

# Myopic lasik outcomes: comparison of three different femtosecond lasers and a mechanical microkeratome using the same excimer laser

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## Research article

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## Abstract

**BACKGROUND** To compare the influence of four different microkeratomes on myopic LASIK outcomes. **METHODS** Retrospective, observational cohort study. We compared 134 eyes treated with the IntraLase 60 kHz, 112 eyes treated with the Femto LDV Z6, 206 eyes treated with the FS200 and 98 eyes treated with the Hansatome zero compression microkeratome. All eyes were operated using the same surgical protocol with the same excimer laser (Wavelight Allegretto) and were allocated in refraction-matched groups. Uncorrected distance visual acuity, best corrected distance visual acuity and residual refraction were evaluated 1 and 7 days, 1 and 3 months postoperatively. **RESULTS** One day and one week postoperatively, uncorrected distance visual acuity was significantly lower in the FS200 group compared to others ( $P=0.0001$ ). This difference disappeared at the 1- and 3-month postoperative visits. Significant differences were found among groups in terms of safety index ( $P=0.0001$ ), residual sphere ( $P=0.0001$ ) and residual cylinder ( $P=0.02$ ) at the 3-months postoperative visit. No significant differences were found in corrected distance visual acuity or efficacy index. **CONCLUSIONS** According to our results, a slight delay in visual restoration after FS200 LASIK surgery might be expected. This delay was statistically significant at 1 day and 1 week postoperatively, but there were no differences from the 1-month visit onwards.

## Background

Laser in situ keratomileusis (LASIK) is the gold standard among refractive surgery techniques for the surgical correction of myopia<sup>1,2</sup>. With the advent of femtosecond lasers and their wide adoption in clinical practice, the use of mechanical microkeratomes (MM) has declined in recent years. As a consequence, MM-related flap complications have become less frequent.<sup>3,4</sup> Compared to flaps cut with a MM, flaps created with femtosecond lasers are more predictable in terms of attempted thickness and homogeneity<sup>2,5</sup>, are associated with fewer higher order aberrations<sup>6-9</sup>, offer higher contrast sensitivity<sup>7,8</sup>, induce less dry eye<sup>10</sup> and afford higher corneal biomechanical stability.<sup>11</sup> Due to these important clinical advantages, nowadays 70% of LASIK procedures are performed using a Femtosecond laser<sup>1</sup>.

Most of the published studies on femtosecond LASIK performance were conducted with the IntraLase® laser (Abbott Medical Optics Inc., Santa Ana, California), as this was the first and only available device for some years. Although its efficacy, safety and predictability have been repeatedly demonstrated<sup>4,5,12</sup>, the available published evidence for some of the more recently developed femtosecond platforms remains limited. A paper by the American Academy of Ophthalmology<sup>5</sup> reviewing the use of femtosecond laser (IntraLase®) versus MM concluded that outcomes with the former were as good as or better than with the latter for flap creation, and encouraged more studies in order to compare efficacy outcomes of newer femtosecond platforms by other manufacturers. Clinically relevant differences in outcomes might be expected among femtosecond systems due to variations in photodisruption characteristics, flap morphology, energy transmission, gas management, etc. Overall, these technical differences could induce dissimilar tissue responses specific to each femtosecond laser.

Most of the published studies comparing different femtosecond platforms have been designed to compare flap morphology and predictability or intraocular pressure elevations during the procedure.<sup>13-15</sup> Unfortunately, there is less published evidence on visual and refractive results with these newer femtosecond lasers. This is clinically important, as satisfactory clinical outcomes should not be taken for granted, especially if new laser platforms have not been adequately compared against existing, well-established options. A recently published review and meta-analysis<sup>16</sup> showed some significant differences among femtosecond platforms in terms of efficacy, predictability and flap complications. In previous studies, certain methodological issues that could have influenced the outcomes should be taken into account (e.g. the different excimer lasers platforms that were used for stromal ablation).

In order to control these potential biases, we designed a specific study protocol that basically consists in: using the same surgical protocol, the same excimer laser, and to include refraction matched eyes.

## Methods

This was a retrospective cohort study of patients younger than 40 years who underwent LASIK with MM or a femtosecond laser for the correction of myopia with or without astigmatism between 2008-2014.

