

# **SMILE**

**and**

## **Safe Corneal Thickness**

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- Corneal ectasia represents a reduction in biomechanical integrity below the threshold required to maintain corneal shape and curvature, resulting in interlamellar and interfibrillar biomechanical slippage analogous to naturally occurring keratoconus.

- When a patient undergoes LASIK, there can be an underlying worry about ectasia, but what about SMILE?.

- SMILE is believed to have less of a biomechanical impact on the integrity of the cornea than LASIK. *(Wang et al., 2014).*
- Although the theoretical risk of ectasia may be reduced after SMILE, it is not completely eliminated due to disruption of stroma that follows the surgery. *(Hafezi 2017).*

# Percent Tissue Altered (PTA) as a risk factor of postLASIK ectasia

**NEW CONCEPTS**

## Role of Percent Tissue Altered on Ectasia After LASIK in Eyes With Suspicious Topography

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**OBJECTIVE:** To evaluate the association between percent tissue altered (PTA) and the occurrence of ectasia in eyes with suspicious topography.

**DESIGN:** Retrospective analysis of 100 eyes with suspicious topography that underwent LASIK.

**SETTING:** A tertiary care eye center.

**PATIENTS:** 100 eyes with suspicious topography that underwent LASIK.

**MEASUREMENTS AND MAIN RESULTS:** The mean PTA was 1.2% (range 0.1-4.8%). The mean post-LASIK PTA was 1.2% (range 0.1-4.8%). The mean post-LASIK PTA was significantly higher than the pre-LASIK PTA ( $P < .001$ ). The mean post-LASIK PTA was significantly higher than the pre-LASIK PTA in eyes with suspicious topography ( $P < .001$ ). The mean post-LASIK PTA was significantly higher than the pre-LASIK PTA in eyes with suspicious topography ( $P < .001$ ).

**CONCLUSIONS:** PTA was significantly higher post-LASIK than pre-LASIK in eyes with suspicious topography.

**Clinical Update**

## REFRACTIVE SURGERY

### Easy Calculation Evaluates Post-LASIK Ectasia Risk

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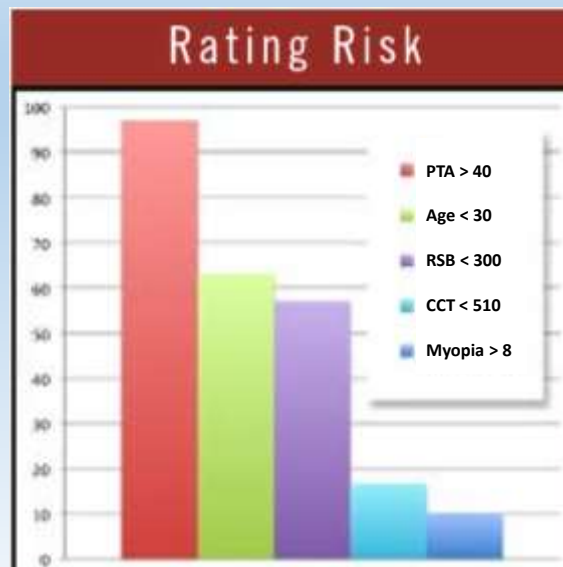
**Key Points:**

- PTA was significantly higher post-LASIK than pre-LASIK in eyes with suspicious topography.
- The mean post-LASIK PTA was significantly higher than the pre-LASIK PTA in eyes with suspicious topography ( $P < .001$ ).

**Conclusion:** PTA was significantly higher post-LASIK than pre-LASIK in eyes with suspicious topography.

## Percent Tissue Altered (PTA) as a risk factor of postLASIK ectasia. (Santhiago et al., 2015)

- This metric consist of an equation that calculates the proportion of the cornea that will be impacted by LASIK.
- The PTA is derived from:  $(FT + AD) \div CCT$ .
- PTA greater than 40% was the most significant independent variable associated with post-LASIK ectasia in eyes with normal corneal topography before surgery.



## **What about PTA in SMILE?**

- From conceptual basis, the amount of tissue altered in SMILE is less compared to that in LASIK, so the safety threshold for PTA in SMILE should be lower than that in LASIK.

