



# ...and the winner is: PRK, LASIK or SMILE ?

Omid Kermani MD, Köln  
Augenlinik am Neumarkt



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## Indications



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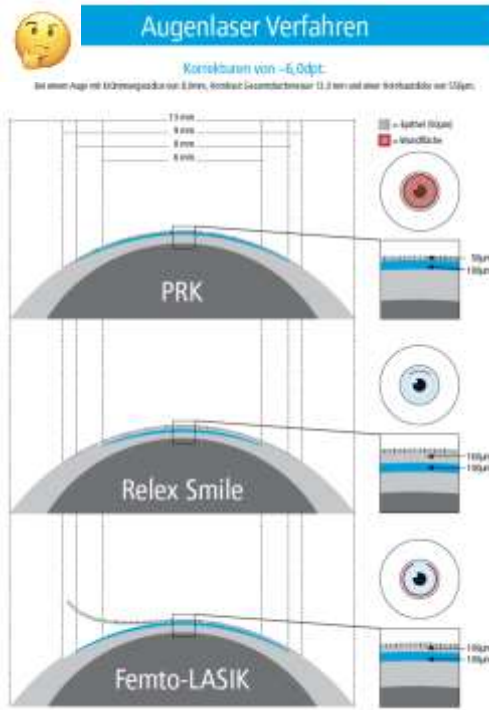
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Indications:

Myopia:  
-0,25D to -8,0D  
Astigmatism:  
6.0D

Myopia:  
-0,25D to -10,0D  
Astigmatism:  
6.0D  
Hyperopia  
+4,0D

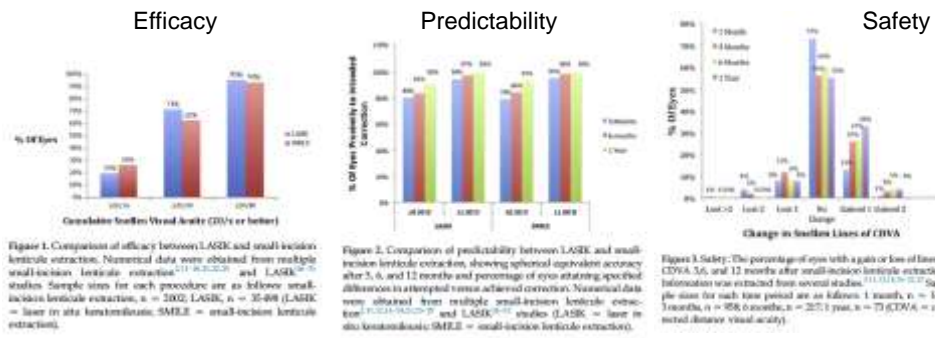
Myopia:  
-1,0D to -10,0D  
Astigmatism:  
6.0D



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# Clinical Results

# Meta-Analysis SMILE = LASIK

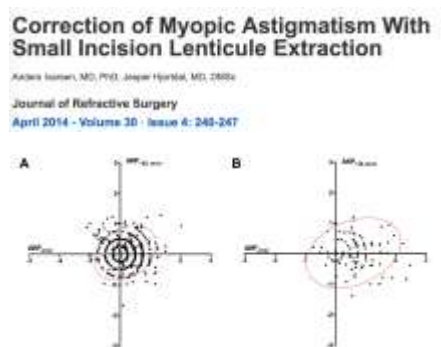


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# Correction Of Astigmatism

- SMILE (Zeiss VisuMax)
  - No torsion error control
  - No Iris tracking
  - No pupil centroid shift



- Signifikant undercorrection of refractive cylinder:
  - Astigmatismus < 2,50 D: 13% undercorrection per attempted D correction
  - Astigmatismus ≥ 2,50 dpt: 16% undercorrection per attempted D correction

