Cyclotorsion compensation for treatment of Astigmatism in SMILE - An Update

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Financial Disclosure: The author is a consultant for Carl Zeiss Meditec

// IMPORTANT NOTE – *CUSTOMER SLIDE*

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INTRODUCTION

- In refractive surgery, the outcome of astigmatism correction has been shown to depend upon the accuracy of the axis treatment

- Rotational movement of the eye (cyclotorsion) static or dynamic

- Shift in the treatment axis leading to undesirable results like under correction and induction of aberrations(1,2).

Febbraro JL, Koch D. Detection of static cyclotorsion and compensation for dycyclotorsion in laser in situ keratomileusis, J Cataract Refract Surg 2010; 36:1718–1723

INTRODUCTION

- **Excimer laser platforms** can detect and compensate for cyclotorsion by advanced software and eye tracking
- **Numerous studies in LASIK-** Cyclotorsion compensation improved the accuracy of cylinder correction
- **All femtosecond, flapless small incision lenticule extraction (SMILE)** procedure for correction of myopic astigmatism- **lack of data**

Vector analysis of myopic astigmatism corrected by femtosecond refractive lenticule extraction

J Cataract Refract Surg 2013; 39:759–769 © 2013 ASCRS and ESCRS

Correction of Myopic Astigmatism With Small Incision Lenticule Extraction

Anders Ivarsen, MD, PhD; Jesper Hjortdal, MD, DMSc

[J Refract Surg. 2014;30(4):240-247.]

FLEX & SMILE - Effective for Astigmatic correction , however significant undercorrection was observed

? No compensation of torsional error due to absence of active eye tracker in Visumax FS Laser

Manual limbal markings versus iris-registration software for correction of myopic astigmatism by laser in situ keratomileusis

RESULTS: The mean preoperative spherical equivalent (SE) was −6.64 diopters (D) ± 1.99 (SD) in the limbal-marking group and −6.72 ± 1.86 D in the iris-registration group ($P = .92$). At 6 months, the mean SE was −0.42 ± 0.63 D and −0.47 ± 0.62 D, respectively ($P = .08$). There was no statistically significant difference between groups in the astigmatism correction, success, or flattening index values using 6-month postoperative refractive data. The angle of error was within ±10 degrees in 73% of eyes in the limbal-marking group and 75% of eyes in the iris-registration group.

CONCLUSION: Manual limbal markings and iris-registration software were equally effective and safe in LASIK for myopic astigmatism, showing that checking cyclotorsion by manual limbal markings is a safe alternative when automated systems are not available.

J Cataract Refract Surg 2010; 36:431–436

CLINICAL STUDY

PURPOSE : Incidence and results of cyclotorsion compensation in patients undergoing SMILE correction for clinically significant myopic astigmatism

INCLUSION CRITERIA: Eligible patients age (21- to 40 years) for SMILE with Spherical Equivalent(SE) between -3 to -10 D with a manifest cylinder of at least -1.00 D.

- Prospective, randomised clinical study (143 subjects)

