

SMILE VERSUS LASIK: A COMPARISON OF FUNCTIONAL OPTICAL ZONES



Does the difference in optical zones have a significant effect on quality of vision?

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COMPARATIVE STUDY OF FUNCTIONAL OPTICAL ZONE: SMALL INCISION LENTICULE EXTRACTION VERSUS FEMTOSECOND LASER ASSISTED EXCIMER LASER KERATOMILEUSIS

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Industry support: None

ABSTRACT SUMMARY

A retrospective case series compared the size of the functional optical zones (FOZs) after SMILE and femtosecond laser-assisted LASIK (FS-LASIK) for the treatment of myopia (range, -0.50 to -8.00 D; -5.22 ± 1.59 D) and myopic astigmatism (range, 0 to -3.00 D; -0.87 ± 0.69 D).

The SMILE and FS-LASIK treatment arms comprised 63 patients (123 eyes) and 70 patients (139 eyes), respectively. FOZ size was measured with the Pentacam (Oculus Optikgeräte) before and 3 months after surgery to determine the achieved FOZ (AFOZ), which was defined as the largest ring diameter when the total corneal refractive power was 0.50 D or less than the refractive power at the central 4 mm of the cornea.

When a 6.5-mm FOZ was planned, the AFOZ at 3 months postoperatively was 1.45 ± 0.27 and 1.67 ± 0.25 mm smaller than the preoperative FOZ in the SMILE and

LASIK groups, respectively. The AFOZ was significantly larger ($P < .001$) with SMILE than LASIK. FOZ variation was negatively correlated with preoperative spherical equivalent (SE) and positively correlated with variations in mean keratometry values, spherical aberration (SA), and Q values (all $P < .001$) in both groups. At 3 months, the SMILE group had better UCVA than the FS-LASIK group ($P = .002$). No significant difference ($P = .988$) in BCVA was found between the groups.

DISCUSSION

Quality of vision (QOV) is highest at the central cornea and decreases toward the periphery owing to

increased SA. This so-called periphery effect is more pronounced after myopic refractive surgery because SA increases at the margin of the treated area. Adequate AFOZ size can improve QOV.

The FOZ is the area of the corneal surface that provides functional vision, features the lowest amount of aberrations, and provides the best QOV at the central cornea.² OZ size is the only modifiable parameter that determines the patient's postoperative visual outcome. Theoretically, the postoperative and planned FOZs should be similar. As the study by Song et al demonstrates,¹ however, the AFOZ is smaller than expected

STUDY IN BRIEF

- A retrospective case series found that the functional optical zones (FOZs) achieved with both SMILE and femtosecond laser-assisted LASIK for the treatment of myopia and myopic astigmatism were smaller than the planned FOZs. When the planned FOZ was the same for both procedures, a larger FOZ was achieved with SMILE.

WHY IT MATTERS

The study findings can help guide the treatment of eyes with pupils that are larger than the FOZ after SMILE or LASIK for myopia or myopic astigmatism. The goal is to improve patients' functional vision under mesopic conditions and lessen glare and halos.

regardless of whether there is a transition zone. The reduced FOZ size may be associated with changes in corneal curvature, wound healing, and/or altered corneal biomechanics.³

The edges of the SMILE ablation area tend to be sharp, so laser energy is not lost during cutting of the peripheral area. In contrast, excimer laser intrastromal ablation during FS-LASIK transmits more energy to the adjacent tissue, leading to a stronger wound healing response. The relatively

low amount of laser energy applied during SMILE can effectively mitigate a stromal remodeling effect and postoperative corneal inflammation, which may partially explain the larger AFOZ observed in the SMILE group.^{1,3,4}

In the study by Song et al,¹ the variations in Q values and SA appeared to be positively correlated with the extent of FOZ reduction. A more spheroidal postoperative corneal shape would result in a larger SA increment and a smaller FOZ. SMILE

had less impact on the anterior cornea than FS-LASIK surgery, which might account for the larger AFOZ observed in the SMILE group. The patients treated with SMILE also had lower Q and SA values, better QOV, and better postoperative UCVA than those who underwent FS-LASIK. In addition, a higher preoperative SE was associated with a smaller postoperative FOZ; multiple linear regression showed that preoperative SE negatively influenced AFOZ in the SMILE group.

