THESIS OVERVIEW

Astigmatism is a common refractive error that affects the clarity of vision, characterised by an irregular curvature of the cornea or lens, resulting in improper focusing of light on the retina. It can manifest as myopic astigmatism (myopia with astigmatism), hyperopic astigmatism (hyperopia with astigmatism) or mixed astigmatism (a combination of myopia and hyperopia with astigmatism). Astigmatism causes blurred or distorted vision at all distances and can be accompanied by symptoms such as eye fatigue, headaches and difficulty seeing at night. Traditional methods of correcting astigmatism include glasses and contact lenses, which compensate for irregular corneas and improve vision. However, laser refractive procedures have emerged as a long-term solution for correcting astigmatism.

Femtosecond LASIK (Laser-Assisted in Situ Keratomileusis)

FS-LASIK is a popular refractive laser procedure that can effectively correct astigmatism. The procedure involves two key steps: creating a corneal flap with a femtosecond laser and reshaping the cornea with an excimer laser. The femtosecond laser creates a precise, thin flap in the cornea that is lifted to access the underlying tissue. This step eliminates the need for a microkeratome, providing greater precision and reduced risk. The excimer laser then reshapes the cornea by removing microscopic layers, correcting astigmatism. The excimer laser ablates corneal tissue with exceptional precision, allowing for personalised treatment based on the individual's specific refractive error.

One of the advantages of Femtosecond LASIK is its ability to simultaneously correct both astigmatism and other refractive errors such as myopia or hyperopia. The procedure is usually quick, takes only a few minutes for each eye, and is performed on an outpatient basis. After the procedure, patients may experience some discomfort and temporary sensitivity, but the recovery period is relatively short.

TransPRK (Transepithelial Photorefractive Keratectomy)

TransPRK is another refractive laser procedure used to correct astigmatism. Unlike LASIK, TransPRK eliminates the need for a corneal flap. Instead, the outer layer of the cornea (the epithelium) is gently removed using an excimer laser, and the cornea is then reshaped to correct the astigmatism.

TransPRK offers several advantages, including a lower risk of complications associated with creating a flap and a faster recovery time. By treating the corneal surface directly, TransPRK provides smooth and precise correction of astigmatism, addressing irregularities in the cornea. The procedure is suitable for patients with thin corneas or those in contact sports or professions with an increased risk of eye trauma. Following the procedure, a bandaged contact lens is usually placed on the eye to protect the cornea and promote healing. Patients may experience some discomfort, light sensitivity and temporary blurred vision during the initial healing period. However, the epithelial layer regenerates over time, and improved vision is often visible within a few days. Complete stabilisation and optimal vision can take several weeks to several months.

When it comes to treating mixed and hyperopic astigmatism with refractive laser procedures such as Femtosecond LASIK and TransPRK, there are a few technical difficulties that can arise. While these procedures are generally effective, it is important to consider the following challenges:

1. Accuracy of treatment: correction of mixed and hyperopic astigmatism requires precise and accurate corneal reshaping. Achieving the desired refractive result can be more difficult compared to treating myopic astigmatism alone. The surgeon must carefully plan and execute laser ablation to address the astigmatic components while achieving the desired hyperopic correction. The complexity of treating mixed and hyperopic astigmatism increases the margin of error and may require more extensive preoperative evaluation and surgical planning.

2. Limitations: Laser refractive procedures have certain limitations in terms of the amount of refractive error that can be effectively corrected. Treating high levels of farsightedness or astigmatism can be more difficult with standard laser platforms. In cases where the refractive error exceeds the treatment range of the laser system, it may be necessary to consider alternative options such as intraocular lens implants.

3. Induced higher order aberrations: Higher order aberrations (HOA) refer to irregularities in the eye's optical system that can affect visual quality. While Femtosecond LASIK and TransPRK aim to correct astigmatism, there is the potential to induce or aggravate HOA, especially in cases of complex astigmatism or higher degrees of correction. Surgeons should carefully evaluate and discuss with patients the potential impact on visual quality and contrast sensitivity, especially when treating mixed and hyperopic astigmatism.

4. Scarring and epithelial stability: In TransPRK, complete removal of the corneal epithelium can result in a longer and sometimes more uncomfortable recovery period compared to LASIK. The healing process and visual stability may take longer, especially when treating hyperopic and mixed astigmatism. Patients may experience temporary blurred vision, discomfort and light sensitivity during the initial healing phase. Careful postoperative monitoring and proper management are essential to ensure proper healing and optimal visual outcomes.

5. Patient selection: treating mixed and hyperopic astigmatism with laser refractive procedures requires careful patient selection. Factors such as corneal thickness, pupil size and pre-existing eye conditions should be considered. Some patients with thin corneas or large pupils may not be suitable candidates for certain laser procedures due to potential risks of corneal instability, blindness or other visual disturbances.

It is essential that surgeons thoroughly assess each patient's individual characteristics, perform detailed preoperative assessments and provide clear and realistic expectations to ensure the best possible results when addressing mixed and hyperopic astigmatism with Femtosecond LASIK or TransPRK.

Astigmatism can be effectively treated with laser refractive procedures such as Femtosecond LASIK and TransPRK. These advanced techniques provide precise corneal reshaping, correcting myopic, hyperopic and mixed astigmatism. With Femtosecond LASIK, creating a corneal flap and reshaping the cornea with an excimer laser provides precise and effective correction of astigmatism. TransPRK, on the other hand, eliminates the need for a flap, making it a suitable option for people with thin corneas or those involved in high-impact activities. Both procedures provide excellent results, allowing patients to achieve improved visual clarity and reducing their dependence on corrective lenses.

SUMMARY OF PERSONAL RESEARCH

This thesis provides an overview of astigmatism, its types and explores two popular laser procedures - femtosecond LASIK and TransPRK - for correcting myopic, hyperopic and mixed astigmatism. This PhD work includes 3 studies

Personal research objectives

Primary objectives

1. Evaluation of clinical outcomes of laser refractive surgery in terms of visual acuity, refractive errors and stability of postoperative outcome over a 12-month period.

2. To assess patient satisfaction after laser refractive procedures, looking at factors such as comfort, quality of vision, independence from optical correction.

3. Documentation of the incidence and management of adverse effects and potential complications associated with the intervention.