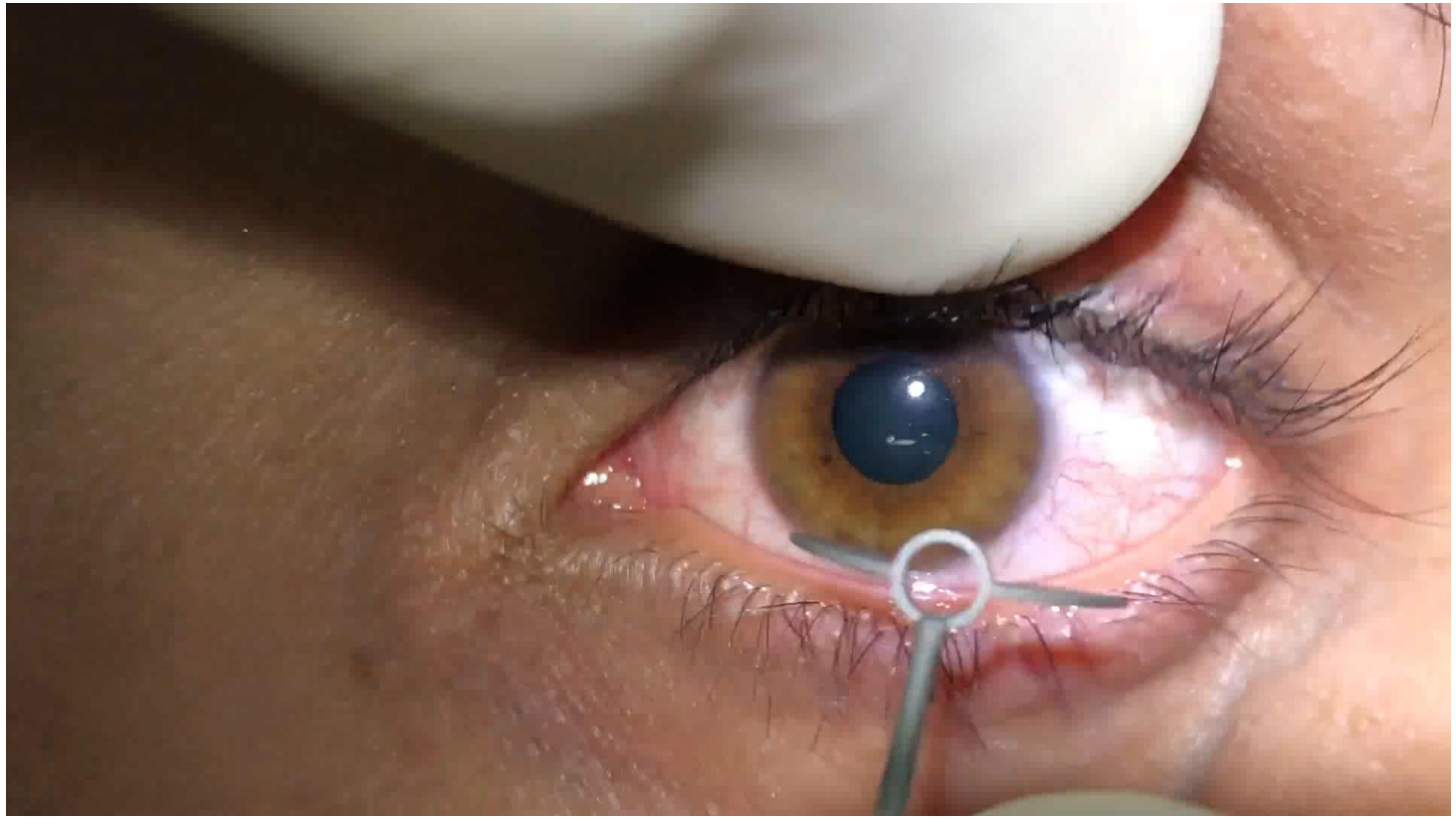
Two groups:

- No compensation group (n=72 eyes)
- Compensation group(n=71 eyes)