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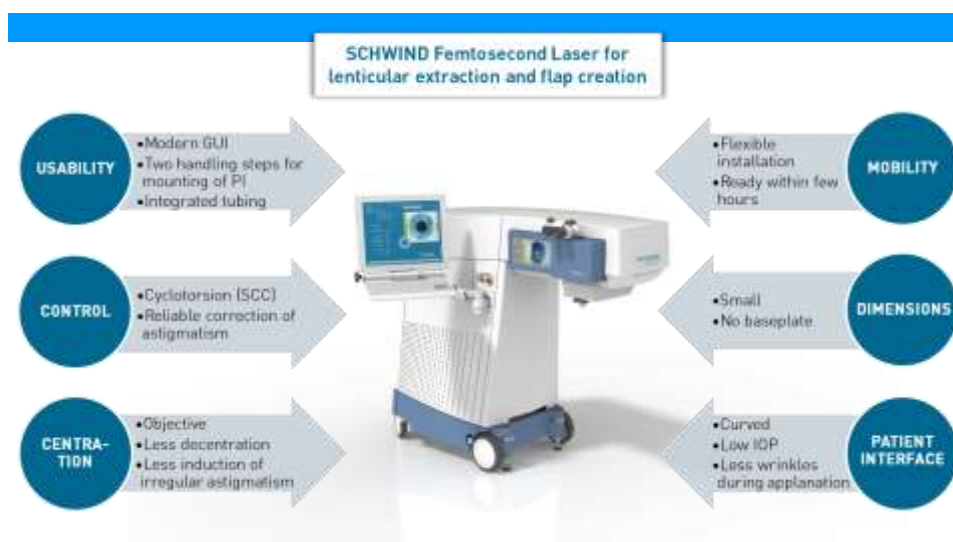
## New Kids On The Block



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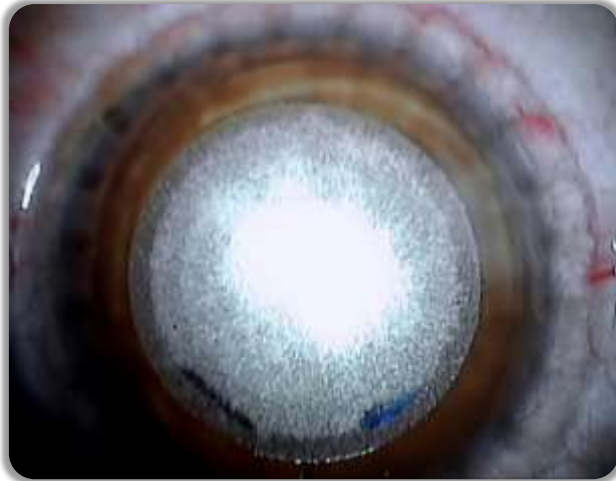
## SCHWIND Femtosecond Laser



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# First in Human Results (FiH)



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Courtesy of Schwind Germany

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## Complications



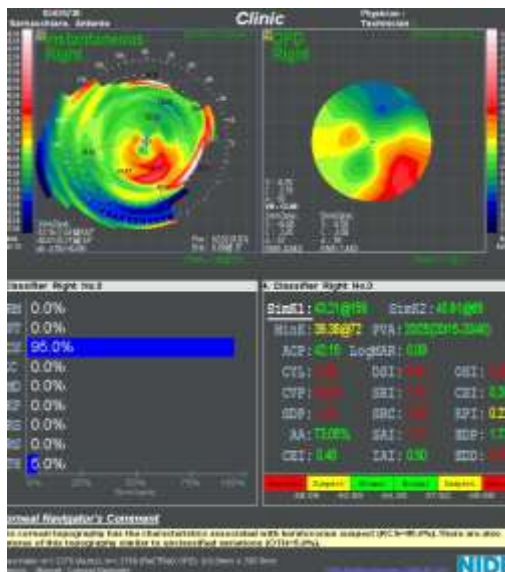
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# Post-LASIK Ectasia

- VA threatening
- Incidence 0,05 - 0,16%
- Days or years post-OP
- Therapy: CXL/ICR/PRK
- No restitutio ad integrum



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# Advantage SMILE

- Vertical cuts (LASIK) destabilize more than horizontal cuts (SMILE)
- Anterior stroma is the stronger than posterior stroma



Reinstein DZ et al. Small incision lenticule extraction (SMILE) history, fundamentals of a new refractive surgery technique and clinical outcomes. Eye Vis (Lond) 2014;1:3

# Disadvantage SMILE

Table 3. Differences of 12-month postoperative versus preoperative measurements  
 LASIK = laser-assisted in situ keratomileusis; SD = standard deviation; SMILE = small-incision lenticule extraction; Δ = 12-month postoperative versus preoperative