- *Moshirfar and his colleagues in 2017* calculated the difference of disruption of the anterior corneal lamellae between these two procedures regarding the ratio of the vertical incisions and its effect. They theoretically interpreted that SMILE inducing 70% less disruption of anterior corneal lamellae than LASIK For myopic correction. Therefore, the ratio of SMILE/LASIK effect would be equal 0.3.

- They offered a **modified PTA (mPTA)** formula using the difference of the effect of the two procedures

$$\mathbf{mPTA = (S/L) \times CT + LT / CCT = 0.3 \times CT + LT / CCT.}$$

- *Moshirfar and his colleagues* applied this formula to four cases which have been reported in the literature.

- Seven eyes of these 4 cases developed Post SMILE ectasia, 5 eyes of them have preoperative subclinical Keratoconus and high Randleman ectasia risk score.

- The mean **mPTA** was found as 23% of the CCT.

- They believed that mPTA above this value is considered as a high risk.

- These value is very low. May be due to the abnormal preoperative topography of these eyes.

- If this value was applied to a case with **CCT** 550 $\mu$  and **CT** 110 $\mu$  the maximum available **LT** will be 95 $\mu$  that can not correct more than **SE** -7.5 D on 6 mm OZ !!!

**Table 2** Pachymetric analysis of SMILE lenticule and corneal thickness alteration

Case	Eye	Cap diameter (mm)	CT ( $\mu\text{m}$ )	Optical zone (mm)	Side cut incision angle (degrees)	Max LT ( $\mu\text{m}$ )	RSB (mm)	PTA (%)	mPTA (%)
Sachdev et al <sup>9</sup>	R	7.10	110	6.0	48	85	304	38	23
	L	7.10	110	6.0	48	82	305	37	22
Mattila and Holopainen <sup>16</sup>	R	NR	NR	NR	NR	50 <sup>a</sup>	357 <sup>a</sup>	32	16
	L	NR	NR	NR	NR	50 <sup>a</sup>	389 <sup>a</sup>	30	15
El-Naggar <sup>17</sup>	R	NR	NR	NR	NR	54 <sup>a</sup>	307 <sup>a</sup>	36	19
	L	NR	NR	NR	NR	59 <sup>a</sup>	303 <sup>a</sup>	37	20
Wang et al <sup>18</sup>	R	7.60	120	6.6	53	137	289 <sup>a</sup>	47	32
	L	7.60	120	6.6	53	134	288 <sup>a</sup>	47	31

(Moshirfar et al., 2017)

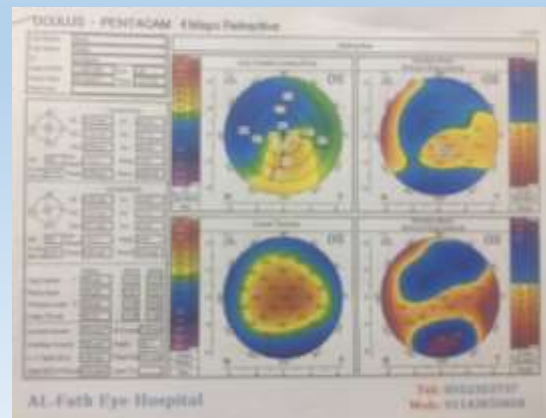
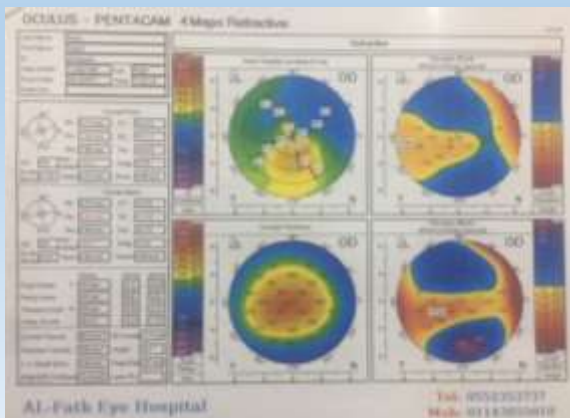
**Table 1** Patient characteristics

