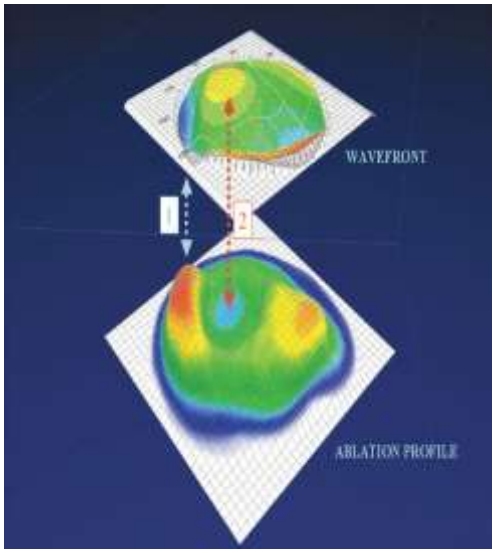
Wavefront-guided Ablations



BY
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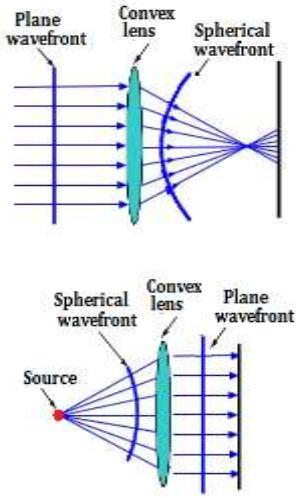
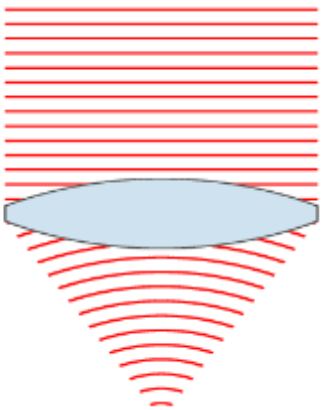
Sohag University

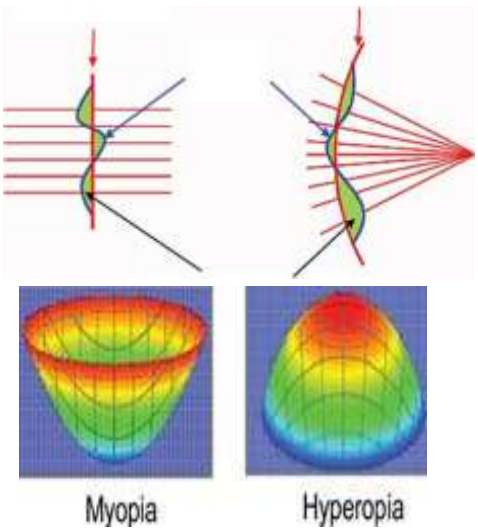
No Conflict of interest

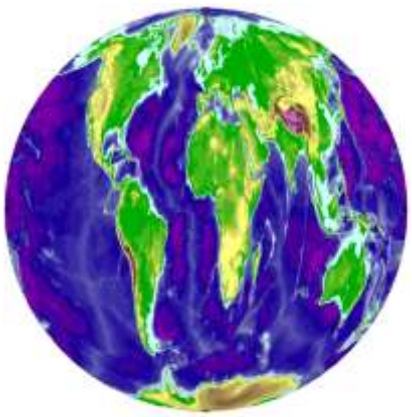
What is the wavefront?