Parameter	Mean ± SD [Range]		P-value
	LASIK (n = 33)	SMILE (n = 63)	
<b>Δ Corneal volume (mm³)</b>			
3-mm diameter region	-0.42 ± 0.23 [-1.3 to 0.5]	0.48 ± 0.14 [0.7 to -0.3]	.020
5-mm diameter region	-0.99 ± 0.29 [-0.5 to 0.1]	-1.17 ± 0.39 [-1.7 to -0.6]	.003
7-mm diameter region	-1.61 ± 0.85 [-4.0 to 0.7]	-1.89 ± 0.96 [-2.9 to -0.8]	.009
10-mm diameter region	-1.90 ± 1.32 [-6.2 to 2.7]	-1.82 ± 1.10 [-4.2 to -0.7]	.884
<b>Δ Corneal thickness (µm)</b>			
Apex	-84.80 ± 30.65 [-136 to -32]	-75.62 ± 20.20 [-120 to -30]	.013
2-mm diameter region	-88.59 ± 35.15 [-149 to -28]	-89.57 ± 35.90 [-150 to -29]	.824
4-mm diameter region	-85.88 ± 24.32 [-132 to -39]	-82.85 ± 35.06 [-141 to -24]	.004
6-mm diameter region	-84.91 ± 15.21 [-107 to -62]	-83.79 ± 15.48 [-104 to -62]	.002
8-mm diameter region	-84.05 ± 11.83 [-97 to -70]	-82.55 ± 12.45 [-94 to -70]	.008

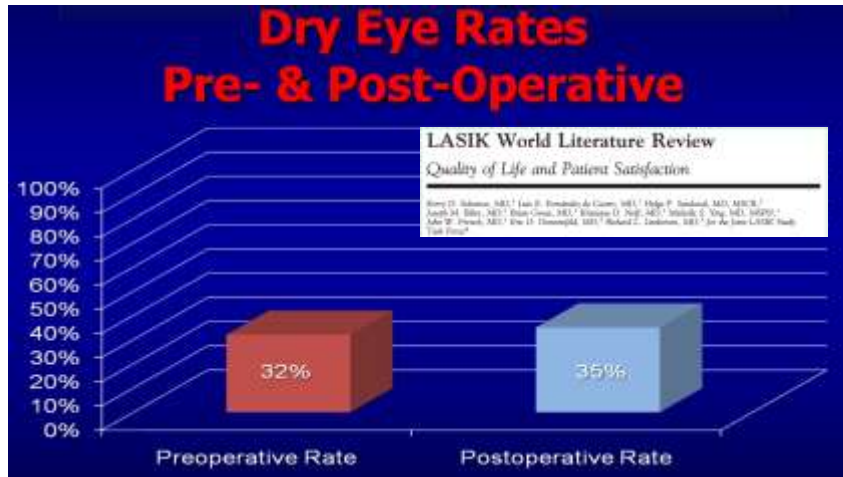
**Higher tissue consumption for SMILE compared to LASIK for the same given ametropia !**

17 Shajari M, Kolb CM, Mayer WJ, Vounotrypidis E, Steinwender G, Kohent T, Kook D. Comparison of changes in corneal volume and corneal thickness after myopia correction between LASIK and SMILE. Submitted for publication

# SMILE & Ectasia ?

**„Normal Corneal Topography“ 27% of Ectasia Cases**  
 Randlemann JB et al.: Risk assessment for ectasia after corneal refractive surgery. Ophthalmology 2008; 115:37-50