4. Comparison of the results of refractive surgery with other surgical or non-surgical methods of ametropia correction.

5. Comparison of uncorrected visual acuity differences (UCVA), predictability, efficiency and safety of the techniques (FS-LASIK and TransPRK).

General methodology of personal research

The retrospective study conducted between 2018-2022 included patients who presented to the ALCOR Bucharest ophthalmology clinic, expressed their desire to undergo refractive surgery and met the study inclusion criteria. They were treated either by Streamlight TransPRK or FS-LASIK. The postoperative follow-up period was 12 months. All procedures were performed by the same surgeon using the same laser platforms: FS200 - femtosecond and EX500- excimer.

Inclusion criteria

- patients aged ≥ 18 years
- patients diagnosed with myopia/hyperopia and astigmatism
- patients with stable refractive error at least 1 year prior to surgery
- patients who have agreed to sign an informed consent and who were able to follow the post-operative assessment protocol including attendance at visits

Exclusion criteria

- diagnosis of severe dry eye syndrome
- patients with pre-existing ocular pathologies including glaucoma, keratoconus, corneal stromal dystrophies, Fuchs endothelial dystrophy, collagen diseases, bacterial keratitis, viral keratitis
- pregnancy or lactation

- uncontrolled diabetes or ocular complications of diabetes
- patients with a history of intraocular surgery or trauma
- uncontrolled intraocular inflammation
- immunosuppressed patients
- patients with autoimmune pathologies or other systemic diseases affecting the eye
- history of chronic medication that may affect the cornea or depress tear film secretion
- patients with a history of non-compliance with medication
- residual stroma < 250µm

The study included 198 eyes from 108 patients. Of these, 92 had surgery on both eyes and 16 on one eye.

Patients were initially divided into 2 groups according to the surgical technique used: the TransPRK group and the FS-LASIK group. In each group the eyes were divided according to the type of astigmatism: myopic, hyperopic or mixed. A total of 103 eyes were operated on by TransPRK. Of these 62 had myopic astigmatism, 16 had hyperopic astigmatism and 25 had mixed astigmatism. A total of 95 eyes were included in the group of patients operated on by FS-LASIK, of which 37 had myopic astigmatism, 34 had hyperopic astigmatism and 24 had mixed astigmatism.

Statistical analysis

Data were statistically analyzed using Statistical Package for Social Sciences v24.0 (SPSS Inc., Chicago, USA). Data normality was tested using the Shapiro-Wilk test. Quantitative data were presented as mean ± standard deviation (SD), and categorical data were presented as number (%). For normally distributed data, parametric student T-tests were used, and comparison between groups was performed by independent sample T-test. Data with non-parametric distributions were analysed by the non-parametric Mann-Whitney U test. Paired T-test was used for analysis of pre/post values for data with normal distribution and Wilcoxon signed rank test related samples for data with non-parametric distribution. Categorical data analysis was performed using Chi square test or Fischer`s exact test. Statistical significance in all cases was set at $p< 0.05$.

The data were further analysed by Pearson/Spearman`s rho coefficient to determine the significance of any correlation between the preoperative parameters: spherical diopter, cylindrical diopter, spherical equivalent, visual acuity and the postoperative values.

In each group patients were distributed into three subgroups corresponding to the type of astigmatism: myopic astigmatism, hyperopic astigmatism and mixed astigmatism. These were analysed individually and comparatively. Thus :

- 62 eyes with myopic astigmatism, 16 with hyperopic astigmatism and 25 with mixed astigmatism were included in the TransPRK group (Figure 1)

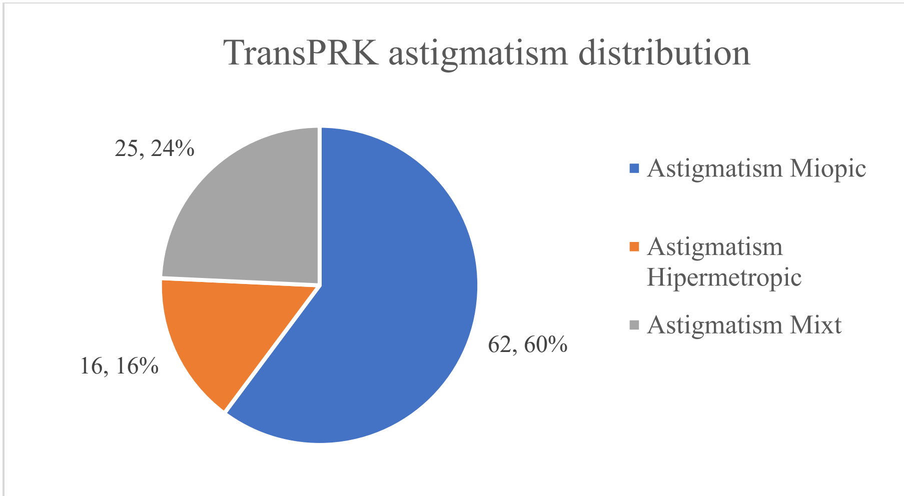

Figure 1. *Distribution of astigmatism types for the TransPRK technique*

- The FS-LASIK group included 37 eyes with myopic astigmatism, 34 with hyperopic astigmatism and 24 with mixed astigmatism (Figure 2).

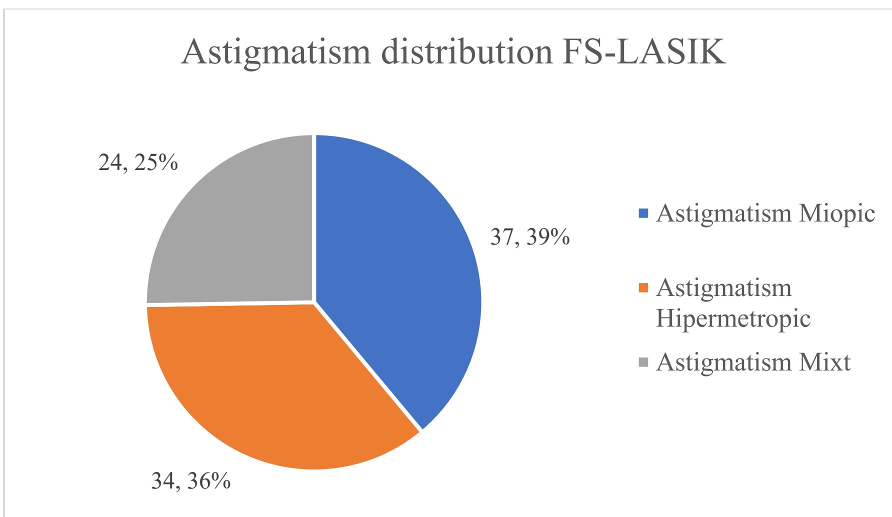

Figure 2. *Distribution of astigmatism types for the FS-LASIK technique*

Analysis of myopic astigmatism

Patients with myopic astigmatism treated with TransPRK were assigned to group A and those treated with FS-LASIK were assigned to group B. The gender distribution in group A was 37.1% female (n = 23), 62.9% male (n = 39).