PROSPECTIVE, RANDOMIZED, CONTRALATERAL EYE COMPARISON OF FUNCTIONAL OPTICAL ZONE, AND VISUAL QUALITY AFTER SMILE AND FS-LASIK FOR HIGH MYOPIA

He S, Luo Y, Chen P, et al⁵

Industry support: None

ABSTRACT SUMMARY

A prospective, randomized, paired-eye study compared FOZs and QOV after SMILE and FS-LASIK. Investigators randomly assigned 46 patients with high myopia (> -6.00 D) to undergo SMILE in one eye and FS-LASIK in the contralateral eye. FOZs, decentration, wavefront aberrations, contrast sensitivity, and patient-reported QOV were evaluated.

Postoperative visual and refractive outcomes were similar between groups. At 6 months, 91% of SMILE eyes and 96% of FS-LASIK eyes had an uncorrected distance visual acuity of 20/20 or better. The FOZ was larger after SMILE than FS-LASIK (5.62 ± 0.31 vs -0.78 ± 0.25 mm). Total decentration was greater with SMILE (0.29 ± 0.14 vs 0.22 ± 0.11 mm), and the induced change in SA was less with this procedure. Contrast sensitivity under mesopic conditions was better in eyes that underwent SMILE versus FS-LASIK. There was no significant difference in QOV scores between groups.

STUDY IN BRIEF

- ▶ A prospective, randomized, paired-eye study found that differences in the functional optical zone (FOZ) and decentration did not significantly affect quality of vision after SMILE or femtosecond laser-assisted LASIK for the treatment of high myopia. The FOZ was larger and decentration greater in SMILE eyes.

WHY IT MATTERS

Earlier studies compared patients rather than contralateral eyes. Understanding differences in FOZs and quality of vision with SMILE versus femtosecond laser-assisted LASIK could influence surgeons' choice of treatment for patients with high myopia.

The differences in FOZ size and decentration between groups had little effect on visual outcomes.

DISCUSSION

SMILE created a larger FOZ and greater decentration than FS-LASIK. No significant differences were observed from 1 week to 6 months after either procedure, suggesting a stable postoperative FOZ.⁶ Central corneal thickness was greater after SMILE, indicating that the procedure removed less tissue than FS-LASIK, but no relationship was found between central corneal thickness and FOZ.

More energy is lost in the peripheral zone during FS-LASIK because of the perpendicular ablation. During

SMILE, laser energy is released more uniformly in the peripheral zone.⁷ This could account for the larger FOZ observed after SMILE in this study.⁵

Decentration induces higher-order aberrations (HOAs) that can lead to visual disturbances (eg, halos, glare) and poor visual outcomes. He et al found that vertical decentration had a positive correlation with vertical coma, root mean square coma, and total HOAs in SMILE eyes.⁵ No correlation was observed in the FS-LASIK eyes. Decentration greater than 0.30 mm induced more total HOAs and coma. The amount of decentration in both study groups was less than 0.30 mm. Differences in coma and total HOAs between groups were not significant.

Fewer induced SA changes were found in SMILE eyes, perhaps related to the larger FOZ. The induction of SA can extend depth of focus and improve intermediate visual acuity. Larger FOZs reduce the risk of undercorrection in patients with high myopia.^{8,9}

Compared to FS-LASIK, SMILE created a larger FOZ and greater decentration when the same FOZ was planned for the treatment of myopia. The objective and subjective visual symptoms patients experienced after SMILE and FS-LASIK were similar. ■

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