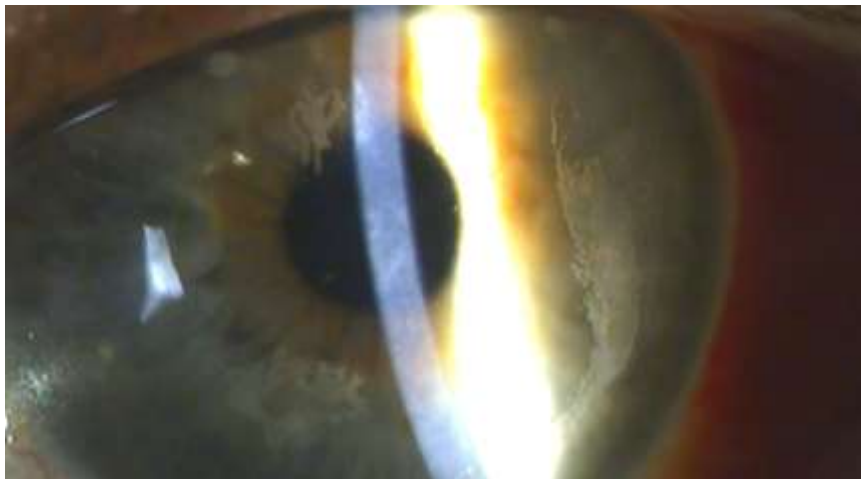
# LASIK & Trockenes Auge



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# Epithelial Ingrowth



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## Incidence & Risk Factors



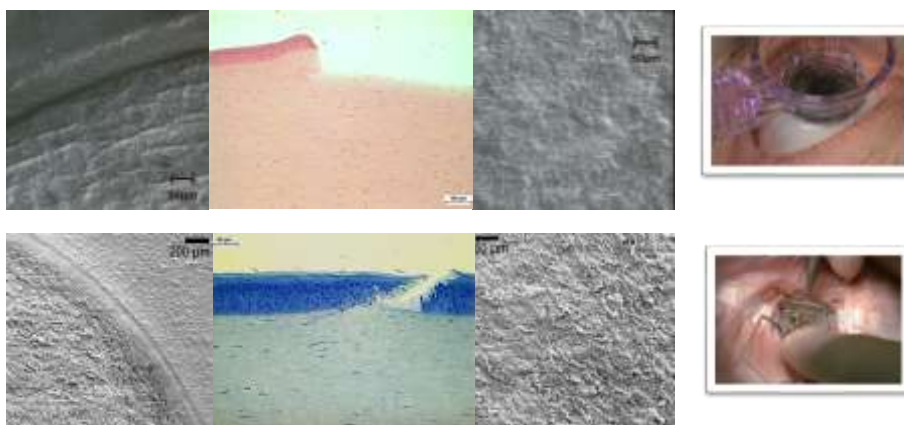
- Influence of original flap creation method on incidence of epithelial ingrowth after LASIK retreatment
  - Letko E, Price MO, Price FW Jr
  - Journal of Refractive Surgery (Thorofare, N.J. : 1995) [2009, 25(11):1039-1041]
    - 272 LASIK retreatments ( 4 years period)
    - 132 eyes MK-Flap & 140 eyes Femto-Flap
    - Epi ingrowth in MK-Flap: 6,1%
    - Epi ingrowth in Femto-Flap: 0,0%

## Flap geometry ?

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## Fs.-Laser vs. Mikrokeratom




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# SMILE

Capfolds



**Figure 2:** Two optical coherence tomography images of the lens and the cornea of a myopic normal healthy individual (SMILE). The arrows show the microdistortions in Bowman's layer that result from the capfolds.

ORIGINAL ARTICLE

## Microdistortions in Bowman's Layer Following Femtosecond Laser Small Incision Lenticule Extraction Observed by Fourier-Domain OCT

Peijun Yao, MD, PhD; Jing Zhao, MD; Meijun Li, MD; Yong Shen, MD; Zixian Dong, MD, PhD; Xingzao Zhou, MD, PhD

**ABSTRACT**

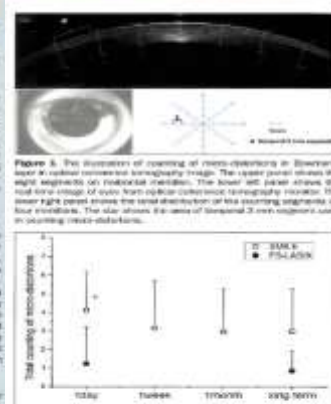
**PURPOSE:** To study microdistortions in Bowman's layer after femtosecond laser small incision lenticule extraction (SMILE) using Fourier-domain optical coherence tomography (OCT) and to investigate possible sources and potential visual effects.

**METHODS:** A nonrandomized, stratified prospective study enrolled 52 eyes of 26 consecutive patients undergoing SMILE with a mean age of 43.3 ± 3.84 years and 4.2 mm spherical refraction. The microdistortions in Bowman's layer were recorded at 3, 10, 1, and 1 month postoperatively and at long-term follow-up. Another 36 eyes of 20 patients undergoing femtosecond laser-assisted LASIK (FS-LASIK) were recruited at 1 day and long-term postoperatively as the control group.