Spherical diopter decreased from -3.03 ± 2.06D preoperatively to 0.14 ± 0.45D postoperatively ($p<0.05$), and mean cylindrical diopter decreased from -2.08 ± 1.04D preoperatively to -0.55 ± 0.31D postoperatively (p<0.05). A statistically significant shift towards emmetropia was evident in postoperative spherical and cylindrical diopter compared to preoperative values.

Table 1. *Pre- and postoperative myopic astigmatism parameters -TransPRK*

Variable	*Preop*	*Postop*	*p-value (mean difference)*
CDVA/UDVA (logMAR)	0.032 ± 0.068	0.024 ± 0.058	<0.001*
SEQ (D)	-4.07 ± 2.07	-0.13 ± 0.45	<0.001*
Cylinder (D)	-2.08 ± 1.04	-0.55 ± 0.31	<0.001*
Sphere (D)	-3.03 ± 2.06	-0.14 ± 0.45	<0.001*

In group B the gender distribution was 62% female (n = 23), 37.8% male (n = 1 4). In these cases the mean spherical diopter decreased from -4.25 ± 2.04D preoperatively, to 0.09 ± 0.5D postoperatively (p<0.05), and the mean cylindrical diopter decreased from -1.91 ± 1.08D preoperatively, to -0.45 ± 0.26D postoperatively (Table 4). There was also a statistically significant shift towards emmetropia for both variables.

Table 2 *Pre- and postoperative myopic astigmatism parameters* **-** *FS-LASIK*

Variable	*Preop*	*Postop*	*p-value (mean difference)*
CDVA/UDVA (logMAR)	0.047 ± 0.90	0.040 ± 0.63	0.101
SEQ (D)	-4.86 ± 2.38	-0.14 ± 0.51	<0.001*
Cylinder (D)	-1.91 ± 1.08	-0.45 ± 0.26	<0.001*
Sphere (D)	-4.25 ± 2.04	0.09 ± 0.5	<0.001*

The postoperative SEQ was similar between the 2 groups, reaching -0.09 D postoperatively for patients undergoing TransPRK technique and -0.25 D for those operated by FS-LASIK (Figure 19), with no statistically significant differences (p=0.114). We observed a linear, stable evolution of the mean SEQ between the two groups at 1 month (p=0.816)), 6 months (p=0.799), and 1 year (p=0.459), respectively.

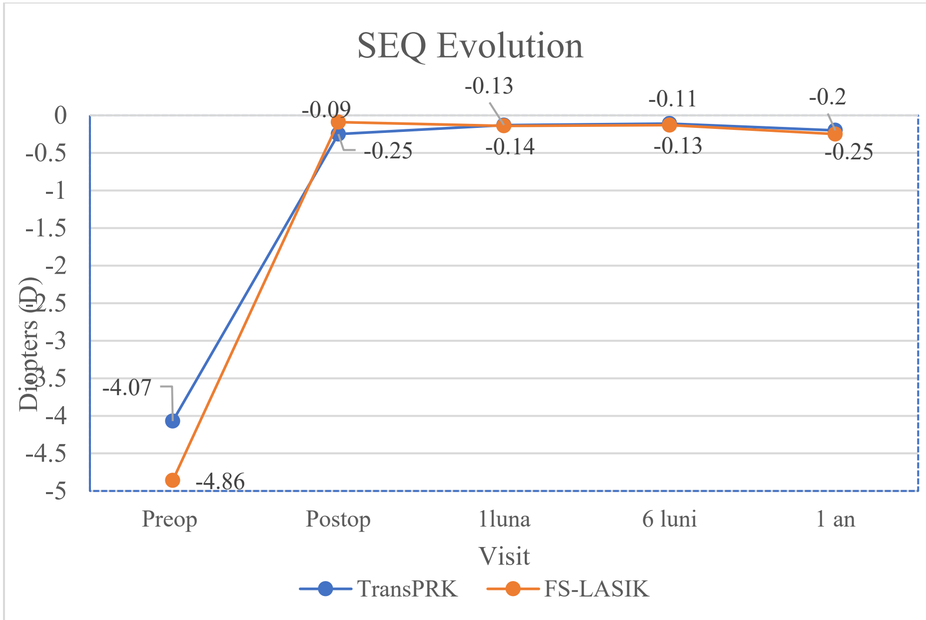

Figure 3. *Comparative graph of the spherical equivalent (SEQ) evolution over one year between the 2 techniques used for myopic astigmatism*

At 12 months postoperatively, 91.9% of patients in group A achieved a UDVA at least as good as the preoperative BCVA, and in group B the percentage was 94.6%.

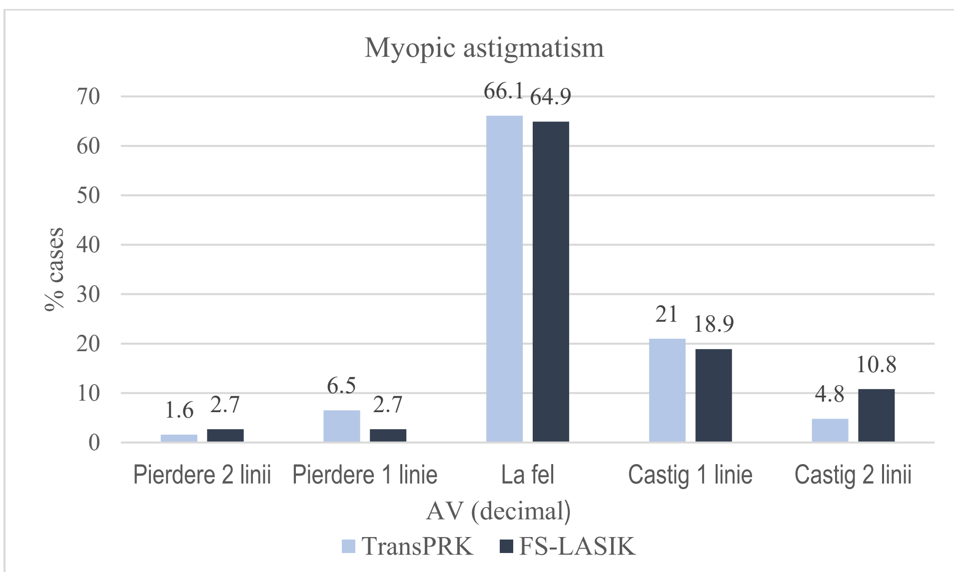

Figure 4. *Difference between UDVA at 1 year postoperatively and BCVA preoperatively myopic astigmatism*

