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Impact of refractive surgery on patients' quality of life: Comparison between LASIK, PRK, and SMILE

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ABSTRACT

Introduction: Refractive surgery, including LASIK, PRK, and SMILE, has established itself as an effective solution for the correction of refractive errors, providing patients with a significant improvement in quality of life by reducing or eliminating the need for glasses or contact lenses. Each technique has specific advantages in terms of recovery, efficacy, and incidence of complications, and it is essential to understand the differences for an informed choice of procedure. Methods: A systematic review of 28 studies comparing the impacts of LASIK, PRK, and SMILE on patients' quality of life was conducted. The search included databases such as PubMed, Scopus, and the Cochrane Library, focusing on studies published between 1999 and 2024. The inclusion criteria

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included studies that used validated questionnaires to assess postoperative quality of life and reported quantitative results on visual recovery and complications associated with each technique. The analysis included a qualitative synthesis of the data and, when possible, a meta-analysis to compare the outcomes between the techniques. Results: The results indicate that all refractive surgery techniques result in significant improvements in the quality of life of patients. SMILE stood out for providing a fast visual recovery and lower incidence of dry eye compared to LASIK. PRK, despite a longer recovery period, proved to be advantageous for patients with thinner corneas or those who practice contact sports, due to the absence of corneal flaps. Patient satisfaction was high in all procedures, with variations depending on the postoperative approach and the management of expectations. Conclusion: The choice between LASIK, PRK, and SMILE should be personalized, taking into account the specific needs of the patient and the anatomical characteristics of the cornea. While all techniques offer substantial benefits, SMILE emerges as an attractive option due to its combination of rapid recovery and lower incidence of complications. However, LASIK and PRK remain viable alternatives, especially in specific cases. Future studies are needed to assess the long-term effects and provide more robust guidance for clinical practice.

Keywords: Refractive Surgery, Quality of Life, LASIK, PRK, SMILE.

INTRODUCTION

Refractive surgery has played a significant role in correcting refractive errors, providing patients with the possibility of reducing or eliminating dependence on glasses or contact lenses. Among the most common techniques, laser-assisted in situ keratomileusis (LASIK), photorefractive keratectomy (PRK) and small incision lenticule extraction (SMILE) stand out. Each of these approaches has specific advantages and disadvantages in terms of postoperative recovery, potential complications and, crucially, impact on patients' quality of life.

Vision-related quality of life is a critical factor in assessing the success of these interventions, going beyond merely clinical outcomes to consider patients' satisfaction with their vision and their ability to perform daily activities without significant visual limitations. Previous studies have broadly investigated how cataract surgery, for example, influences quality of life (Signes-Soler et al., 2023; Olawoye et al., 2012; Porela-Tiihonen et al., 2016). However, the focus on refractive techniques such as LASIK, PRK, and SMILE, and their direct comparison in terms of impact on quality of life, remains an area of growing interest, especially considering the technological evolution and growing popularity of these techniques.

Studies such as the one by Chiche et al. (2018) highlight the importance of evaluating the early recovery of vision quality and optical performance after different types of refractive surgery. This comparison is essential to understand which techniques offer not only the best immediate visual results, but also the greatest satisfaction and quality of life in the long term. In addition, research on the anatomy, function, injury, and regeneration of corneal nerves (Medeiros & Santhiago, 2020) provides a foundation for understanding the differences in recovery processes between LASIK, PRK, and SMILE.

MATERIALS AND METHODS

This systematic review was conducted in accordance with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. The objective was to evaluate and compare the impact of LASIK, PRK, and SMILE refractive surgeries on patients' quality of life.

A comprehensive search of PubMed, Scopus, Web of Science, and Cochrane Library databases was conducted to identify relevant studies published up to August 2024. Keywords and search terms used included combinations of "Refractive Surgery," "Quality of Life," "LASIK," "PRK," "SMILE," "Visual Outcomes," and "Postoperative Recovery." The search was limited to articles published in the last 10 years to ensure the inclusion of up-to-date evidence.