A masked investigator performed the preoperative examination that included uncorrected distance visual acuity (UDVA), corrected distance visual acuity (CDVA) (Nidek autochart projector CP 670, Nidek, Gamagori, Japan), manifest and cycloplegic refraction, ultrasound corneal pachymetry (DGH 5100 contact pachymeter, DHG Technology Inc, Exton, PA; OcuScan RXP, Alcon Laboratories, Inc, Fort Worth, TX), topography/tomography and keratometry (Dicon CT200, Vismed Inc., San Diego, CA; CSO Construzione Strumenti Oftalmici, Italy), mesopic infrared pupilometry (Colvard Pupillometer, Oasis 78 Medical Inc., Glendora, CA), slit-lamp biomicroscopy, Goldmann tonometry and dilated funduscopy.

Exclusion criteria were unstable refraction, suspicion of keratoconus or other ectatic corneal condition (defined as any localized steepening documented with Placido corneal topography or bowing of the posterior corneal surface detected with corneal tomography), prior ocular surgery, or systemic diseases that could alter refractive or visual outcomes.

The choice of a femtosecond or the MM depended mainly on the preoperative keratometric measures and the pupil size. For keratometric measurements < 41.0 diopters (D) or > 46.0 D and pupil diameter  $\geq 7$  mm, the flap was always created with a femtosecond laser. In patients suitable for both procedures, the final decision was based on the patient's preference after being thoroughly informed about both techniques. The patients were allocated in one of the three femtosecond groups depending on device availability in the facilities at the time of surgery.

All patients provided informed consent and the Institutional Review Board approved the study protocol. The study was performed in accordance with the tenets of the Declaration of Helsinki.

### **Surgical technique**

Two experienced surgeons (M.A.T. and M.G.G.) performed all the procedures in a private practice setting.

Povidone-iodine solution 5% was applied on the eyelids and conjunctiva before the sterile surgical drape and eyelid rigid speculum were positioned. All surgeries were performed under topical anaesthesia (Lidocaine 2%).

In eyes treated with the MM (group H), the flap was cut with the Hansatome Zero-compression<sup>®</sup> keratome, (Hansa Research and Development, Miami, FL, USA and commercialized by Bausch & Lomb Corporation) using a 8.5-9.5 mm suction ring, a 120 µm blade and superior hinge.

In the femtosecond groups three platforms were used: a) the 60-kHz IntraLase<sup>®</sup> laser (group IL), programed for raster pattern photon delivery, bed energy level of 0.90 µJ, side-cut energy of 0.90 µJ, spot separation of 7 µm, side cut angle of 70 degrees, superior hinge angle of 50 degrees, attempted flap depth of 110 µm and flap diameter of 8.5 mm; b) the Wavelight FS200<sup>®</sup> laser (group F) by Alcon Laboratories, Inc. Fort Worth, TX, USA, programed for raster pattern photon delivery, bed energy level of 0.83 µJ, side-cut energy of 0.80 µJ, spot separation of 8 µm, side cut angle of 70 degrees, superior hinge angle of 90 degrees, attempted flap depth of 120 µm and flap diameter of 9.0 mm; c) the Femto LDV Z6<sup>®</sup> (group Z) by Ziemer Ophthalmic Systems AG, Port, Switzerland, programed for raster pattern photon delivery, bed energy level of 1.0 µJ, side-cut energy of 0.90 µJ, spot size of 1 µm, side cut angle of 70 degrees, superior hinge angle of 90 degrees, attempted flap depth of 110 µm and flap diameter of 9.0 mm. A suction ring of 9-10 mm was used depending on the corneal curvature according to the manufacturer's recommendations.

In all groups, once the flap was cut, it was lifted with a spatula and the stromal bed was dried with a sponge. The stromal ablation was performed with the Wavelight Allegretto<sup>®</sup> excimer laser (WaveLight Laser Technologies AG) programed for spot separation of 0.95 mm, fluence of 200 mJ/cm<sup>2</sup>, repetition rate of 400 Hz, optical zone of 6-7.5 mm (larger than- or equal to the patient's mesopic pupillary size) and conventional treatment (non-customized) according to the manufacturer's recommendations.

After the ablation, the residual stromal bed was gently rinsed with balanced salt solution (BSS<sup>®</sup>, Alcon Laboratories Inc., Ft. Worth, TX) and the flap was repositioned over the stromal bed. Antibiotic drops (ciprofloxacin 3mg/mL, Oftacilox<sup>®</sup>, Alcon Cusí, Barcelona, Spain) and non-steroidal anti-inflammatory eyedrops (ketorolac trometamol 5 mg/mL, Acular<sup>®</sup>, Allergan, Madrid, Spain) were instilled before the speculum was removed.