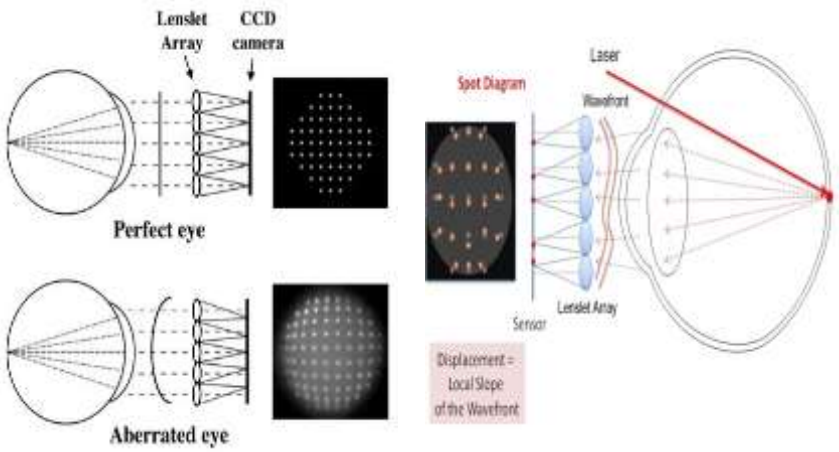


Wavefront aberration



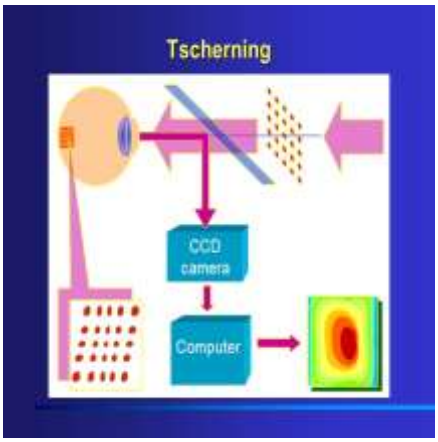


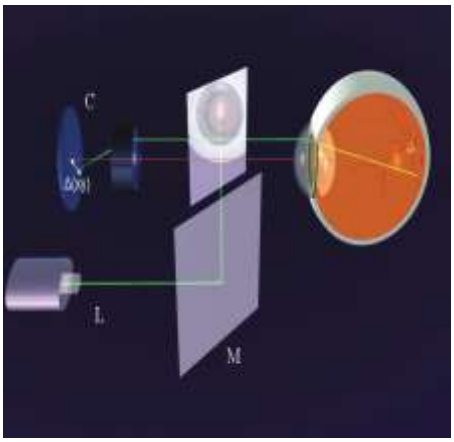
Measurement of wavefront aberration (Aberrometry)