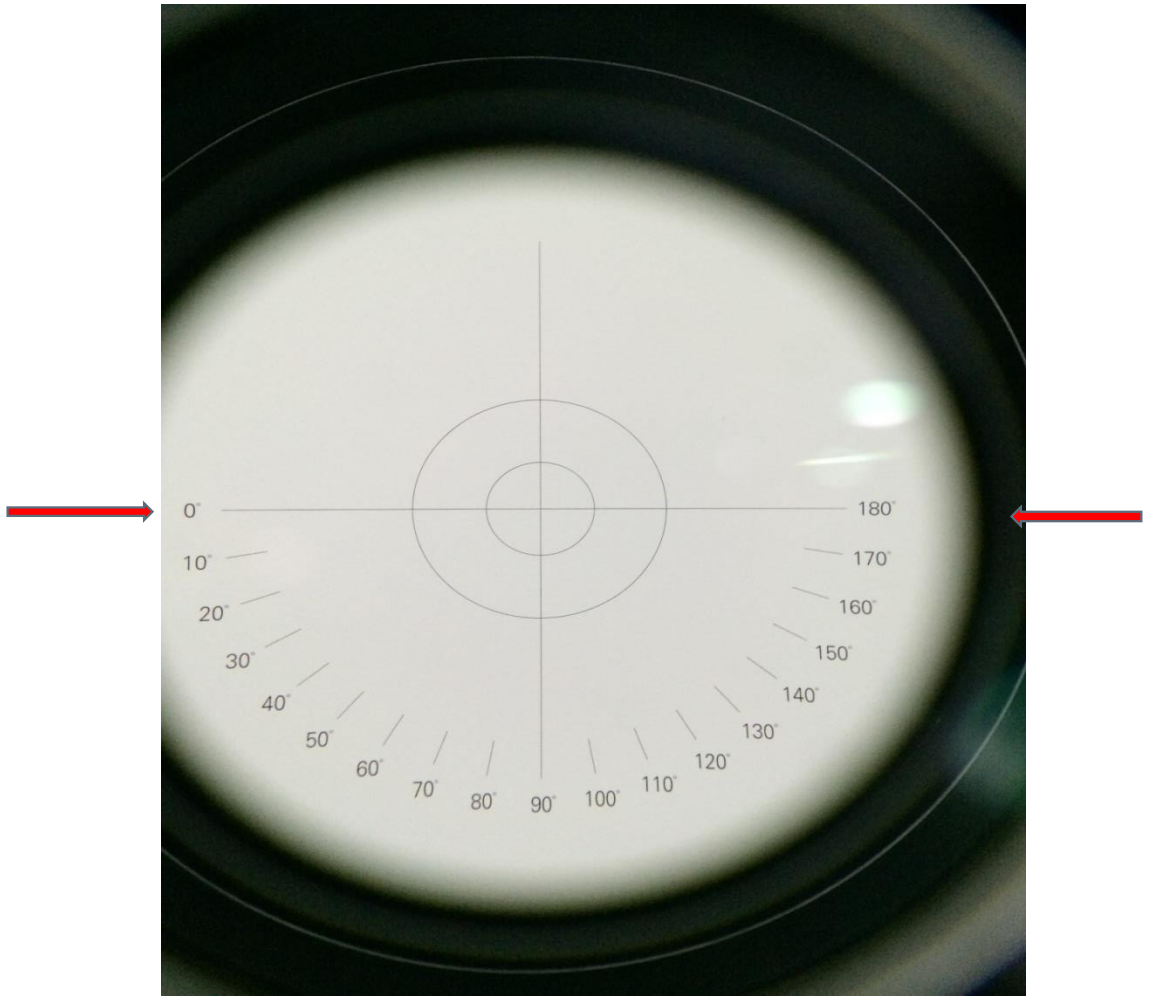
Mean follow up=6 months

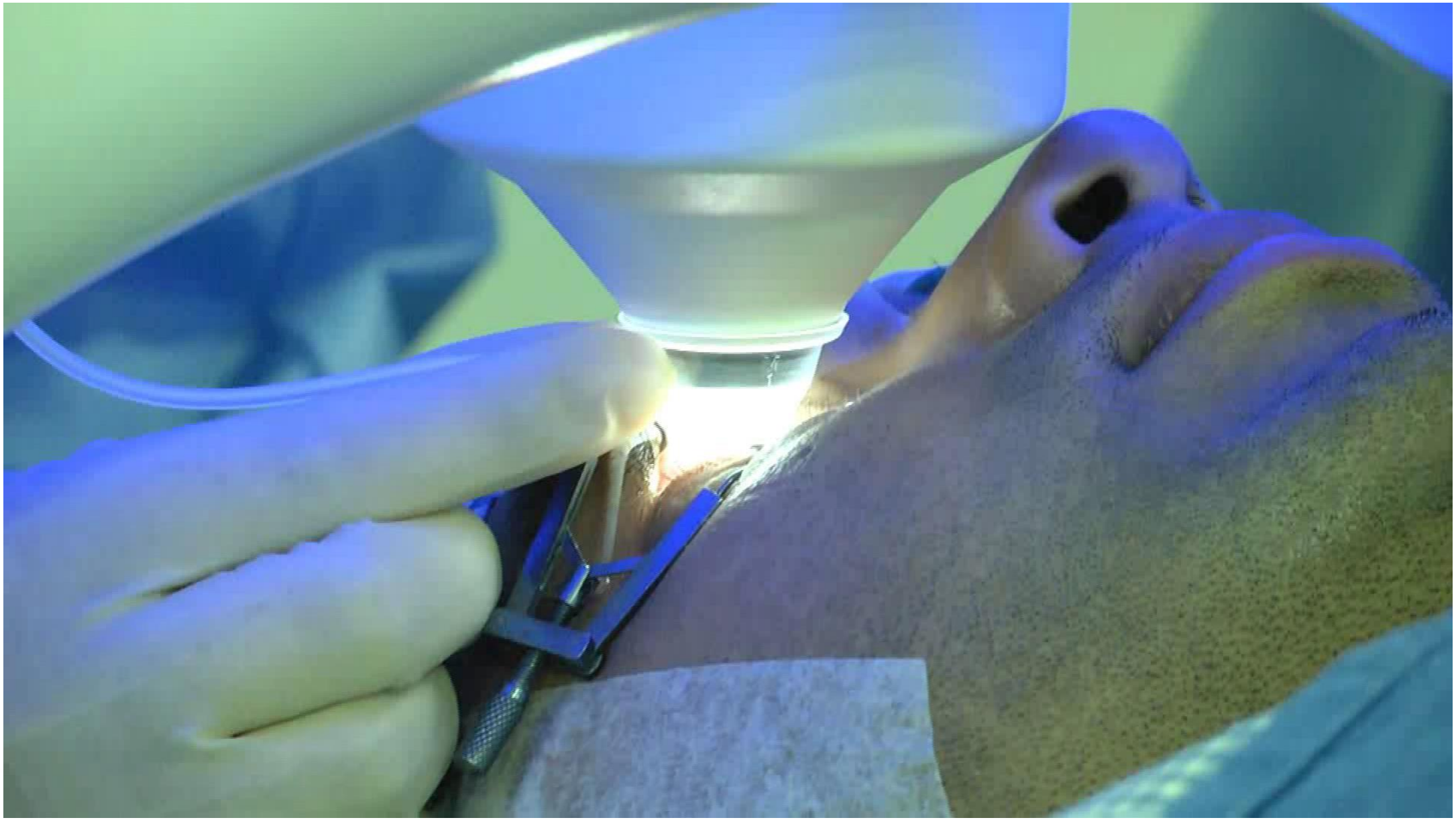
METHOD OF MANUAL CYCLOTORSION COMPENSATION

- Preoperative 0-180 degree marking : using Akahoshi marker under TA on slit lamp in upright position
- Patient positioned under the Visumax laser
- Instructed to look into the green flashing fixation light



- Eye docked
- Suction applied
- Any cylotorsion(excyclo/ incyclo) measured in degrees by noting the relative