Conventional refractive surgery such as LASIK or PRK only treats lower order aberrations like defocus (myopia, hyperopia) and astigmatism. It is well known that there is the potential to induce higher order aberrations of 3\textsuperscript{rd}, 4\textsuperscript{th} or 5\textsuperscript{th} order. Custom corneal ablation can treat lower order aberrations, but it also has the potential to resolve higher order aberrations, such as coma, trefoil and others.

Custom corneal ablation is a combination of two components:
- Aspheric ablation – to preserve the prolate shape of the cornea and to decrease the risk for induced spherical aberrations and night symptoms of glare and halos.
- Multipoint ablation – using a 1 mm spot to treat an irregularity component.

Custom ablation is divided into 2 modalities of optional treatments:
- Wavefront-guided (OPD) that can be with or without multipoint ablation.
- Topography guided
  - OATz (Optimized Aspheric Treatment Zone) to treat with aspheric ablation only
  - CATz (Customized Aspheric Treatment Zone) to treat with aspheric ablation as in OATz but with multipoint ablation for the irregularity component.

The Nidek NAVEX platform has the ability to diagnose, analyze, and to perform custom ablation. There are 3 components:

1) The Nidek OPD-scan for diagnosis and mapping. It is a time-based wavefront sensor using a dynamic skiascopy principle. In 0.4 seconds, it can perform auto-skiascopy, auto-topography, auto-keratometry and auto-aberrotometry. Root mean square (RMS) is the value in microns used to represent the higher order aberrations (HOA).

2) The final fit software (FFS) imports the data from the OPD-scan, and generates the ablation algorithms for the EC-CX Excimer laser.

3) The EC-5000 Cx excimer laser performs the treatment.

Custom corneal ablation may be performed for primary cases or for enhancement treatments. Criteria that a refractive surgeon should consider for performing custom ablations are:
• primary laser refractive surgery patient with higher order aberrations (RMS >0.5 \( \mu \)m)
• previous refractive surgery patient with induced higher order aberration
• clinically significant visual symptoms of glare or halos that reduce visual quality
• sufficient residual corneal tissue to perform the ablation

Two clinical cases will be presented. The first case is custom ablation for primary LASIK using the topography CATz mode, and the second case is custom ablation for primary LASIK using the topography OATz mode.

**OATz Patient Example LR**

A 32-year-old female presented for bilateral primary LASIK surgery. Her preoperative manifest refraction was –2.50 -0.25 x 145 right eye, and –2.75 in the left. The best-corrected vision was 20/15 OU. A preoperative patient vision satisfaction questionnaire revealed the patient had night vision difficulties, but otherwise was relatively satisfied. In normal light, her pupil diameters measured 6.5mm and 8.5 mm in dim light. Preoperative contrast sensitivity was within normal range. The RMS preoperatively was 0.333 \( \mu \)m OD and 0.106 \( \mu \)m OS. The patient underwent uneventful LASIK surgery with aspheric ablation (OATz) utilizing a 5.0 mm primary treatment zone, a 6.5 mm sub optical zone and a 9.0 mm transition zone. At 5 weeks postoperatively, she measured 0.00 -0.25 x 155 right eye and plano-spherical in the left eye, with an uncorrected vision of 20/15 OU. Contrast sensitivity showed slight improvement in both eyes. The RMS postoperatively was 0.221 \( \mu \)m OD and 0.197 \( \mu \)m OS (Fig. 1a, b). The postoperative patient vision satisfaction questionnaire revealed total resolution of the patient’s nighttime visual symptoms and complete satisfaction with the surgery.

![Preoperative OPD Scan](image1.png)  ![Post-op OPD Scan](image2.png)
CATz Patient example SC

A 30-year-old female presented for bilateral primary LASIK surgery. Her preoperative manifest refraction was –3.00 -1.00 x 25 right eye and –3.00 -1.00 x 167 in the left. The best-corrected vision was 20/15\(^{-1}\) OU. A preoperative patient vision satisfaction questionnaire revealed the patient had moderate concerns with night vision difficulties, including glare and halos. In normal light, her pupil diameters measured 3.5 and 6.5 mm in dim light. Preoperative contrast sensitivity was within normal range. The RMS preoperatively was 0.415 \(\mu m\) OD and 0.395 \(\mu m\) OS. The patient underwent uneventful LASIK surgery with aspheric ablation (CATz) utilizing a 6.0 mm treatment zone and a 9.0 mm transition zone. At 2 months postoperatively, her refraction was -0.25 -0.25 x 30 in the right eye and 0.25 -0.25 x 175 in the left eye. Her best uncorrected vision was 20/15\(^{-1}\) OU. Contrast sensitivity showed slight improvement in both eyes. The RMS postoperatively was 0.185 \(\mu m\) OD and 0.467 \(\mu m\) OS (Fig. 2a, b). The postoperative patient vision satisfaction questionnaire revealed total resolution of the patient’s nighttime visual symptoms and complete satisfaction with the surgery.

Summry

The NAVEX platform is a promising treatment modality for performing custom corneal ablation. Custom ablation can be chosen for selected primary and enhancement cases. In the future this modality may be considered for correcting other corneal problems like irregular astigmatism after cataract surgery.

Future studies will clarify which patients may benefit most from custom corneal ablation.