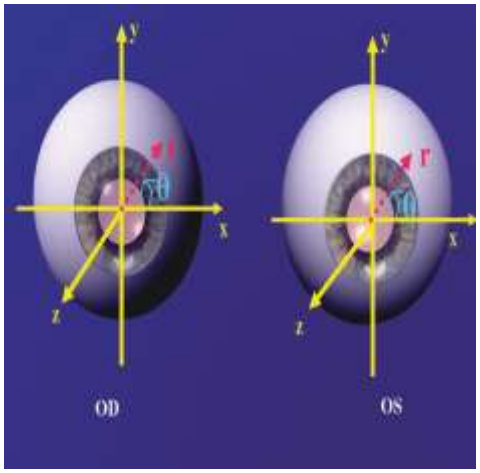
Hartman-shack aberrometer

Other aberrometers

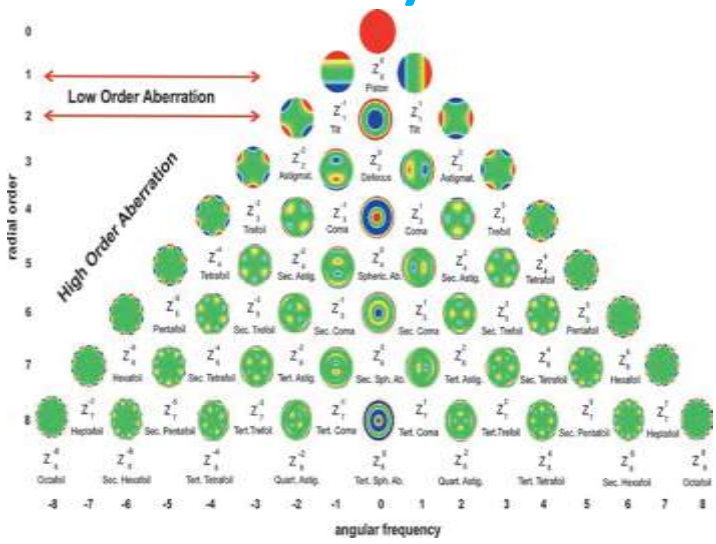




Mathematical description



Zernike Polynomials

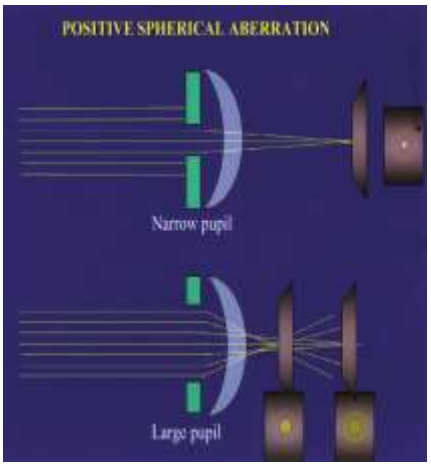


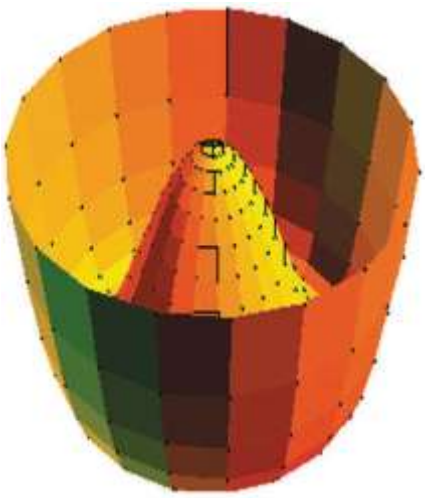
High order aberrations

(Irregular Astigmatism)

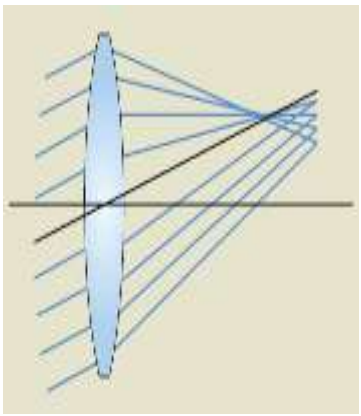
HOA may decrease the quality of vision and cause symptoms in up to 15% of the general population