position of the limbal marks in relation to the 0-180 degree axis of the reticule (right eye piece)
- Cone rotated to align the two





PRE-OPERATIVE DATA

	No compensation	Compensation group	P-value
NO OF EYES	72	71	P=0.45
Age (years)	27.96	26.81	P=0.34
Mean SE(D)	-5.01 ± 2.45	-5.14 ± 2.27	P=0.56
Mean Cylinder(D)	-2.09 ± 0.50	-2.46 ± 0.70	P=0.78

INTRAOP CYCLOTORSION

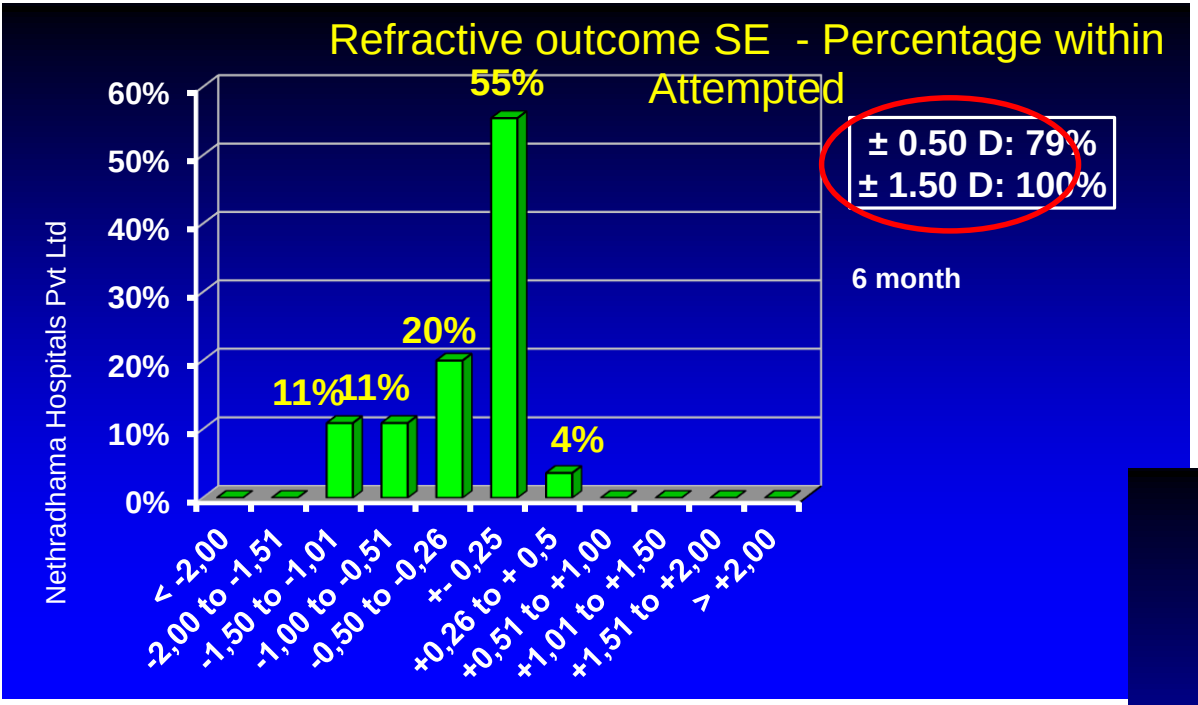
- **Mean cyclotorsion: 5.64 ± 2.55 (range 2-12)degrees**