The two graphs exemplify the differences between the groups in terms of preoperative BCVA and postoperative UDVA. In terms of preoperative optimally corrected visual acuity, in Group A 72.6% had a BCVA of 1 (decimal), and 27.4% had a BCVA between 0.5 and 0.9 (decimal). In Group B 70.3% of eyes had a maximum visual acuity of 1 (decimal), with the remainder also falling between 0.5 and 0.9 (decimal)

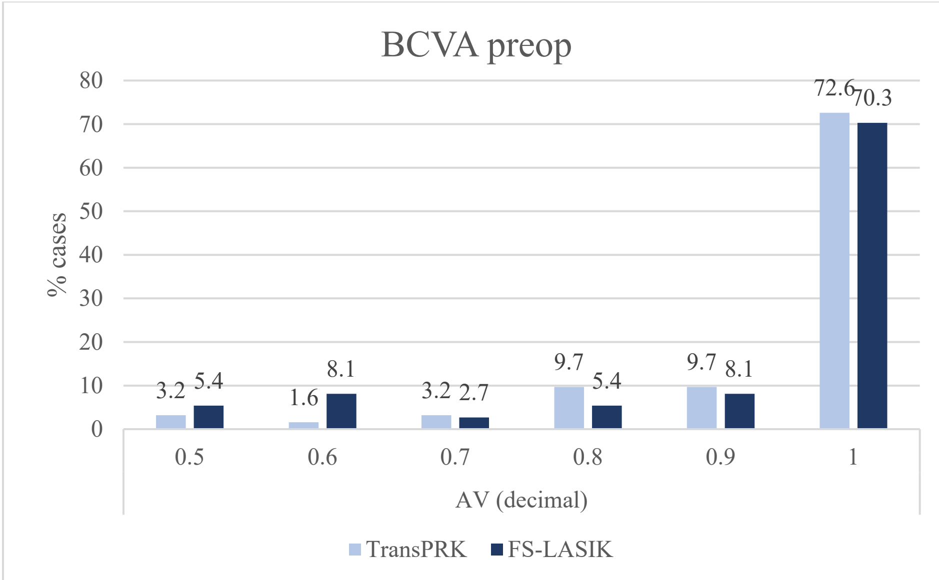

Figure 5. *Comparative graph of preoperatively corrected optimal visual acuity between the 2 techniques for myopic astigmatism*

Postoperatively, in group A, 72.6% had UDVA equal to 1 decimal place, and in group B 64.9% of the operated cases.

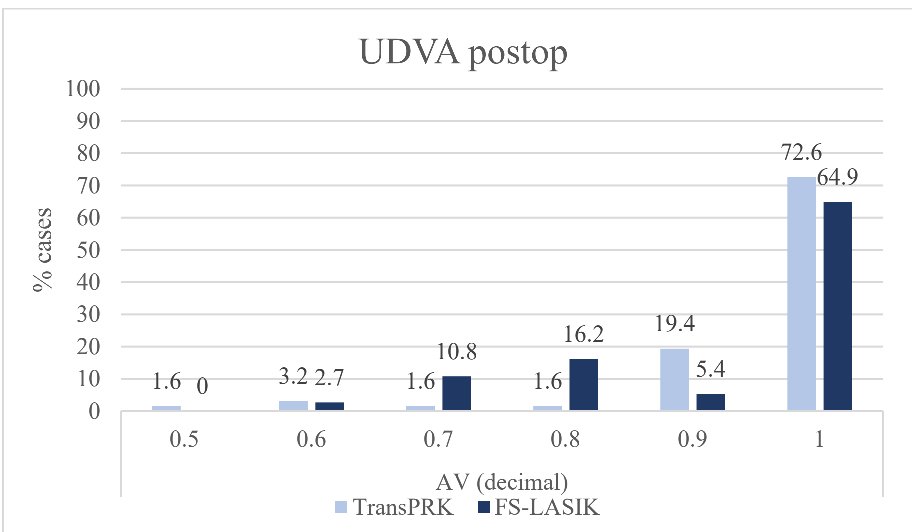

Figure 6. *Comparative plot of postoperative uncorrected visual acuity between the 2 techniques for myopic astigmatism*

By the end of the follow-up period, an increase in UDVA was noted in both groups: 85.5% of patients operated on by TransPRK achieved a UDVA of 1 decimal place and 83.8% of those operated on by FS-LASIK.

Analysis of hyperopic astigmatism

Patients with hyperopic astigmatism treated with TransPRK were assigned to group C and those treated with FS-LASIK were assigned to group D.

Thus, 16 eyes were included in group C, the mean age of the patients was 28 ± 6.73 years and the gender distribution was 25% male (n = 4) and 75% female (n = 12). 34 eyes were included in group D, the mean age of the patients was 32.1 ± 8.24 years and the gender distribution was 61.8% male (n = 21) and 38.2% female (n = 13).

In group C the spherical diopter decreased from 3.92 ± 1.18D preoperatively to 0.59 ± 0.51 D postoperatively ($p<0.05$), and the mean cylindrical diopter decreased from -2.15 ± 1.18D to -0.59 ± 0.51 D. There was a statistically significant ($p<0.05$) shift towards emmetropia of the spherical and cylindrical diopter postoperatively compared to preoperative values. As for uncorrected visual acuity, there was also a statistically insignificant improvement in this compared to preoperative values ($p = 0.058$).