### **Postoperative follow-up**

Ciprofloxacin 3mg/mL and steroid drops (dexamethasone alcohol 1 mg/mL, Maxidex<sup>®</sup>, Alcon Cusí, Barcelona, Spain) were prescribed four times daily during the first postoperative week and preservative-free artificial tears were applied as needed.

All patients were examined at 1 day, 1 week, 1 and 3 months postoperatively by two experienced masked optometrists who recorded UDVA and CDVA in the same room using the same light adjusted to mesopic conditions. At the 3-month visit, a complete ocular examination was performed, including manifest residual refraction, CDVA and topography.

### **Statistical analysis**

Statistical analysis was performed with the "Statview SE + Graphics" program (Abacus Concepts Inc., Berkeley, CA, USA) for Macintosh.

Visual acuity measurements were performed in decimal scale (Snellen quotation) but were converted to LogMAR quotation for the statistical analysis using a conversion chart.

The Kolmogorov-Smirnov test was used to test normality and factorial ANOVA was used for multiple comparisons analysis. Intra-group linear regression analysis was performed. Ninety-five percent confidence intervals (CIs) were set up and P values < 0.05 were considered statistically significant.

## **Results**

Five hundred fifty myopic eyes were included and were allocated in 4 refraction-matched groups: 134 eyes were allocated to group IL, 112 eyes to group Z, 206 eyes to group F, and 98 eyes to group H. The preoperative sphere and cylinder were matched within ± 0.50 diopters (D) between groups.

Preoperative data are shown in TABLE 1; preoperative sphere range was -0.75D to -7.75D, and cylinder was ≤ -4.5D. Some statistically significant differences were found in terms of CDVA, keratometry and age, due to a large sample size of the study. Nevertheless, CDVA was ≥ 1.0 (decimal) in all patients preoperatively, and the mean age of the sample was younger than 40 years; therefore, these differences were considered not to be clinically relevant.

Statistically significant differences in UDVA (both in Decimal and LogMAR notations) were noted among the groups in the 1-day and 1-week postoperative visits (eyes in group F had lower UDVA than all other groups, P=0.001), but these differences were not significant at the 1-month and 3-month postoperative visits (TABLE 2). Similarly, no statistically significant differences in CDVA were found among groups at the 3-month postoperative visit (TABLE 3).

The myopic residual sphere in eyes of group F was significantly higher (P=0.0001) compared to eyes of the rest of the groups (TABLE 3). The residual cylinder in eyes of group F reached emmetropia, while pairwise comparisons revealed that there was statistically significant difference in residual cylinder only for the

comparison between eyes of group IL and group F ( $P=0.02$ , TABLE 3).

FIGURE A depicts UDVA data three months after surgery. The mean change in lines between preoperative and postoperative CDVA for the groups is shown in TABLE 3.

The efficacy index was similar in all groups, but a tendency for significance was detected between eyes in group F versus those in group IL and versus those in group H (TABLE 3). Regarding the safety index, statistically significant differences were found between eyes in group F versus those in group IL and group H ( $P=0.0001$ ). No statistically significant differences in the safety index were detected between eyes in groups F and Z (TABLE 3). None of the patients lost more than 2 lines of CDVA. Other changes in lines of CDVA are summarized in FIGURE B.

The predictability of residual spherical equivalent (SE) within 1.0 D and within 0.5 D was similar ( $P=0.04$  and  $P=0.5$ , respectively) among the groups (FIGURE D).

Linear regression analysis showed a positive, statistically significant relationship between preoperative SE and the effectively corrected refraction in all groups (FIGURE C).

## Discussion

We found a slight delay in visual recovery after myopic LASIK in eyes of group F in the early follow up visits. This delay was statistically significant at 1 day and 1 week postoperatively, but there were no differences from the 1-month visit onwards.

In all groups, visual acuity improved throughout the follow up visits. Eyes in group Z achieved better UDVA with minimal standard deviation in all visits, except the third month visit where it was surpassed by F device. In accord with this finding, a slightly higher efficacy index was noted for eyes in the F group.

Several studies have been published comparing the use of femtosecond lasers versus MMs<sup>1,2,4,6,7,13,17-20</sup>. The existing evidence suggests that femtosecond lasers are at least comparable to MMs<sup>5</sup>, or even superior in terms of predictability<sup>2</sup>, visual restoration<sup>13</sup>, flap morphology<sup>5</sup>, higher order aberrations<sup>1</sup> and intraoperative safety profile.<sup>2,5</sup>

Refractive and visual outcomes after IntraLase LASIK have been reported by numerous groups. Compared to some of the published series, the eyes in our group IL achieved similar<sup>21</sup> or better results<sup>12,22</sup>. Similarly, the eyes in our groups F and Z achieved similar<sup>23-25</sup> or better<sup>26,27</sup> results than those reported in previous series.