Case	Age	Sex	Eye	Preoperative CCT ( $\mu\text{m}$ )	Preoperative refraction	MRSE (D)	Preoperative CDVA	Postoperative ectasia	Preoperative anterior Km (D)	Preoperative topography	Randleman ectasia risk score
Sachdev et al <sup>9</sup>	26	M	R	511	-3.75-1.50x180	-4.5	20/20	No	44.9 (max)	Normal	Low (1)
			L	513	-3.50-1.50x165	-4.25	20/20	Yes	45.1 (max)	Normal	Low (1)
Mattila and Holopainen <sup>16</sup>	24	M	R	527	-2.00-0.50x170	-2.25	20/12.5	Yes	NR	SK	High (6)
			L	559	-1.50-1.50x173	-2.25	20/12.5	Yes	NR	SK	Low (2)
El-Naggar <sup>17</sup>	33	M	R	481	-2.00-1.00x65	-2.5	20/15	Yes	40.4/41.6	Normal	High (4)
			L	482	-2.25-1.25x105	-2.87 $\frac{1}{2}$	20/15	Yes	40.8/41.4	MK	High (4)
Wang et al <sup>18</sup>	19	M	R	546	-6.75-1.00x45	-7.25	20/20	Yes	41.7/42.4	SK	High (8)
			L	542	-6.75-0.75x140	-7.125	20/20	Yes	41.5/43.0	SK	High (8)

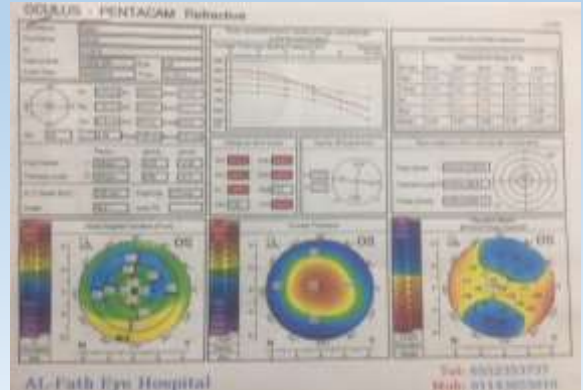
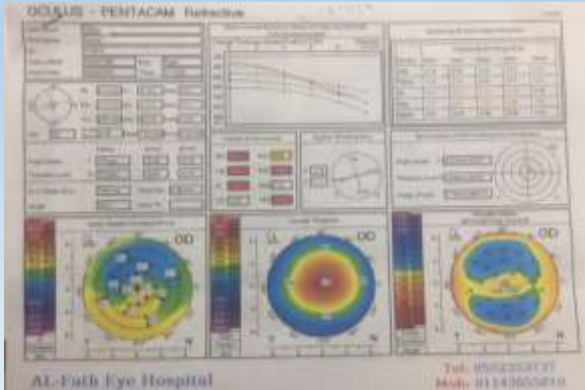
**Abbreviations:** CCT, central corneal thickness; MRSE, manifest refraction spherical equivalent; CDVA, corrected distance visual acuity; Km, keratometry; M, male; R, right; L, left; NR, not reported; SK, subclinical keratoconus; MK, mild keratoconus.

(Moshirfar et al., 2017)

- On observing more than one thousand eyes that had undergone SMILE surgery with normal preoperative corneal topography at our center within the last 3 years, only 4 eyes (2 cases) have been reported that they developed post-SMILE ectasia.
- Analysis of their pachymetric measurements revealed that the mean **mPTA** of the 4 eyes was 30.9%







### Pachymetry and mPTA

Case	Eye	CCT	CT	LT ( $\mu$ )	RSB ( $\mu$ )	mPTA (%)
Case 1	Rt	540	110	135	295	31.1
	Lt	522	110	129	283	31.0
Case 2	Rt	528	100	137	291	31.6
	Lt	519	100	128	291	30.4

- The most probable cause of the ectasia for these 4 eyes was the relatively thick extracted lenticule and the high mPTA value as well.
- Based on this observation, if we believed in the **mPTA** formula as a risk factor for post-SMILE ectasia, the correct value for the patients with normal preoperative corneal topography must be considered as **30%** of their central corneal thickness.



**For safe corneal thickness after SMILE surgery**

**mPTA Should not exceeds 30% of the CCT**

**THANK YOU**  
for your attention