**RESULTS:** Microdistortions in Bowman's layer were observed by OCT with an overall significant corneal shape under in vivo conditions in 10 eyes (38.5%) on day 1 after SMILE and in 10 eyes (43.1%) after FS-LASIK, with more in SMILE eyes than in FS-LASIK eyes. The number decreased at 1 week and then remained stable. There were more microdistortions in the center and than in the periphery in both groups. Microdistortions were more in the inferior than the superior quadrant in the cornea after SMILE but there was no difference at long-term follow-up. Microdistortions after SMILE were associated with the refractive lenticule thickness and surgical entry but had no significant impact on long-term visual outcomes or quality of vision.

**CONCLUSIONS:** Microdistortions in Bowman's layer after SMILE were associated with the refractive lenticule thickness and surgical entry. The microdistortions remained stable after 1 week and had no impact on long-term visual performance.

*J Refract Surg.* 2015;31(10):666-674.



**Figure 3:** The mean counting of microdistortions of each eye at different postoperative times. The error bar represents the standard deviation of the mean value of the group. The star shows the significant difference in counting of microdistortions between the 3 day and long-term points. SMILE = small incision lenticule extraction; FS-LASIK = femtosecond laser-assisted LASIK.

# Other Complications

## LASIK

- Buttonhole
- Irregular ablation
- DLK

## SMILE

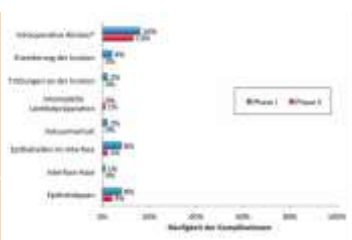
- Incomplete cut
- Incomplete lenticule
- DLK

**Erfahrung bei der Einführung von SMILE: Lernkurve der ersten 200 Behandlungen**

**Experience with Introduction of SMILE: Learning Phase of our First 200 Treatments**

**Autoren:** S. Tamer<sup>1,2</sup>, S. Kibar<sup>1</sup>, A. Boer<sup>1</sup>, S. Dalk<sup>1</sup>

**Wortwahl:** <sup>1</sup> Augenklinik am St. Paulus Hospital, Dresden | <sup>2</sup> Eye Institute (Energie, München | Augen-EMH, Ruhr-Universität Bochum | Medizinische Fakultät

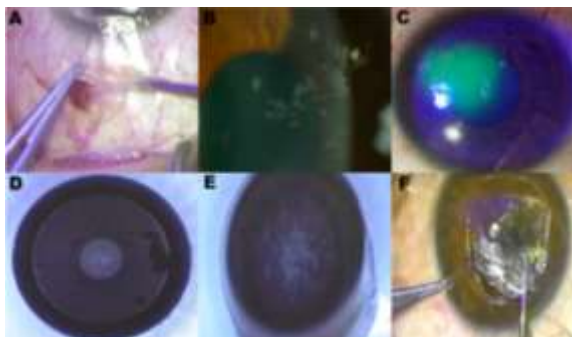


## SMILE: Flat Learning Curve



### Refractive Lenticule Extraction Complications

Atanas Rastvor-Miracle, MD; Tim Rastvor-Laguna, MD; Giuseppe Nanni, MD, PhD,  
and Zoran G. Chiriac-Horowitz, MD, PhD



Cornea • Volume 38, Number 10, October 2015

**TABLE 1.** Distribution of SMILE Complications

Complication, n (%)	n	%
Button loss	5	11.4
Cap rotation	7	16.3
Epithelial defect	14	31.9
Mask spin	4	9
Optic lenticle loss	7	15.7

**Complication rate: 26,9 % (43 of 160)**

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## Retreatments



### Femto LASIK

- PRK on top
- Flap lift
- Flap re-cut

### SMILE

- Excimer Laser necessary !
- Flap cut on cap
- PRK on top



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## What about PRK...is it out ?



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## 12 Month Refractive Results



### Analysis 1,12: Comparison 1 LASIK versus PRK, Outcome 12 Mean postoperative spherical equivalent at 12 months post-treatment.

Review: Laser-assisted in-situ keratomileusis (LASIK) versus photorefractive keratotomy (PRK) for myopia

Comparison: 1 LASIK versus PRK

Outcome: 12 Mean postoperative spherical equivalent at 12 months post-treatment

### Conclusion:

VA rehabilitation faster post LASIK and less pain/discomfort.  
However, after 12 months the results do not show significant differences !