Table 3. *Pre- and postoperative hyperopic astigmatism parameters - TransPRK*

Variable	*Preop*	*Postop*	*p-value (mean difference)*
CDVA/UDVA (logMAR)	0.057 ± 0.076	0.071 ± 0.085	0.058
SEQ (D)	2.84 ± 1.00	0.296 ± 0.46	<0.001*
Cylinder (D)	-2.15 ± 1.18	-0.59 ± 0.45	<0.001*
Sphere (D)	3.92 ± 1.18	0.59 ± 0.51	<0.001*

In group D the spherical diopter decreased from 4.78D ± 1.39D preoperatively to -0.25 ± 0.8D postoperatively ($p<0.05$), and the mean cylindrical diopter decreased from -2.37 ± 1.34D preoperatively to -0.7D ± 0.46D postoperatively. Thus a statistically significant shift towards emmetropia ($p<0.05$) was evident for both variables. We observed a statistically significant improvement in uncorrected visual acuity in this group as well ($p<0.01$).

Table 4. *Pre- and postoperative hyperopic astigmatism parameters - FS-LASIK*

Variable	*Preop*	*Postop*	*p-value (mean difference)*
CDVA/UDVA (logMAR)	0.070 ± 0.102	0.138 ± 0.153	<0.001*
SEQ (D)	3.62 ± 1.58	-0.61 ± 0.8	<0.001*
Cylinder (D)	-2.37 ± 1.34	-0.70 ± 0.46	<0.001*
Sphere (D)	4.78 ± 1.39	-0.25 ± 0.8	<0.001*

Analyzing visual acuity at the 12-month visit, we observed that 87.4% of patients in group C achieved UDVA at least as good as preoperative BCVA, and in group D the percentage was slightly higher at 88.3%.

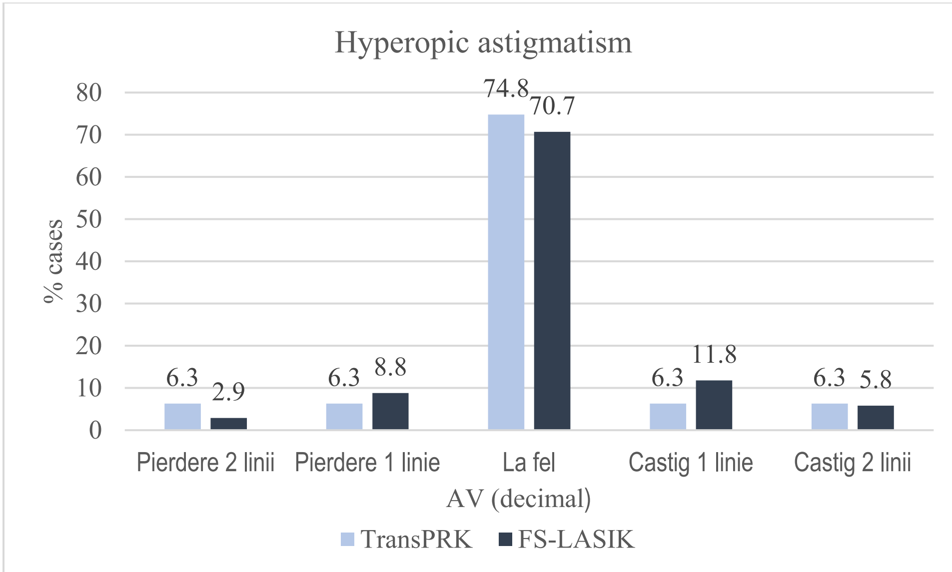

Figure 7. *Difference between UDVA at 1 year postoperatively and BCVA preoperatively hyperopic astigmatism*

The evolution of the postoperative mean spherical equivalent was stable and similar between the 2 groups, for the patients operated by TransPRK it recorded a value of 0.03D at 12 months, and for those operated by FS-LASIK technique a slight overcorrection was observed, the SEQ being -0.38D.

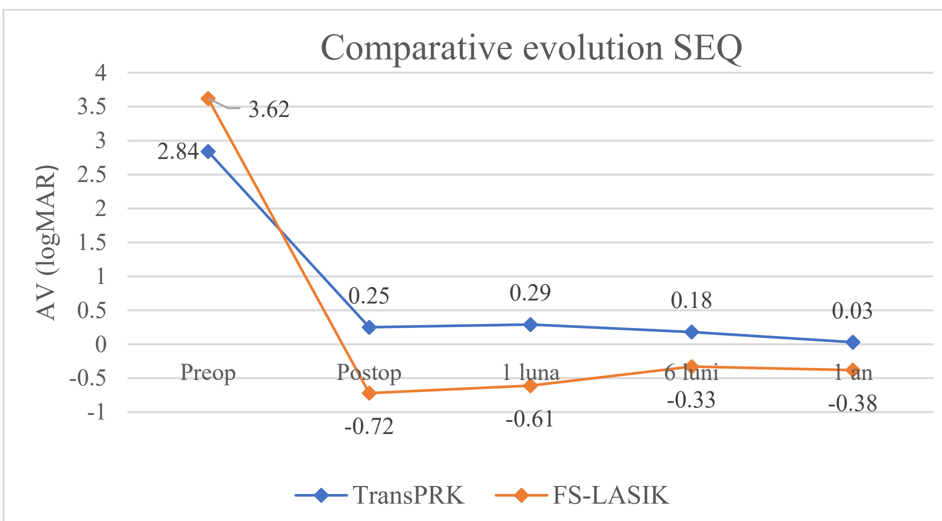

Figure 8. *Comparative evolution of spherical equivalent (SEQ) between the 2 techniques for hyperopic astigmatism over one year*

In terms of preoperatively corrected optimal visual acuity, in Group C 56.1% had a BCVA of 1 (decimal) and 43.9% had a BCVA between 0.6 and 0.9 (decimal). In Group D 53% of eyes had a maximum visual acuity of 1 (decimal) with the remainder between 0.4 and 0.9 (decimal) .