TABLE 4 summarizes previous publications that report results with two or more of the microkeratomes that were studied in the current paper<sup>3,4,6-9,17-20,28-34</sup>. The disparity of results presented in TABLE 4 can be explained by the fact that numerous parameters (magnitude of ametropia treated, study design, length of follow-up, version of the femtosecond device, excimer laser used, etc.) can affect final refractive outcomes. Consequently, it is precarious to draw conclusions on the performance of different platforms from studies with different methodologies and patient populations. Our study allows a more accurate comparison of the devices as a number of biases were avoided, because all operations were performed by two experienced refractive surgeons following the same surgical protocol with the same excimer laser in operating rooms with identical temperature and humidity levels<sup>35,36</sup>. Additionally, all patients received an identical postoperative eye drop regimen. Although statistically significant differences were found in preoperative CDVA among groups, spherical and cylindrical refraction was matched within 0.5 D in order to minimize bias. To avoid the recruitment of participants with presbyopia and its influence on postoperative refractive and visual outcomes, only patients younger than 40 years were included.

In addition to using the same excimer laser in all surgeries, we were able to obtain a more accurate description of each microkeratome results during the first 3 postoperative months. While Z group provided the most homogeneous UDVA throughout the follow up visits and reached better CDVA at the 3 month visit, F group provided higher disparity of the results, been the ones that showed higher standard deviation in all the parameters studied, except in residual cylinder. Eyes in H group surpassed IL group results in terms of CDVA, UDVA, residual sphere and cylinder, but similar safety and efficacy index were found between them.

We can only speculate about the reasons explaining the slower improvement of visual acuity in eyes of group F. An initial in vitro study with the device that we used in group F found that the corneal flap thickness deviation was only  $\pm 10 \mu\text{m}$ <sup>37</sup>, but later studies reported greater deviations<sup>38</sup>. These variations might be related to transient tissue changes induced by the laser treatment, such as different degrees of flap or interface inflammation and/or edema, or ultrastructural changes in the stromal bed or flap not previously described, that may vary among different units of the same device.

One limitation of the current study is that a comparison of higher order aberrations between the platforms was not performed because such aberrometric data were unavailable in a significant proportion of participants. Such a comparison could be useful, as it could potentially discriminate safer devices for longer follow up periods.

The current study has highlighted interesting differences in the postoperative evolution of refractive characteristics in eyes treated with various microkeratomes. Further studies are warranted to better evaluate these particular clinical and refractive characteristics with different devices, as this knowledge could be valuable for the optimization of femtosecond technology.

## Conclusions

In conclusion, compared with the other microkeratomes, a transient delay in visual restoration after LASIK surgery with the femtosecond device used in group F of our study might be expected in the early follow up period.

## Abbreviations

BSS: balanced salt solution

CCT: Central corneal thickness

CDVA: corrected distance visual acuity

D: diopter

F: FS200 microkeratome

H: Hansatome microkeratome

IL: IntraLase microkeratome

LASIK: laser in situ keratomileusis

MM: Mechanical microkeratome

SE: spherical equivalent

UDVA: uncorrected distance visual acuity

Z: Femto LDV microkeratome

## Declarations

### Ethics approval and consent to participate

All patients provided informed consent, and the Institutional Review Board approval was obtained. The study was performed in accordance with the tenets of the Declaration of Helsinki.

### Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

### Competing interests

The authors declare that they have no competing interests.

### Funding

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## Tables

**TABLE 1.** Preoperative data for the groups.

Parameter	Group IL (n=134)	Group Z (n=112)	Group F (n=206)	Group H (n=98)	P-value
Sphere (D) (-0.75D to -7.75D)	-3.91±1.6	-3.93±1.8	-3.96±1.6	-3.51±1.0	0.1
Cylinder (D) (≤ -4.5D)	-0.68±0.67	-0.75±0.78	-0.65±0.64	-0.56±0.55	0.2
CDVA (LogMAR)	-0.07±0.01	-0.07±0.02	-0.05±0.05	-0.08±0.03	0.0001
CDVA (Decimal)	1.18±0.0	1.18±0.1	1.13±0.1	1.21±0.1	0.001
CCT (µm)	551.67±28.3	557.16±27.7	552.17±26.7	557.67±28.1	0.2
Keratometry K1 (D)	43.04±1.5	42.59±1.4	43.49±1.3	42.60±1.3	0.0001
Keratometry K2 (D)	43.88±1.6	43.33±1.5	44.47±1.4	42.23±1.5	0.0001
Age (years)	31.03±5.05	29.59±5.4	31.61±6.1	31.42±5.0	0.01

Results are presented as mean ± standard deviation. CDVA = corrected distance visual acuity; CCT = central corneal thickness; D = diopters.

