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Small-Incision Lenticule Extraction

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Keywords

• SMILE • LASIK • Refractive • Efficacy • Safety • Predictability • Complications

Key points

- Small-incision lenticule extraction (SMILE) is comparable with LASIK in regard to efficacy, predictability, and safety, while having a reduced side effect profile.
- The procedure consists of the creation of a corneal lenticule with a femtosecond laser with manual removal of that lenticule for the correction of myopia with or without mild cylindrical error.
- The procedure is shown to cause less postoperative inflammation, transect fewer corneal nerves, and preserve the biomechanical structure of the anterior cornea compared with LASIK.
- Complications are similar to other refractive surgeries; however, unique complications to the procedure include retained lenticule fragments, incisional edge tears, and corneal cap perforation.
- Future applications include the preservation of lenticules for purposes of corneal patching and for subsequent implantation in the treatment of hyperopia with or without mild cylindrical error.

Video content accompanies this article at http://www.advancesinophthalmology.com.

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INTRODUCTION

Small-incision lenticule extraction (SMILE) is a recent addition to surgical applications of the femtosecond laser for the correction of refractive errors. This article examines its advantages, constraints, difficulties, and future use. The effectiveness, predictability, and safety of SMILE has been shown to be comparable with those of laser in situ keratomileusis (LASIK). Over time, the inherent benefits of SMILE have become more apparent. Risks associated with flap formation are avoided, postoperative inflammation is comparably lower, and the ocular surface integrity of the eye is better preserved, leading to fewer symptoms of dry eye. Eyes undergoing the SMILE procedure have shown a reduced incidence of postoperative corneal denervation, a reduced incidence of higher-order aberrations (HOA), and a quickened rate of corneal nerve recuperation relative to LASIK.

The femtosecond laser has superseded the mechanical microkeratome as the instrument of choice in the creation of corneal flaps during refractive surgery. With the initial integration of the femtosecond laser in LASIK procedures, investigations concerning the laser's potential to perform keratomileusis without flap creation also were conducted.

Early investigations with the femtosecond lenticule extraction (Carl Zeiss Meditec AG, Jena, Germany) and SMILE (Carl Zeiss Meditec AG) have shown promising outcomes in treating patients with myopia with or without mild to moderate astigmatic error [1,2]. By creating a small peripheral corneal incision, SMILE eliminates the need for a corneal flap, making this a far less invasive alternative to femtosecond lenticule extraction and LASIK for the correction of myopia. The initial SMILE treatments performed by Sekundo and colleagues [2] as early as 2008 used two opposing 5.0-mm incisions at the 12-o'clock and 6-o'clock positions. With experience and knowledge gained from repetition, the shift from a bi-incisional to a monoincisional approach with a simultaneous decrease in incision size to 2.0 mm came to fruition [3]. The advantages of creating an incision rather than a corneal flap include a potential improvement in corneal biomechanical stability and the preservation of corneal nerve integrity [4].

This discussion, which is largely adapted from the investigative work of Moshirfar and colleagues [5], includes the applicability, relevant patient concerns, efficacy, safety, and postoperative elements in relation to SMILE. Although the characteristics of this procedure are the principle focus, other femtosecond lenticule extraction procedures and descriptions are examined to add comparative context.

SIGNIFICANCE

SMILE is accomplished by making four incisions to create an intrastromal lenticule using a femtosecond laser platform. A single corneal incision that extends to the anterior surface of the intrastromal lenticule also is created (Fig. 1, Video 1) [5]. Although up to three peripheral corneal incisions are made, SMILE typically is performed by extracting the lenticule through one 2.0-mm to 5.0-mm incision,