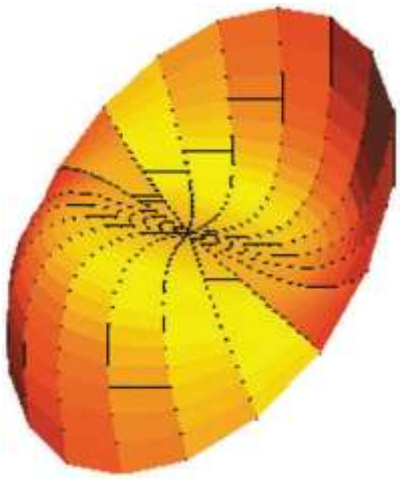
Spherical aberration



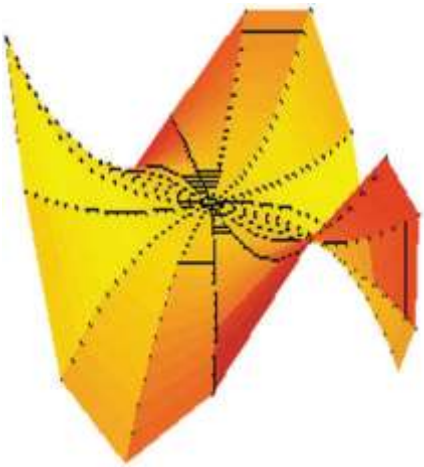


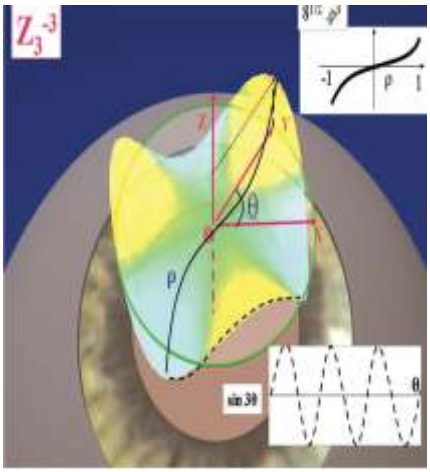
Coma





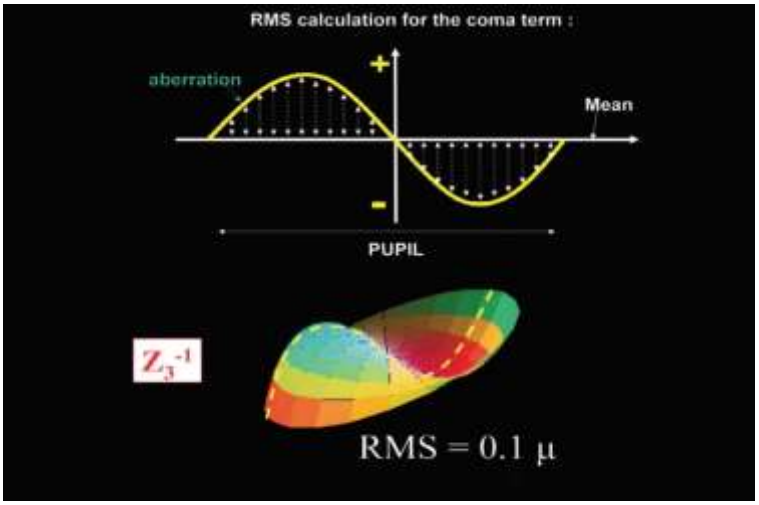
Trefoil



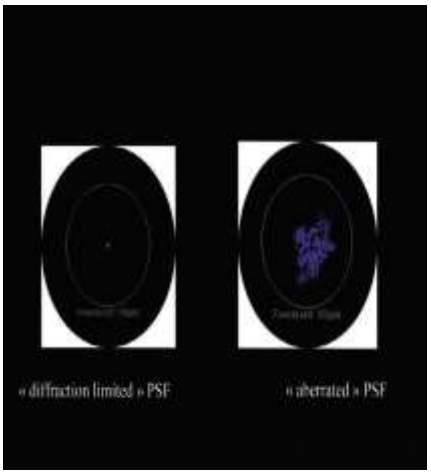


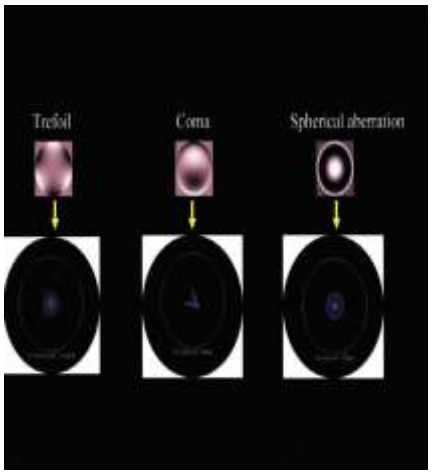
Measurement metrics

1- Root mean square (RMS)

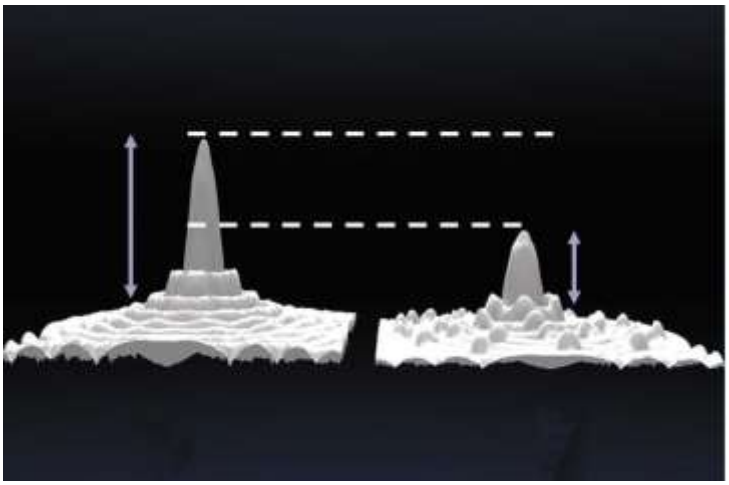


2-Point spread function (PSF)