**TABLE 2.** Uncorrected distance visual acuity (UDVA) evolution up to three-months postoperatively for the groups.

Parameter	Follow-up visit	Group IL (n=134)	Group Z (n=112)	Group F (n=206)	Group H (n=98)	P-value
UDVA (Decimal)	1 day	1.04±0.1	1.08±0.1	0.95±0.2	1.01±0.1	0.0001
	1 week	1.08±0.1	1.13±0.1	0.94±0.2	1.07±0.2	0.0001
	1 month	1.07±0.1	1.14±0.1	1.11±0.2	1.12±0.1	0.2
	3 months	1.12±0.1	1.18±0.1	1.2±0.8	1.15±0.1	0.5
UDVA (LogMAR)	1 day	-0.01±0.1	-0.02±0.1	0.03±0.1	-0.00±0.1	0.0001
	1 week	-0.03±0.05	-0.05±0.04	0.03±0.1	-0.02±0.1	0.0001
	1 month	-0.02±0.6	-0.05±0.03	-0.04±0.1	-0.05±0.05	0.2
	3 months	-0.05±0.05	-0.07±0.04	-0.05±0.1	-0.06±0.04	0.1

Results are presented as mean ± standard deviation. UDVA= Uncorrected distance visual acuity

**TABLE 3.** Three-months postoperative outcomes for the groups.

Parameter	Group IL (n=134)	Group Z (n=112)	Group F (n=206)	Group H (n=98)	P-value
Residual Sphere (D)	-0.01±0.1	0.02±0.1	-0.07±0.2	0.005±0.1	0.0001
Residual Cylinder (D)	-0.03±0.2	-0.02±0.1	0.00±0.00	-0.01±0.1	0.02
CDVA (LogMAR)	-0.05±0.04	-0.07±0.04	-0.06±0.06	-0.06±0.04	0.08
CDVA (Decimal)	1.14±0.1	1.18±0.1	1.16±0.2	1.15±0.1	0.1
Efficacy index	0.95±0.1	1.00±0.1	1.06±0.7	0.95±0.1	0.05
Safety index	0.96±0.1	1.00±0.1	1.04±0.2	0.95±0.1	0.0001
Change in lines of CDVA	-0.02±0.1	-0.001±0.1	0.008±0.1	-0.03±0.1	0.0001

Results are presented as mean ± standard deviation. CDVA = corrected distance visual acuity; D = diopters.

**TABLE 4:** Comparative publications among different microkeratomes for LASIK performance

	Study Design	Devices	Decimal UCVA	LogMAR UCVA	Efficacy Index	Residual sphere	Residual cylinder	Decimal CDVA	LogMAR CDVA	Security Index	SE ±0.5
Our data	Retrospective, 550 eyes  Full range myopia  3 months follow up (FU)	Hansatome  Intralase  FS200  FemtoLDV  <i>Allegretto 400Hz</i>	No differences were found	No differences were found	Trend towards FS200 higher than Hansatome and Intralase	FS200 worse than the others	FS200 better than Intralase	No differences were found	No differences were found	FS200 better than Intralase and Hansatome	No differences were found
<b>INTRALASE VS HANSATOME</b>											
(4) Kezirian GM et al. JCRS 2004; 30:804-11	Prospective  375 eyes  Full range myopia  3 months FU	Intralase  Hansatome  Carriazo-Barraquer  <i>VisxS3</i>		No differences were found						IntraLase better in low-moderate myopia	
(8) Tran DB et al. JCRS 2005;31:97-106	Prospective  18 eyes  Low-Moderate myopia  3 months FU	IntraLase  Hansatome  <i>Technolas 217a</i>		No differences were found	Intralase better than Hansatome						
(9) Durrie DS et al. JCRS 2005;31:120-6	Prospective  102 eyes  Full range myopia  3 months FU	IntraLase  Hansatome  <i>LADAR 4000</i>		IntraLase better than Hansatome		IntraLase better than Hansatome	IntraLase better than Hansatome				No differences were found
(17) Lim T et al. AJO 2006;141:833-9	Non randomized  55 eyes  Full range myopia  3 months FU	IntraLase  Hansatome  <i>Technolas 217z</i>				No differences were found					
(18) Patel SV et al. Ophthalmology 2007; 114:1482-90	Prospective  44 eyes  Full range myopia  6 months FU	IntraLase 15kHz  Hansatome  <i>VisxS4</i>		No differences were found							
(7) Medeiros WF et al. JRS 2007; 23:880-7	Retrospective  410 eyes  Full range myopia  3 months FU	IntraLase 15kHz & 30 kHz  Moria M2  Hansatome  <i>LADAR 4000</i>				Intralase better than Hansatome	Intralase better than Hansatome				
(6) Chan A et al. Arch Ophthalmol 2008;126:1484-90	Prospective  43 eyes  Low-moderate myopia  12 months FU	IntraLase 15kHz  Hansatome  <i>Visx Star S4</i>		No differences were found	No differences were found	No differences were found					No differences were found
(19) Rosa AM et al. JCRS 2009;35:833-8	Prospective  80 eyes	IntraLase 60kHz		Similar, but without statistical		Similar, but without statistical					