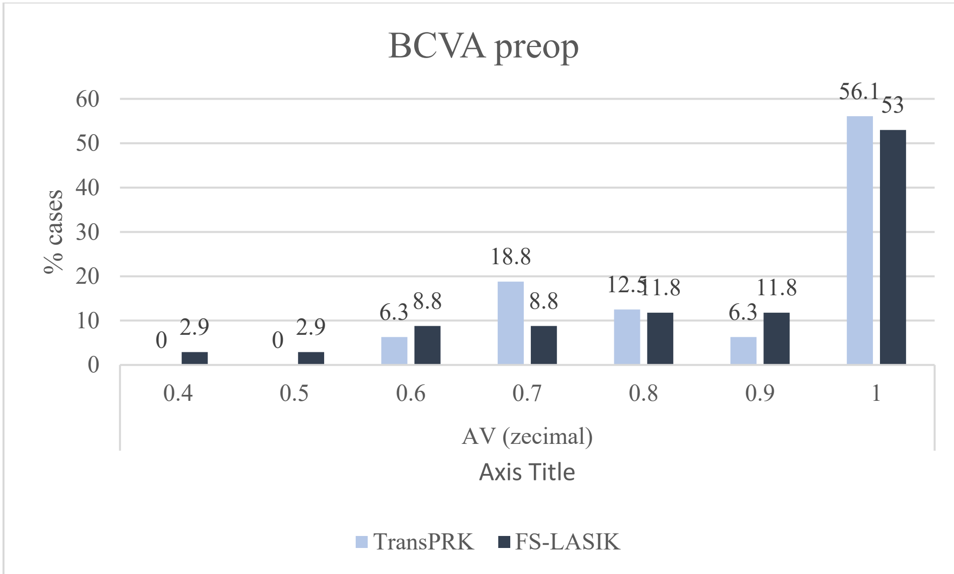

Figure 9. *Comparative graph of preoperatively corrected optimal visual acuity between the 2 techniques for hyperopic astigmatism*

Postoperatively, in group C, only 37.5% had UDVA equal to 1 decimal place, and in group D the same UDVA value was recorded in only 26.6% of cases operated on. These low percentages subsequently improved.

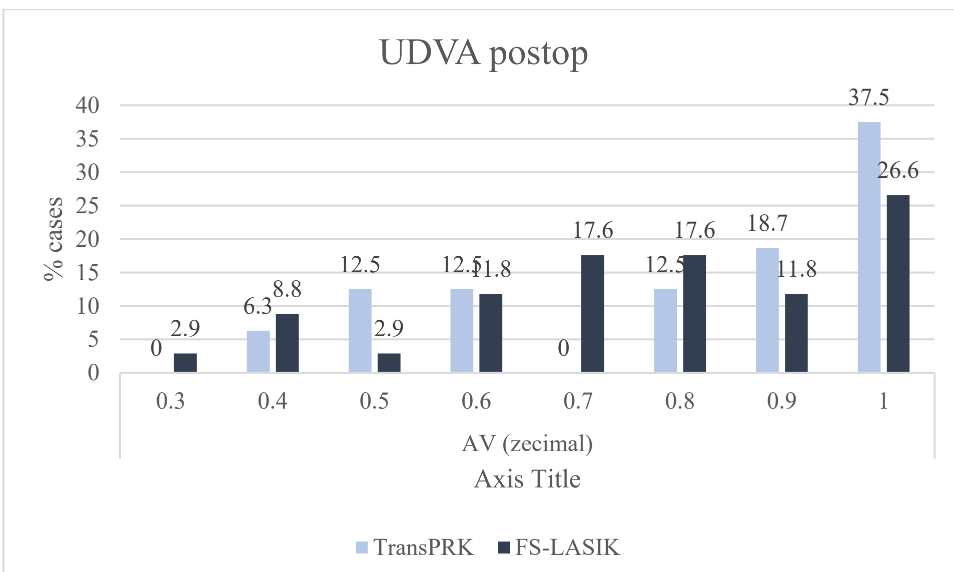

Figure 10. *Comparative plot of postoperative uncorrected visual acuity between the 2 techniques for hyperopic astigmatism*

Analysis of mixed astigmatism

In this cohort, patients with mixed astigmatism treated with TransPRK were assigned to group E and those treated with FS-LASIK were assigned to group F.

Thus, 25 eyes were included in group E, the mean age of the patients was 28.36 ± 5.5 years and the gender distribution was 56% female (n = 1 4) and 44% male (n = 11). 24 eyes were included in group F, the mean age of the patients was 29.88 ± 4.83 years and the gender distribution was 25% female (n = 6) and 75% male (n = 18).

In group E the spherical diopter decreased from 1.79 ± 2.02D preoperatively to 0.16 D ± 0.73D ($p<0.05$) postoperatively, and the mean cylindrical diopter decreased from -3.95 ± 1.29D to -1.05 ± 0.52D. Thus a statistically significant shift towards emmetropia was evident in postoperative spherical and cylindrical diopter compared to preoperative values ($p<0.05$).

Postoperative visual acuity decreased discretely, but not statistically significantly, compared to corrected values prior to surgery, recording a value of 0.095 ± 0.1 logMAR, from 0.079 ± 0.12 logMAR

Table 5. *Pre- and postoperative mixed astigmatism parameters - TransPRK*

Variable	*Preop*	*Postop*	*p-value (mean difference)*
CDVA/UDVA (logMAR)	0.079 ± 0.12	0.095 ± 0.1	0.149
SEQ (D)	-0.18 ± 2.11	-0.36 ± 0.65	0.705
Cylinder (D)	-3.95 ± 1.29	-1.05 ± 0.52	0.002*
Sphere (D)	1.79 ± 2.02	0.16 ± 0.73	<0.001*

In group F the spherical diopter decreased from 2.19 ± 1.39D preoperatively to -0.31 ± 0.44D ($p<0.05$) postoperatively, and the mean cylindrical diopter decreased from -4.65 ± 1.34D to -0.73 ± 0.45D. Thus a statistically significant shift towards emmetropia was evident for both variables. Visual acuity in this group improved from the postoperative visit compared to the preoperative CDVA, statistically insignificantly from 0.102 ± 0.125 logMAR to 0.08 ± 0.098 logMAR.