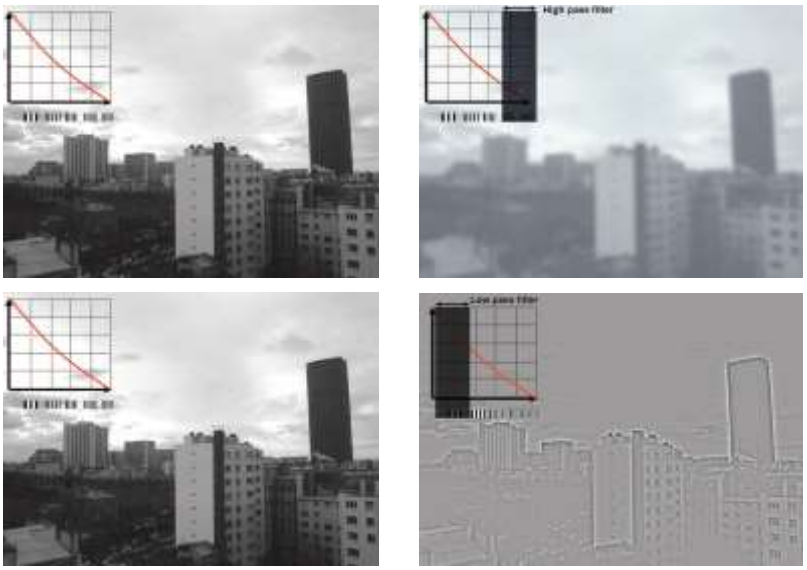




3- Strehl Ratio



4-Modualtion transfer function (MTF)



5-Zernike coefficients

Polar Zernike Coeffs(μ) at Ap. Diam: 4.00mm All Order Aberrations Graph

	Value	Coefficient Name	0.0 2.31382	Axis
Z_{20}	-2.31382	Defocus		
Z_{22}	1.04944 @ 56°	Astigmatism		
Z_{31}	0.07090 @ 312°	Coma		
Z_{33}	0.02708 @ 67°	Trefoil		
Z_{40}	-0.02659	Sph. Aberration		
Z_{42}	0.01275 @ 148°	Astig. 2nd Order		
Z_{44}	0.01113 @ 38°	Tetrafoil		
Z_{51}	0.00183 @ 15°			
Z_{53}	0.00115 @ 118°			
Z_{55}	0.00298 @ 42°			
Z_{60}	0.00182			
Z_{62}	0.00098 @ 44°			
Z_{64}	0.00104 @ 61°			
Z_{66}	0.00160 @ 7°			

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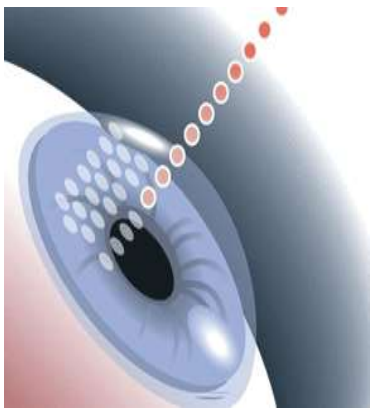
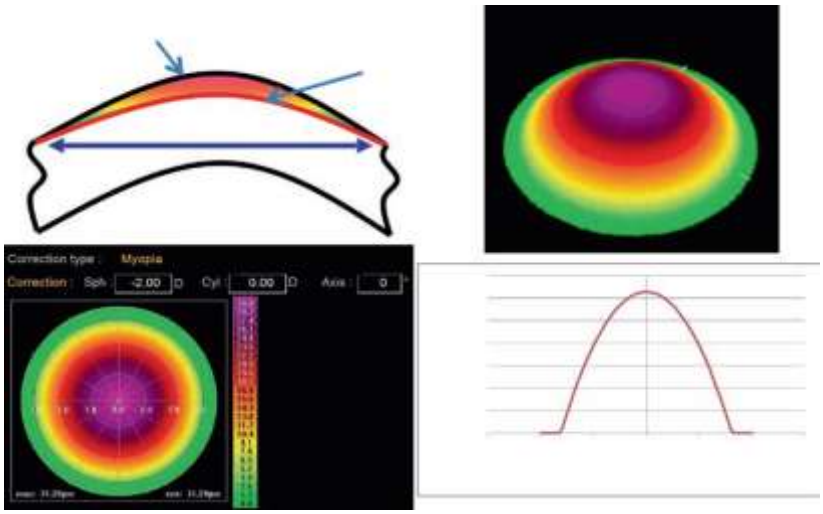
Types of ablation