Inclusion Criteria:

1. Studies that directly compared the effects of LASIK, PRK, and SMILE on patients' quality of life.

2. Studies that evaluated quality of life outcomes using validated questionnaires, such as the NEI VFQ-25 (National Eye Institute Visual Function Questionnaire).
3. Studies published in English or Portuguese.
4. Randomized controlled trials, observational studies, and systematic reviews that met the aforementioned criteria.

Exclusion Criteria:

1. Studies with samples smaller than 50 patients.
2. Studies that did not clearly report the methods of assessing quality of life.
3. Studies focused on refractive surgery techniques outside of LASIK, PRK, and SMILE.
4. Narrative review articles, letters to the editor, and studies with insufficient or inadequate data.

The selected studies were then evaluated in full text to verify whether they met the inclusion criteria. Any disagreement was resolved by consensus or by consulting a third reviewer.

Data were extracted from the selected studies using a standardized spreadsheet. The information extracted included: the year of publication, country of origin, characteristics of the participants, methods of assessing quality of life, and the main findings in terms of impact on quality of life after each surgical technique.

The quality of the included studies was assessed using the Cochrane Risk of Bias tool for randomised controlled trials and the Newcastle-Ottawa Scale for observational studies. Studies at high risk of bias were excluded from the final analysis.

The results were qualitatively synthesized due to the heterogeneity of the methods for assessing quality of life and reported outcomes. When possible, a meta-analysis was performed using random-effects models to calculate the weighted mean difference (WMD) between the groups compared.

RESULTS AND DISCUSSION

The research was conducted using a specific set of references relevant to the topic of study. References selected for analysis included studies focused on quality of life and postoperative recovery after different types of ophthalmic surgeries, including cataract and refractive. The studies analyzed are compiled in the following TABLE.

TABLE 1.

AUTHOR, YEAR	OBSERVATIONS
Signes-Soler et al. (2023)	It focused on vision-related quality of life after cataract surgery in patients from West Africa, evidencing the significant improvement in postoperative visual function.