	Full range myopia 3 months FU	Hansatome zero compression  Zyoptix XP  <i>Technolas z100</i>  <i>LADAR 6000</i>		analysis published		analysis published					
(3) Moshirfar M et al. JCRS 2010;36:1925-33	Retrospective 1798 eyes Full range myopia 18 months FU	IntraLase 60kHz  Hansatome zero compression							No differences were found		
(20) Calvo R et al. AJO 2010;149:785-93	Prospective 42 eyes Full range myopia 36 months FU	IntraLase 15kHz  Hansatome  <i>Visx Star S4</i>		No differences were found		No differences were found	No differences were found		No differences were found		

	Study Design	Devices	Decimal UCVA	LogMAR UCVA	Efficacy Index	Residual sphere	Residual cylinder	Decimal CDVA	Log MAR CDVA	Security Index	SE ±0
Our data	Retrospective 550 eyes  Full range myopia  3 months follow up (FU)	Hansatome  IntraLase  FS200  FemtoLDV  <i>Allegretto 400Hz</i>	No differences were found	No differences were found	Trend towards FS200 higher than Hansatome and IntraLase	FS200 worse than the others	FS200 better than IntraLase	No differences were found	No differences were found	FS200 better than IntraLase and Hansatome	No differences were found
<b>FS200 VS HANSATOME</b>											
(28) Shetty R et al. JRS 2012;28:S815-20	Prospective 60 eyes  Flap morphology features, no refractive results	FS200  Hansatome  <i>Allegretto EX500</i>									
<b>FEMTO LDV VS HANSATOME</b>											
(29) Zhang X et al. Int J Ophthalmol 2012;5:69-73	Prospective 50 eyes  Full range myopia  1 month	Femto LDV  Hansatome  <i>Technolas 217</i>		No differences were found							Similar but without statistical analysis published
(30) Hashimoto AR et al. Arq Bras Oftalmol 2013;76:335-8	32 eyes  Low-moderate myopia  Hyperopia  3 months	Femto LDV  Hansatome  <i>Allegretto 400Hz</i>		No differences were found	Similar, but without statistical analysis published						
<b>INTRALASE VS FS200</b>											
(31) Liu Q et al. In J Ophthalmol 2016;9:1006-10	Prospective 400 eyes  Full range myopia  1 week	FS200  IntraLase FS60		FS200 better than IntraLase		No differences were found					
(32) Meidani A et al. Clin Ophthalmol 2016;10:1639-46	Prospective 28 eyes  Full range myopia  6 months	IntraLase FS60+Visx Star S4  FS200+Allegretto EX500		No differences were found		No differences were found					No differences were found
<b>INTRALASE VS FEMTO LDV</b>											
(33) Tomita M et al. JRS 2012;28:25-30	Retrospective 400 eyes  Full range myopia  3 months	FemtoLDV  IntraLase FS60  <i>Allegretto 400Hz</i>	No differences were found		No differences were found	No differences were found			No differences were found	Femto LDV superior to IntraLase	No differences were found
(34) Tomita M et al. Clin Ophthalmol 2013;7:1365-71	Prospective 818 eyes	FemtoLDV  IntraLase FS60  <i>Allegretto 400Hz</i>		IntraLase superior to Femto LDV, but without statistical analysis published	No differences were found	Similar, but without statistical analysis published				IntraLase better than Femto LDV, but without statistical analysis published	
(13) Ahn H et al. JCRS 2011;37:349-57	Retrospective 206 eyes  2 months	FemtoLDV  IntraLase FS60  Visumax  Moria M2						No differences were found			