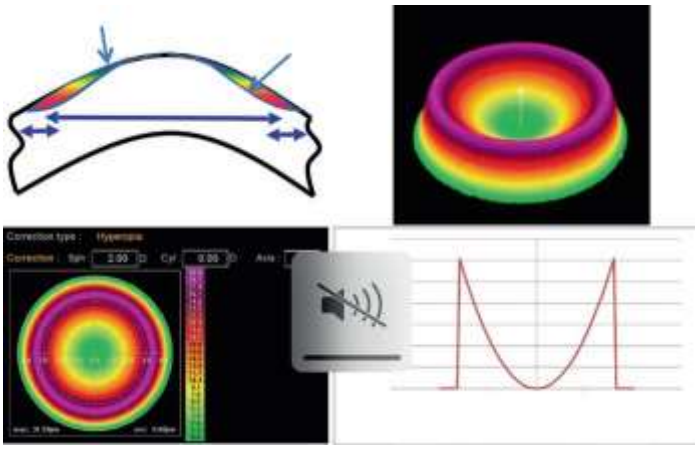
- Conventional
- Wavefront optimized
- Aspheric Q-adapted
- Wavefront guided
- Topography guided



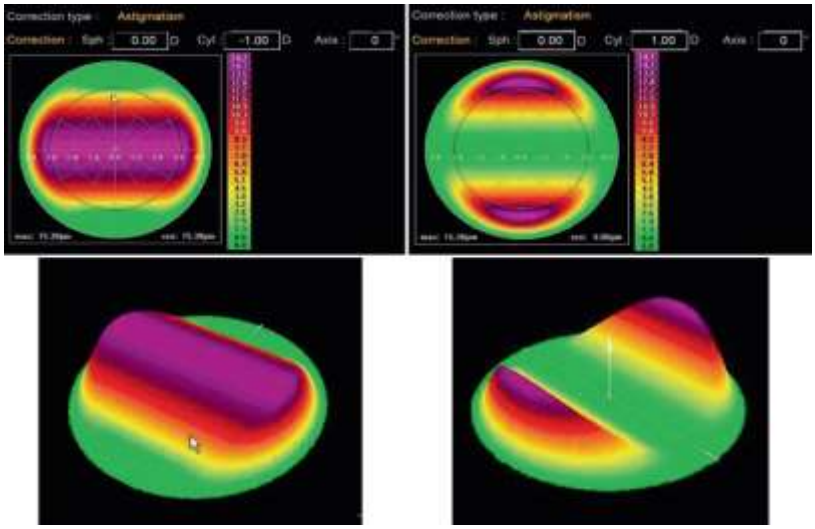
Conventional myopic ablation



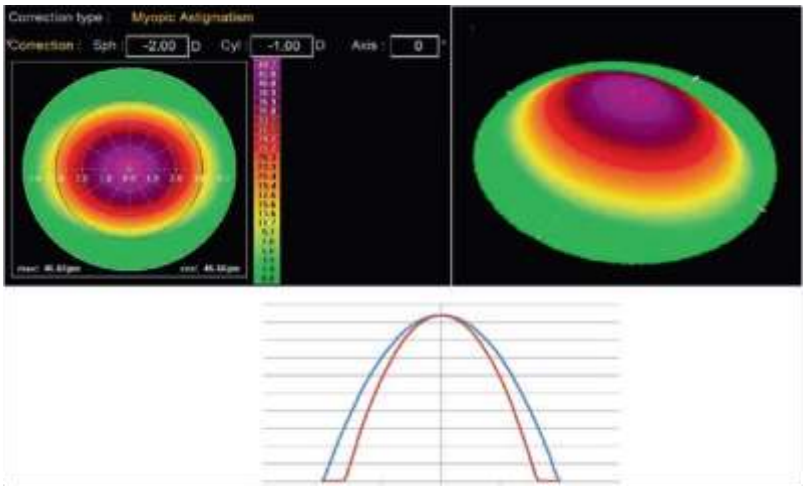
Conventional hyperopic ablation



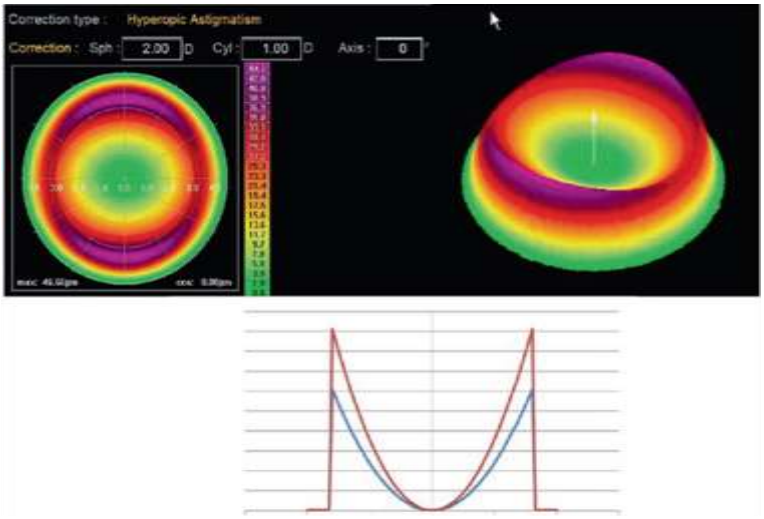
Conventional astigmatic ablation



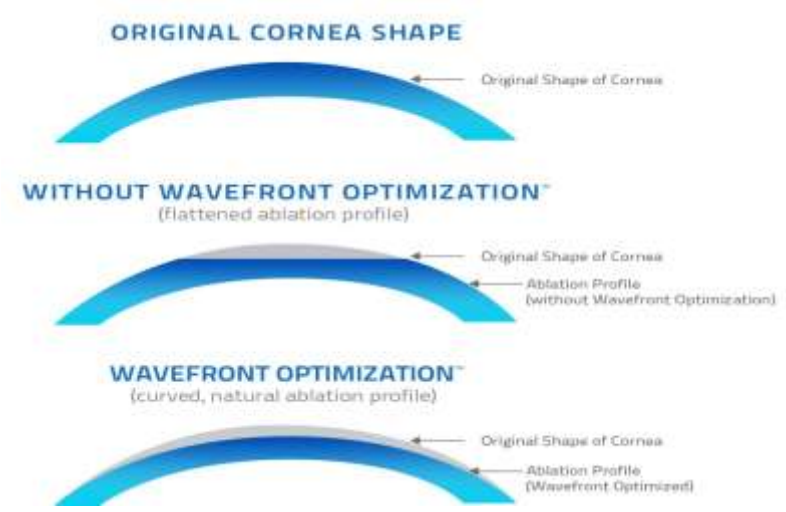
Conventional myopia + astigmatism



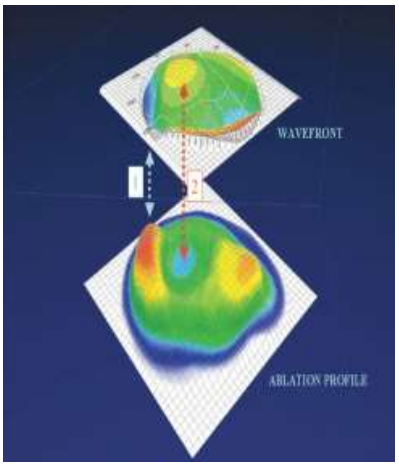
Conventional hyperopia + astigmatism



Wavefront-optimized ablation