Table 6. . *Pre- and postoperative hyperopic astigmatism parameters - FS-LASIK*

Variable	*Preop*	*Postop*	*p-value (mean difference)*
CDVA/UDVA (logMAR)	0.102 ± 0.125	0.08 ± 0.098	0.116
SEQ (D)	-0.14 ± 1.47	-0.90 ± 0.53	0.033*
Cylinder (D)	-4.65 ± 1.34	-0.75 ± 0.45	<0.001*
Sphere (D)	2.19 ± 1.39	0.31 ± 0.44	<0.001*

At 12 months postoperatively, 92% of patients in group E achieved UDVA at least as good as preoperative BCVA, and in group F the percentage was slightly higher (87.5%), but with a better percentage of eyes gaining a line of visual acuity

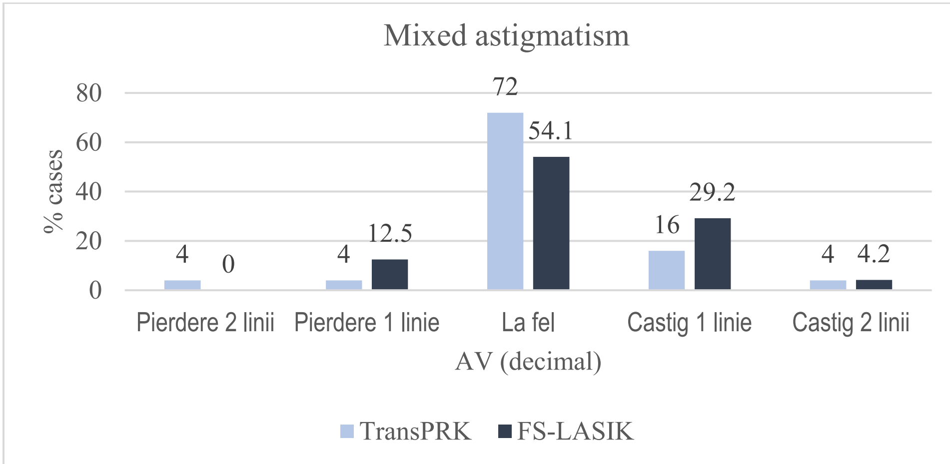

Figure 11. *Difference between UDVA at 1 year postoperatively and BCVA preoperative mixed astigmatism*

The evolution of the postoperative SEQ was stable and similar between the 2 groups, with the TransPRK technique reaching -0.08D at 12 months and a slight overcorrection of -0.24D for the FS-LASIK technique. There was also a tendency to overcorrection in the immediate postoperative period, more pronounced in the FS-LASIK technique. Compared between groups, there was a statistically significant difference between the mean postoperative SEQ at 1 month (p=0.043) which, by the 6-month visit, became insignificant (p=0.296).

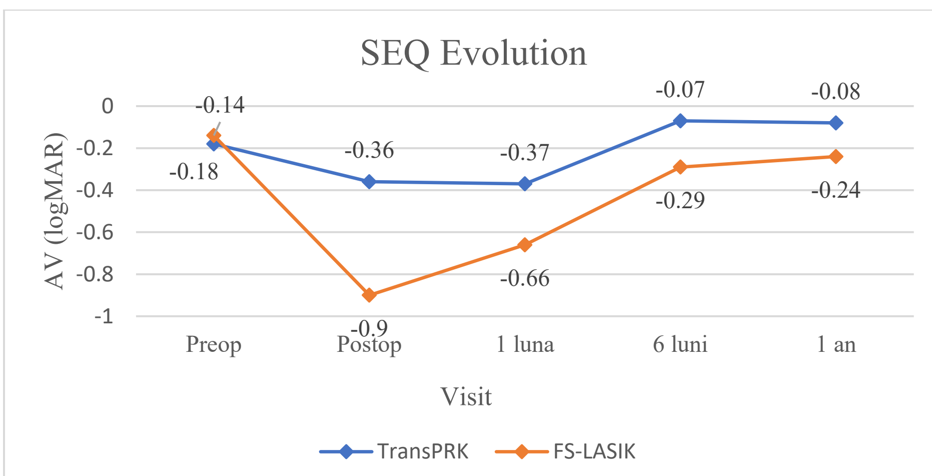

Figure 12. *Comparative graph of spherical equivalent (SEQ) evolution from preoperative visit to 1-year visit between the techniques used for mixed astigmatism*

In terms of preoperatively corrected optimal visual acuity, in Group E 56% had a BCVA of 1 (decimal) and 44% had a BCVA between 0.4 and 0.9 (decimal). In Group F, 29.2% of cases had a maximum visual acuity of 1 (decimal), with the remainder between 0.3 and 0.9 (decimal).

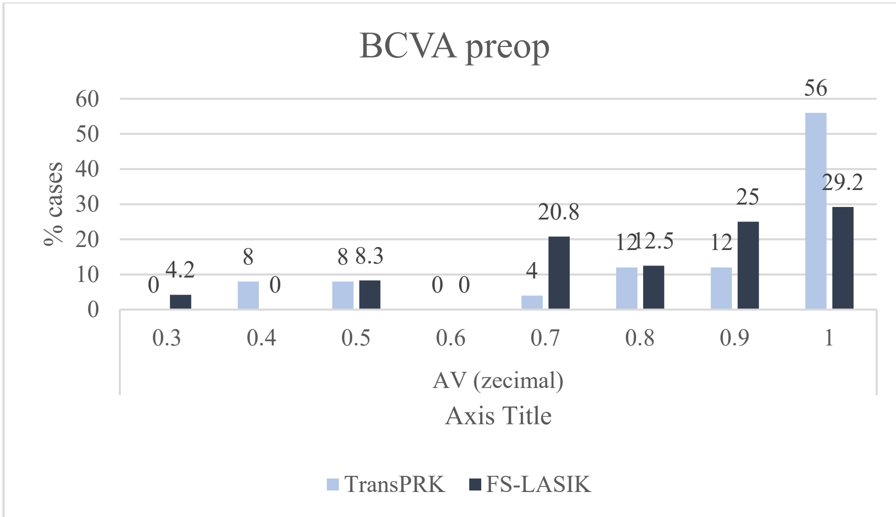

Figure 13. *Comparative graph of preoperatively corrected optimal visual acuity between the 2 techniques for mixed astigmatism*

Postoperatively, in group D, only 36% of eyes showed UDVA equal to 1 decimal place, and in group D the same UDVA value was recorded in 33.3% of operated cases. These low percentages subsequently improved.