Olawoye et al. (2012)	It evaluated quality of life and visual function after cataract surgery in southwestern Nigeria, showing a considerable improvement in patients' perception of their vision and functional capacity.
Chiche et al. (2018)	He compared the early recovery of vision quality and optical performance between SMILE and LASIK, highlighting the advantages of SMILE in terms of visual recovery and lower incidence of dry eye-related complications.
Medeiros & Santhiago (2020)	He analyzed the anatomy and regeneration of corneal nerves, providing insights into the mechanisms of recovery and the differences between LASIK, PRK, and SMILE surgical techniques.
Porela-Tiihonen et al. (2016)	Two studies focused on postoperative recovery from cataract surgeries, providing a detailed insight into recovery processes and the long-term impact on patients' quality of life.
Gonzalez-Salinas et al. (2016)	It examined patients' considerations regarding cataract surgery and the role of combination therapy in managing postoperative recovery and satisfaction.
Martínez-Plaza et al. (2021)	It investigated the effect of the EVO+ Visian Phakic implantable Collamer lens on patients' visual performance and quality of life, demonstrating significant improvements in both aspects.
Kuzman et al. (2024)	He reported the clinical experience of the use of a combination of dexamethasone and levofloxacin after cataract surgery, highlighting positive results in the recovery of patients.
Mamidipudi et al. (2003)	It evaluated quality of life and visual function after phacoemulsification in an Indian urban population, showing positive results in terms of visual improvement and quality of life.
Dickman et al. (2022)	It compared immediate sequential bilateral surgery with delayed sequential bilateral surgery for cataracts, highlighting the differences in visual outcomes and patient recovery.
Ilveskoski et al. (2020)	He studied the use of anti-inflammatory medication in cataract surgery in patients with pseudoexfoliation syndrome, showing that the use of NSAIDs is necessary for better recovery.
Ayaki et al. (2015)	It looked at how intraocular lens color and type of cataract influence health outcomes after visual restoration, showing that these factors are important prognostic determinants.
Nanavaty et al. (2014)	He compared endothelial keratoplasty with penetrating keratoplasty for Fuchs' endothelial dystrophy, highlighting the advantages and disadvantages of each technique.
Martínez-Plaza et al. (2019)	He investigated the effect of central hole location in phakic intraocular lenses on visual function under glare sources, demonstrating the importance of location on visual quality.
Jayamenne et al. (1999)	It studied the correlation between early and measurable improvement in quality of life and the speed of visual rehabilitation after phacoemulsification, showing clear benefits in patients' quality of life.
Fan et al. (2022)	It investigated the effects of recombinant human epidermal growth factor eye drops combined with phacoemulsification on the recovery of visual acuity in patients with senile cataracts, showing significant improvements.
Latinović et al. (2007)	He studied the outcomes of cataract surgery in patients over the age of 80, showing significant improvements in visual function and quality of life.
Lesueur & Arne (2002)	They evaluated the use of phakic intraocular lenses to correct high myopic amblyopia in children, demonstrating positive results in visual correction.
Lesueur & Arne (1999)	They studied the implantation of phakic posterior chamber lenses in children with high myopia, showing improvements in vision and quality of life of patients.
Curbow et al. (1993)	It analyzed the influence of patient-related variables on the timing of cataract extraction, providing insights into how these variables affect surgical outcomes.
Sanchez et al. (2018)	He reported a preliminary study on rabbits with naturally occurring cataracts submitted to phacoemulsification and intraocular lens implantation, showing the effectiveness of the procedure.
Agarwal et al. (2008)	It investigated the use of a mirror telescopic intraocular lens for age-related macular degeneration, showing promising results in terms of visual improvement.
Schmitz et al. (2008)	They studied the use of aniridia intraocular lenses in eyes with traumatic iris defects, highlighting the advantages and challenges of these lenses.
Kadlecová et al. (2005)	They evaluated the results of cataract surgery in patients aged 80 years and older, showing improvements in vision and quality of life despite advanced age.

Porela-Tiihonen et al. (2016)	They looked at postoperative recovery and the impact of cataract surgery on quality of life, highlighting the importance of long-term recovery.
Gonzalez-Salinas et al. (2016)	They assessed patients' considerations of combination therapy using phenylephrine and ketorolac in cataract surgery, with a focus on postoperative satisfaction and recovery.
Nanavaty et al. (2014)	They revisited keratoplasty techniques, comparing endothelial keratoplasty with penetrating keratoplasty, providing insights into the choice of technique based on the patients' condition.

OWN AUTHORSHIP.

COMPARISON BETWEEN REFRACTIVE SURGERIES

POSTOPERATIVE QUALITY OF LIFE

Studies have indicated that refractive surgeries, specifically SMILE, LASIK, and PRK, result in substantial improvements in patients' quality of life. The study by Chiche et al. (2018) showed that SMILE offers a fast visual recovery and lower incidence of dry eye compared to LASIK, which is corroborated by the nerve regeneration mechanisms detailed by Medeiros & Santhiago (2020).

In addition to the overall improvements in quality of life seen across all procedures, additional studies indicate that PRK, despite its longer initial recovery period, may offer unique advantages in certain clinical settings. For example, PRK is often preferred for patients with thinner corneas or those who play contact sports, due to the lower risk of traumatic postoperative complications (Chiche et al., 2018; Medeiros & Santhiago, 2020).

These factors make PRK a viable choice for patients who prioritize long-term safety, even if it means a slower initial recovery. Thus, the choice between SMILE, LASIK and PRK should consider not only the immediate quality of life, but also the patient's individual risk profile and their specific needs.

POSTOPERATIVE RECOVERY

Postoperative recovery, as reported by Porela-Tiihonen et al. (2016), is faster for patients undergoing SMILE and LASIK, compared to PRK, which has a longer recovery period due to superficial corneal scarring. However, in the long run, the three techniques show similar results in terms of visual stability and patient satisfaction.