### Figures

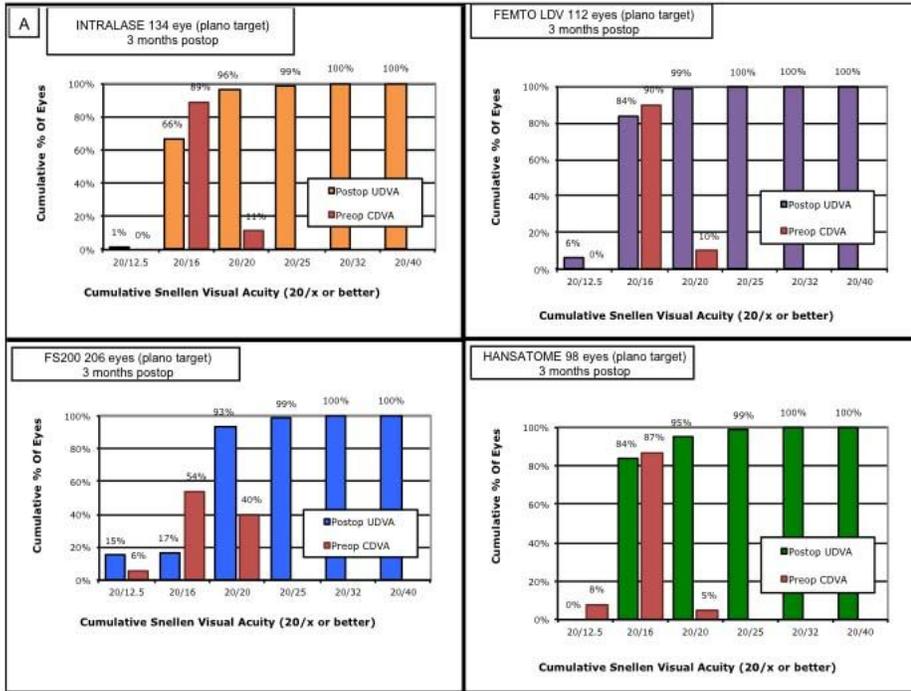


Figure 1

Figure A. Cumulative histogram of uncorrected distance visual acuity three months after myopic LASIK for the study groups.

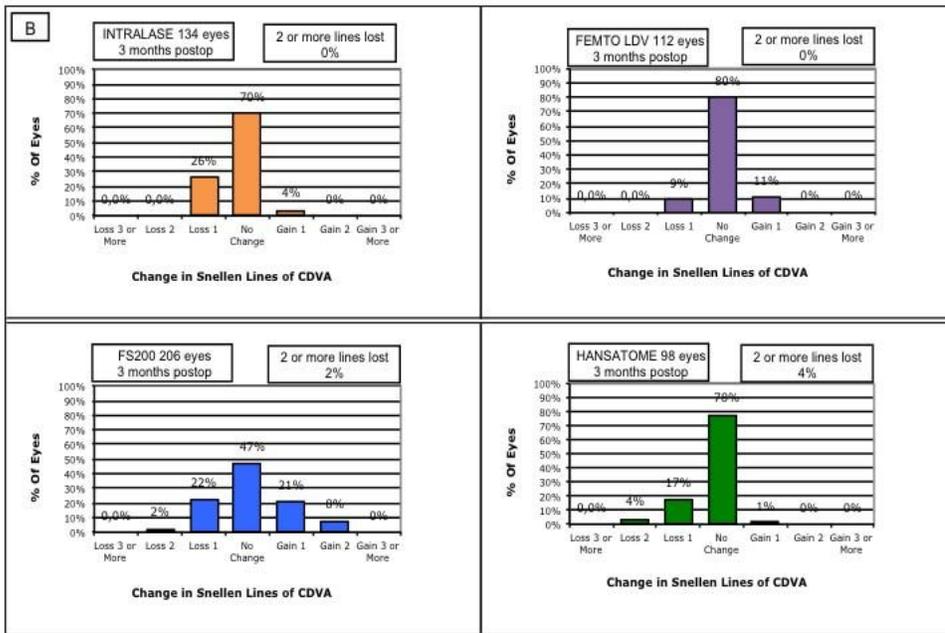


Figure 2

Figure B. Changes in lines of corrected distance visual acuity 3 months after myopic LASIK for the study groups.