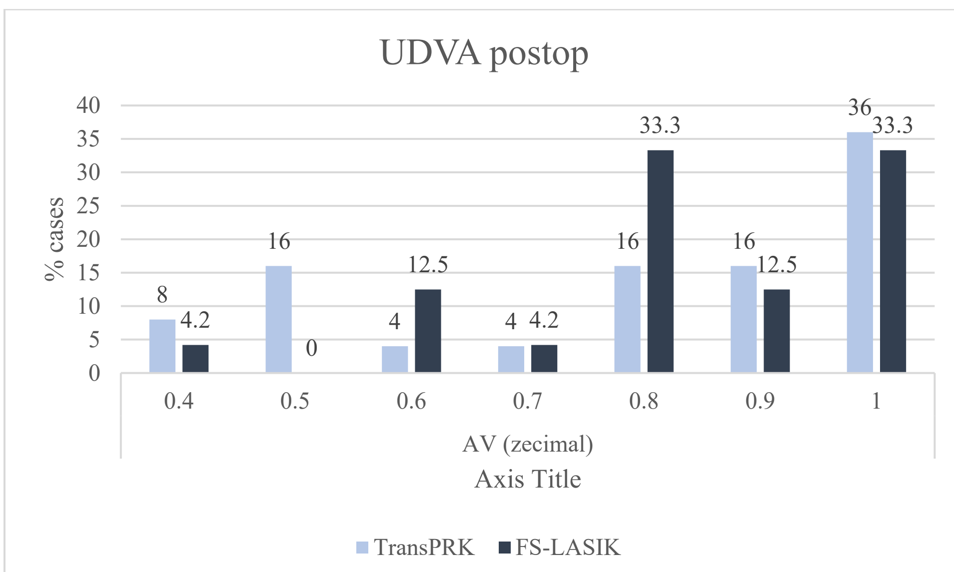

Figure 14. *Comparative plot of postoperative uncorrected visual acuity between the 2 techniques for mixed astigmatism*

Evaluation of efficiency and safety

The effectiveness of the two techniques for all types of astigmatism immediately postoperatively and at 12 months is summarised in Table 18. Good efficiency ratios (≥0.99) are found for both techniques at 12 months, but with small, statistically insignificant ($p>0.05$) differences between them, which will be discussed in the Discussion chapter.

Effective comparison in the treatment of astigmatism between the two techniques

Astigmatism type	*Index*	*1month*		*p-value*	*1year*		*p-value*
		TransPRK	***FS-LASIK***		***TransPRK***	***FS-LASIK***	
Myopic	Efficiency	1.02±0.12	1.03±0.23	0.913	1.05±0.16	1.11±0.25	0.468
	UDVA≥1	72.6%	64.9%		85.5%	83.8 %	
Hyperopic	Efficiency	0.97±0.12	0.88±0.23	0.058	1.01±0.08	0.99±0.17	0.164
	UDVA≥1	50%	26.5%		50%	41.2%	
Mixed	Efficiency	0.98±0.21	1.04±0.17	0.318	1.12±0.27	1.08±0.17	0.974
	UDVA≥1	32%	33.3%		76%	41.7%	

The type and rates of postoperative complications are shown in the table

Postoperative complications

Parameter	***TransPRK (n=103)***	***FS-LASIK (n=95)***	***p-value***
Haze	22.3 %	N/A	N/A
HIGH TIO	12.6%	4.21 %	0.68
DLK	N/A	0.00%	N/A
Complications related to the flap	N/A	2.1%	N/A

Conclusions

Analysis of the results and clinical investigation led to the following conclusions:

- There were 3 primary objectives of this PhD thesis, which set out to investigate the clinical outcomes of the two methods of surgical correction of astigmatism: the first was to determine the impact of the StreamLight transPRK technique and the FS-LASIK technique on visual acuity, refractive error and patient satisfaction. The second objective was to investigate the comparative effectiveness, predictability and safety of the use of refractive procedures as well as the occurrence and management of intra- and postoperative complications. The third objective was to research and improve ablation profiles to improve future clinical outcomes.

- In the study of myopic astigmatism undergoing treatment, both FS-LASIK and TransPRK showed comparable efficacy, safety and predictability across the range of refractive errors. The study identified some differences in safety profiles between the two techniques, such as variations in postoperative pain, corneal haze, dry eye symptoms or other complications. In both groups there was a statistically significant improvement in UDVA and BCVA compared to preoperative values. The predictability of the cylindrical component correction was lower than that of the spherical equivalent. Both techniques showed a slight tendency to residual cylinder as well as a discrete tendency to overcorrect the spherical equivalent. However FS-LASIK proved superior given that there were statistically significant differences in mean preoperative spherical equivalent, a higher percentage of eyes gaining rows of uncorrected visual acuity, and a faster recovery period.

- In the study of hyperopic astigmatism both techniques showed similar efficacy and safety, in both groups there was a statistically significant improvement in UDVA and BCVA compared to preoperative values with a shift towards emmetropia. The TransPRK technique showed better predictability of the discrete spherical equivalent compared to FS-LASIK but with this technique significantly larger magnitude vices were operated. Both showed a tendency towards residual cylinder and in the FS-LASIK group there was a slight overcorrection maintained until the 1-year visit.

- In the mixed astigmatism study also SEQ efficiency, safety and predictability were comparable, and the postoperative mean spherical equivalent trend was similar, with a statistically significant shift towards emmetropia. The predictability of the cylindrical dioptres was superior to the FS-LASIK technique. In these groups most eyes with amblyopia were present, particularly in the FS-LASIK group, where a better criterion for judging the results could be considered the efficiency index. UDVA improved significantly in both groups compared to preoperative values.

- Both transPRK and FS-LASIK provide significant improvements in visual acuity and astigmatic correction in all types. Specific visual outcomes are determined by factors such as preoperative refractive error, severity of astigmatism and the postoperative healing process. The level of astigmatic correction achieved, the stability of the correction over time and patient satisfaction with the procedure could be factors considered in assessing effectiveness.

- In terms of the incidence of complications, although they occurred more frequently in the group of astigmatism treated by TransPRK, all were treated effectively with medication, had minimal transient impact on BCVA, and at the end of the follow-up period patients were satisfied with the final outcome. During the follow-up period, no instances of corneal ectatic or regression were noted.

Personal contributions

- According to the literature accessed for this thesis, this paper is the first in Romania to describe in a standardized format the refractive results obtained by the StreamLight TransPRK procedure and to perform a comparative analysis with the well-known FS-LASIK procedure.

- The results obtained in this thesis were compared with the international literature and are comparable with reports where patients were operated on using the same or different laser platforms.

- Participation in the decision to choose an individualised therapeutic plan, taking into account the organic particularities of each patient in order to reduce the risks of all complications frequently reported in the literature and improve functional outcome.

- Comparative analysis has been used to gain a better understanding of the outcomes and practical differences between the two modalities of surgical treatment of astigmatism and can become a useful tool in the further management of various refractive errors to increase the quality of care and patient satisfaction.