used in the study, has many implications over the standard aaPRK procedures. The ablation profile is calculated estimating that the central epithelial thickness of a normal cornea is 55 and 65 μm at 4 mm from the center.[8] Therefore, the epithelial thickness profile resembles a slight hyperopic treatment (<0.75 D) and proper compensation helps to avoid hyperopic shift. The laser system is tuned to

Kaluzny et al, medicine 2016..

StreamLight avoids too shallow/deep epithelial ablation….

Addressing#2&3

- **StreamLight Epithelial ablation** utilizes the Optimized ablation profile principle ,where more pulses are used outside the 4mm zone to prevent epithelial remnants , but not enough to ablate into stroma and induce a myopic shift …..The estimated difference in ablation depth is driven from normative data …



WaveLight®
StreamLight™

addressing #4

StreamLight™ is an **intelligent procedure** through:

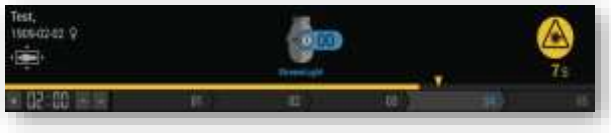
- **Streamlined workflow** through one-step procedure (PTK+PRK)
- As StreamLight™ is a one-step treatment, **only one centration** is required, therefore **enhancing precision**
- PTK treatment zone size and location is automatically determined by the laser, based on the PRK ablation profile
- Laser´s multidimensional eye tracker is active throughout the complete procedure (PTK + PRK)

StreamLight:
Single Step Trans PRK

- **Eye tracker** is active throughout the entire procedure.
- Customized epithelial ablation diameter correlated to the treatment zone
- PTK treatment zone size and location is automatically determined by the laser, based on the PRK ablation profile.
- **Optimized ablation profile principle** : where more pulses are used outside the 4mm zone to prevent epithelial remnants , but not enough to ablate into stroma and induce a myopic shift

Advantages of StreamLight over classic Trans PRK cont…

- Can adjust epithelial ablation depth (45-60 um)
- Software indicates transition from PTK to PRK (visual and audible)



- There is no need to re-center the treatment or re-enter patient's data
- Less incidence of dehydration

StreamLight from the patient prespective….

- **For the patient:**
- **More reassuring "No Touch No Cut"**
- **Less procedure time:**

- **Less post op pain: smaller, healthier, and neater epithelial edge.**

StreamLight™ - Epithelial Depth

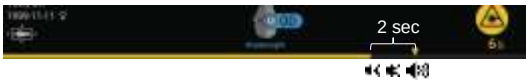
Surgeon can program corneal epithelial depth removal

- **Based on measurement (OCT)**
- **Based on nomogram (what best suites their technique)**

StreamLight™ Epithelial Thickness Settings

Epithelial Depth
45µm 50µm 55µm 60µm 65µm

StreamLight™ vs. SmartSurf[ACE]



WaveLight® StreamLight™

- Software indicates transition from PTK to PRK (visual and audible).
- Surgeon may pause to inspect surface for remnant epithelium.
- Surgeon may select length of pause to best suit their technique for Bowmans inspection.

Schwind SmartSurf[ACE]

- No software indication from PTK to PRK
- Strategic pause not possible
- Inspection of Bowmans surface not possible
- Software performs PRK profile, 1st

So in Conclusion…

- StreamLight is an intelligent , fast module of Trans-Epithelial PRK.
- It mends some classic shortcomings of the procedure.
- It provides faster surgery for the surgeon and speedier recovery for the patient avoiding long bare stroma time.
- The flip side is that it accentuates the importance of Epithelial mapping for proper surgical planning (Avanti or Artemis).
- Still not available with Premium profiles (Custom Q , Contoura).
- And it has a price tag (Cards!!).

Thank You