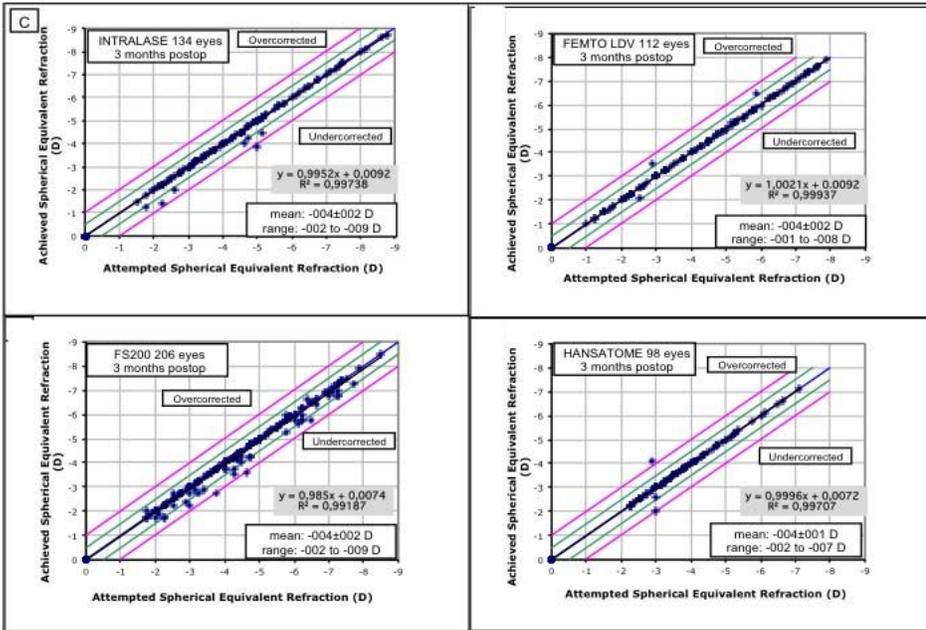


Figure 3  
 Figure C. Attempted versus achieved spherical equivalent refraction scatterplots 3 months after LASIK for myopia correction for the study groups. The linear regression equation and coefficient of determination (r<sup>2</sup>) are displayed.

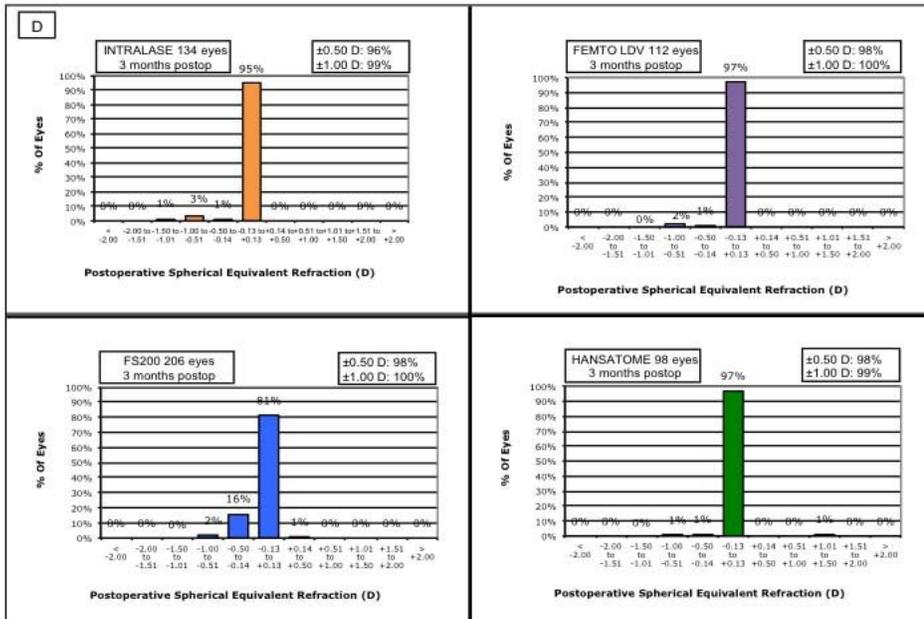


Figure 4  
 Figure D. Three months predictability (spherical equivalent  $\pm 0.5$ D and spherical equivalent  $\pm 1$ D) after myopic LASIK for the groups. LASIK= Laser in situ Keratomileusis; UDVA= uncorrected distance visual acuity; CDVA= corrected distance visual acuity; SE= spherical equivalent.