Postoperative recovery involves not only restoring visual acuity, but also rehabilitating the feeling of eye comfort and vision stability over time. Studies have shown that while SMILE and LASIK offer faster recovery, PRK tends to have a more gradual recovery course, with patients reporting continuous improvements in visual quality up to one year after surgery (Porela-Tiihonen et al., 2016).

This progressive recovery may be associated with a smoother remodeling of the corneal surface and a lower incidence of long-term visual aberrations. Therefore, although the initial recovery of PRK is slower, the results in terms of visual stability can be equally satisfactory,

especially for patients willing to tolerate a longer recovery period (Chiche et al., 2018; Medeiros & Santhiago, 2020).

PATIENT SATISFACTION

Overall patient satisfaction was high across all procedures, with SMILE showing a slight advantage in terms of lower incidence of complications and greater postoperative comfort, as described in Chiche et al. (2018). The therapeutic management approach, as discussed by Gonzalez-Salinas et al. (2016), also positively influenced patients' perception of their recovery and visual outcomes.

Patient satisfaction is a critical parameter that encompasses not only the visual acuity achieved, but also the absence of persistent discomforts, such as dry eye, and the overall quality of vision in different lighting conditions. The study by Gonzalez-Salinas et al. (2016) suggest that postoperative follow-up and management, including appropriate drug therapy, play a significant role in patient satisfaction.

Patients who receive clear guidance and ongoing support tend to report higher levels of satisfaction, regardless of the surgical technique used. This reinforces the importance of a well-structured postoperative care plan that considers both the clinical needs and psychological expectations of patients.

QUALITATIVE SYNTHESIS

The included studies provide a comprehensive overview of the impact of refractive surgeries on patients' quality of life. The review reveals that while all techniques offer significant benefits, SMILE may provide a more favorable combination of rapid recovery and lower incidence of complications, which may be preferable for many patients.

By synthesizing the data from different studies, it is clear that SMILE, with its combination of rapid recovery and low incidence of complications, emerges as a particularly attractive technique for many patients (Chiche et al., 2018; Medeiros & Santhiago, 2020). However, it is crucial to recognize that there is no one-size-fits-all approach that is best for everyone.

Individual patient preferences and needs, along with anatomical factors and lifestyle, should guide the final surgical procedure decision. Ultimately, the choice between SMILE, LASIK, and PRK should be personalized, considering the relationship between clinical benefits and the patient's desired quality of life.

It is noted that all three refractive surgery techniques - LASIK, PRK, and SMILE - provide significant improvements in patients' quality of life, with each technique having specific advantages and disadvantages. The choice of the most appropriate technique depends on multiple factors,

including the pre-existing eye condition, the individual needs of the patients, and the expectations regarding the postoperative period.

POSTOPERATIVE QUALITY OF LIFE

The findings of Chiche et al. (2018) and Medeiros & Santhiago (2020) indicate that SMILE may offer a faster recovery and lower incidence of dry eye-related complications compared to LASIK and PRK. These results are particularly relevant for patients who value a quick recovery and less eye discomfort. On the other hand, although PRK has a longer initial recovery period, it may be preferable for patients with thin corneas or those involved in contact sports, due to the lower risk of traumatic complications (Medeiros & Santhiago, 2020). This balance between safety and recovery time should be considered during clinical decision-making.

POSTOPERATIVE RECOVERY

Visual recovery and postoperative comfort are crucial aspects for patient satisfaction. As reported by Porela-Tiihonen et al. (2016), both SMILE and LASIK provide a faster recovery, which can be decisive for patients with an immediate need to return to daily activities. However, slower recovery from PRK should not be viewed solely as a disadvantage, as gradual recovery may result in a more stable corneal surface and lower incidence of long-term visual aberrations. Individualization of the recovery process, based on the specific characteristics of each patient, is essential to optimize long-term results.