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# PRK vs. RelEx smile

**Conclusion:**  
 Refractive results and recovery are similar.  
 Total HOA significantly higher after SMILE compared to PRK

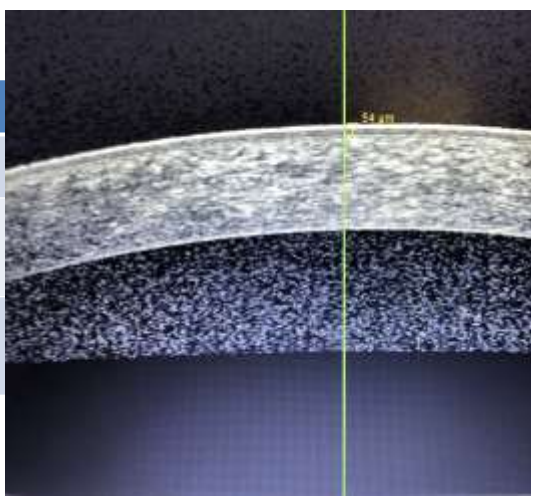
Rand  
 Controlled  
 One Eye PRK (n = 35)  
 One Eye SMILE (n = 35)  
 12 Monate

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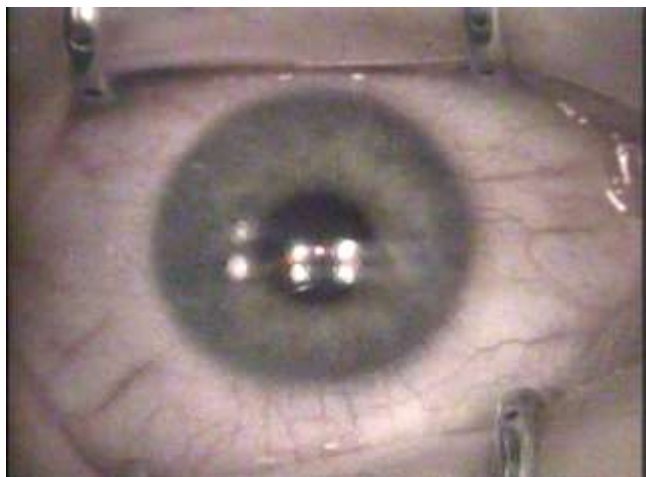


## TransPRK OZ and PTK Diameter

	Myopia	Myopic Astigmatism
(WFO) OZ	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
EPI Depth	45µm 50µm 55µm 60µm 65µm	45µm 50µm 55µm 60µm 65µm



## StreamLight® PRK By Wavelight



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## TransEpi PRK Advantages



- TouchFree
- Faster re-epithelialization
- Less pain and discomfort
- **On Top advantages:**
  - Flap & cap free (one procedure)
  - No flap associated complications
  - Less % Altered Tissue
  - Less Risk of Ectasia
  - Less cost of equipment

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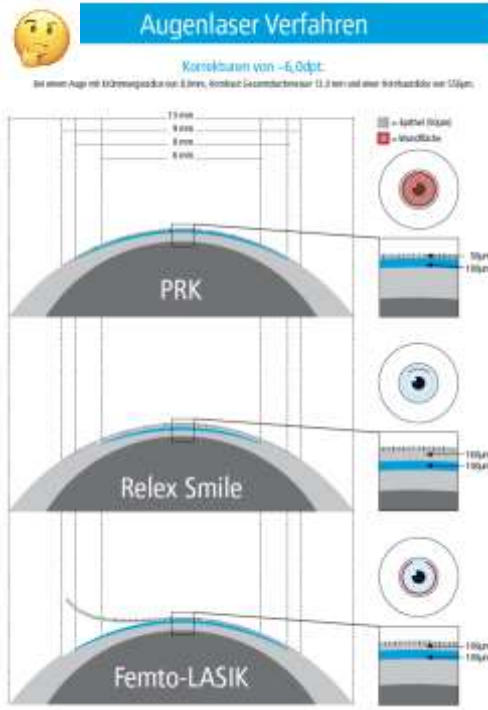


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Myopia:  
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Hyperopia  
+4,0D

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...and the winner is ?