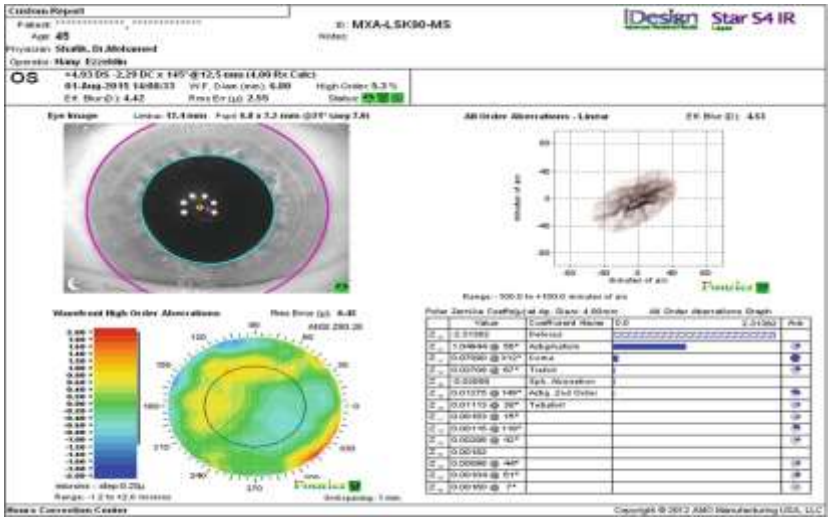
Wavefront-guided ablation



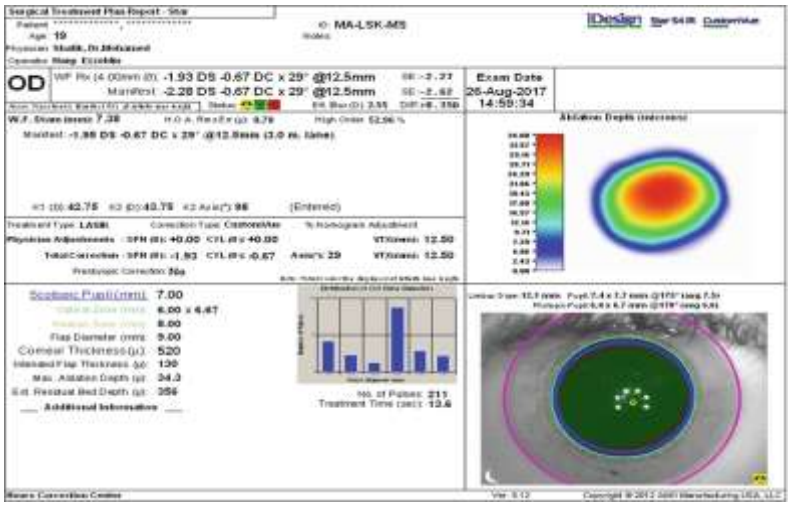
Wavefront platforms

Manufacturer	Laser system	Aberrometer	Principle
Alcon	Allegretto wave-eye-Q	Wavelight	Tscherning
VISX	Star S4	iDesign	Hartmann–Shack
Bausch & Lomb	Technolas	Zywave	Hartmann–Shack
Nidek	EC-5000 CX III	OPD scan	Dynamic skiascopy
Tracey Technologie		Itrace	Ray tracing

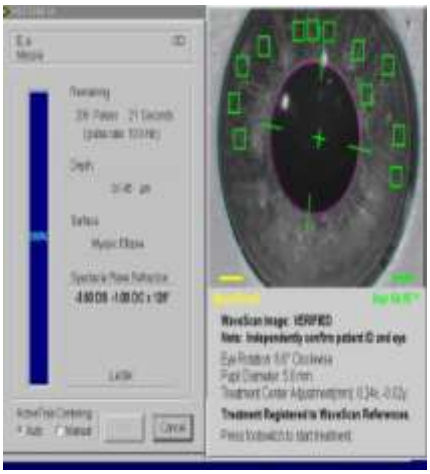
iDesign wavefront sensor

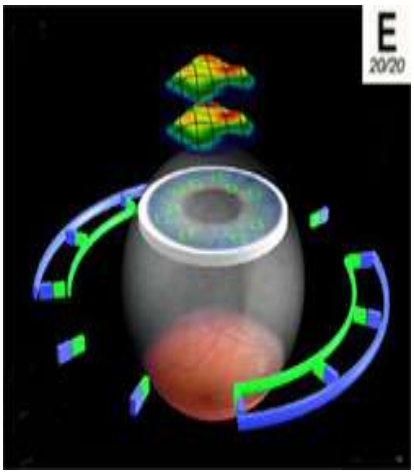


iDesign ablation profile



Iris registration





Indications and contraindications

- Patients with large amount of HOA
- Patients with wide pupils
- Night activity e.g. driving
- Retreatments
- Mild cross-linked keratoconus
- Small Pupil
- Marked difference between wavefront and manifest refraction
- Abnormal ocular surface
- Highly aberrated wavefront
- Relatively thin cornea
- Very high expectations

Take home message

- Wavefront-guided ablation still shows superiority over conventional treatment profiles despite falling short of the high expectations of super-vision promised by earlier studies.

Thank you