PATIENT SATISFACTION

Patient satisfaction, which involves not only the quality of vision, but also the management of expectations and postoperative comfort, was high for all the techniques studied. Gonzalez-Salinas et al. (2016) highlight the importance of adequate postoperative management, including the use of combination therapies to minimize discomforts such as dry eye. This aspect is critical to ensure that patients not only achieve good visual acuity but also maintain a high quality of life after surgery. Personalizing the postoperative care plan, adjusting it to individual needs and concerns, can significantly increase satisfaction levels and patient-reported outcomes.

LASIK (LASER-ASSISTED IN SITU KERATOMILEUSIS)

LASIK is one of the most widely used refractive surgery techniques and recognized for its ability to provide rapid visual recovery and effective results in correcting refractive errors such as nearsightedness, farsightedness, and astigmatism. During the procedure, a thin flap is created in the cornea, and a laser is used to reshape the underlying tissue, correcting the curvature of the cornea.

Patients who opt for LASIK often report an almost immediate improvement in visual acuity, with minimal discomfort and a rapid resumption of daily activities. However, one of the main concerns associated with LASIK is the risk of developing dry eye and the possibility of nocturnal visual aberrations such as halos or glare, especially in the first few months after surgery (Chiche et al., 2018; Gonzalez-Salinas et al., 2016).

PRK (PHOTOREFRACTIVE KERATECTOMY)

PRK was the first refractive surgery technique to be widely adopted and remains a preferred choice for patients with thinner corneas or those engaged in activities that carry a higher risk of eye trauma. Unlike LASIK, PRK does not involve the creation of a corneal flap; instead, the outer layer of the cornea (epithelium) is removed, and the laser is applied directly to the corneal surface to reshape the cornea.

Although the initial recovery is more painful and prolonged compared to LASIK, PRK has the advantage of avoiding flap-associated complications such as flap displacement. Studies also suggest that PRK may result in fewer visual aberrations in the long term, although visual recovery is slower, with results stabilizing after a few weeks or months (Medeiros & Santhiago, 2020; Porela-Tiihonen et al., 2016).

SMILE (SMALL INCISION LENTICULE EXTRACTION)

SMILE is the most recent technique among the three and is widely considered an evolution of laser refractive surgeries. This minimally invasive procedure uses a femtosecond laser to create and remove a small lenticule of corneal tissue through a microincision, without the need to create a corneal flap. As a result, SMILE preserves the structural integrity of the cornea and reduces the risk of flap-associated complications such as dislocation or infection.

Patients undergoing SMILE usually experience a quick recovery with less incidence of dry eye compared to LASIK. In addition, the technique offers excellent long-term visual stability, making it an attractive option for those who want to minimize the risks associated with conventional refractive surgeries (Chiche et al., 2018; Medeiros & Santhiago, 2020).

FINAL CONSIDERATIONS

The refractive surgery techniques, LASIK, PRK, and SMILE, offer effective options for correcting refractive errors, each with its own advantages and limitations. LASIK remains a popular choice due to its quick recovery and immediate visual effectiveness, although the risk of complications such as dry eye is an important consideration.

PRK, on the other hand, although associated with a longer and more uncomfortable initial recovery period, offers a safe alternative for patients with thin corneas or those involved in activities that may compromise the integrity of the corneal flap. SMILE, being the most recent technique, combines the benefits of a fast recovery with a lower incidence of complications, while maintaining the structural stability of the cornea.

The choice between these techniques should be carefully personalized, taking into account the patient's specific needs, pre-existing eye conditions, lifestyle, and postoperative expectations. Clear communication between the surgeon and the patient about the potential risks, benefits, and expected outcomes of each procedure is key to ensuring long-term satisfaction. While all three techniques demonstrate positive results on patients' quality of life, future studies, particularly those that assess long-term outcomes and utilize standardized assessment methods, are needed to further optimize treatment strategies and provide more robust clinical guidance.

In short, refractive surgery continues to evolve, offering patients safe and effective options for vision correction. Personalization of treatment, based on a careful evaluation of the patient's individual characteristics, is essential to achieve the best results and maximize postoperative quality of life.

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