- **Incidence of cyclotorsion: 88%**
- Incyclotorsion : 44% eyes
- Excyclotorsion : 38% eyes
- No cyclotorsion: 18% eyes

Magnitude of cyclotorsion:

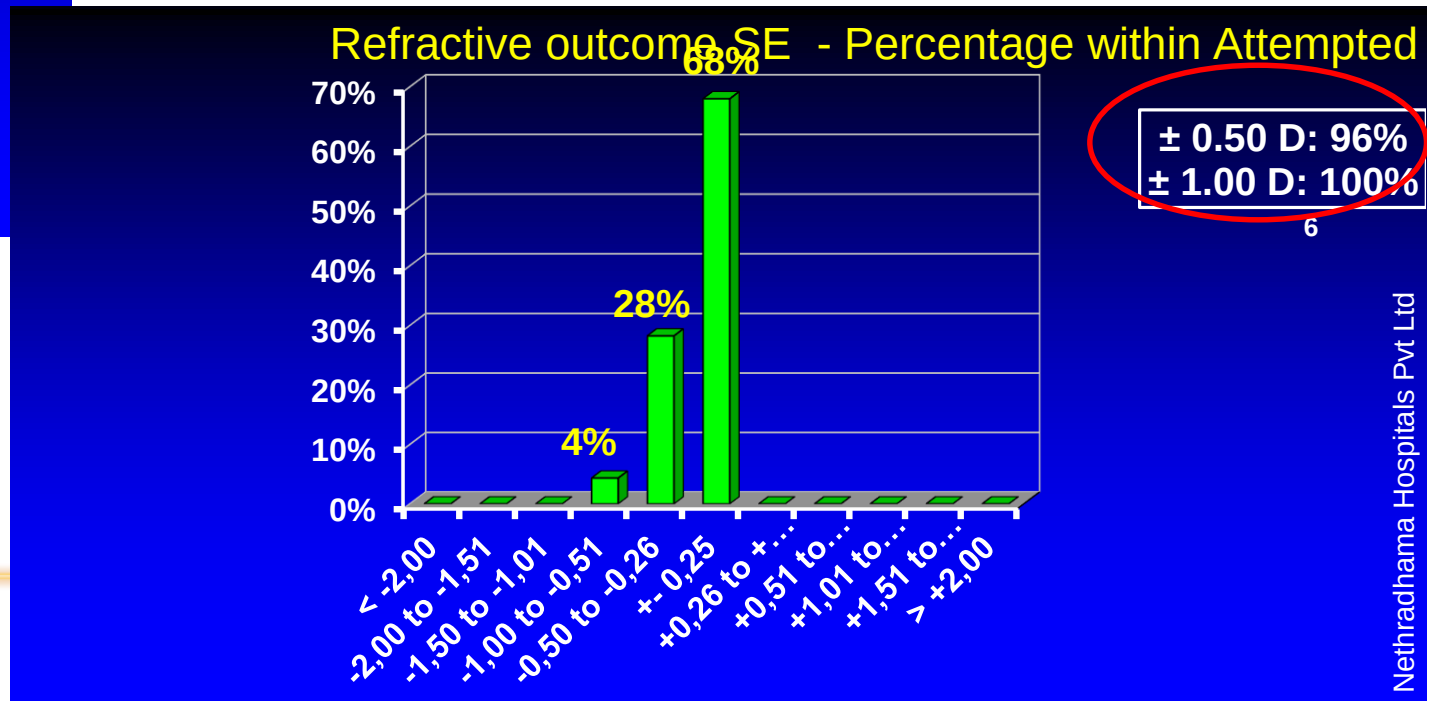
- **≤5° in 81%**
- **6-10° in 17.6%**
- **≥ 10 degrees in 1.2% of eyes**

PREDICTABILITY AT 6 Months



NO COMPENSATION GROUP

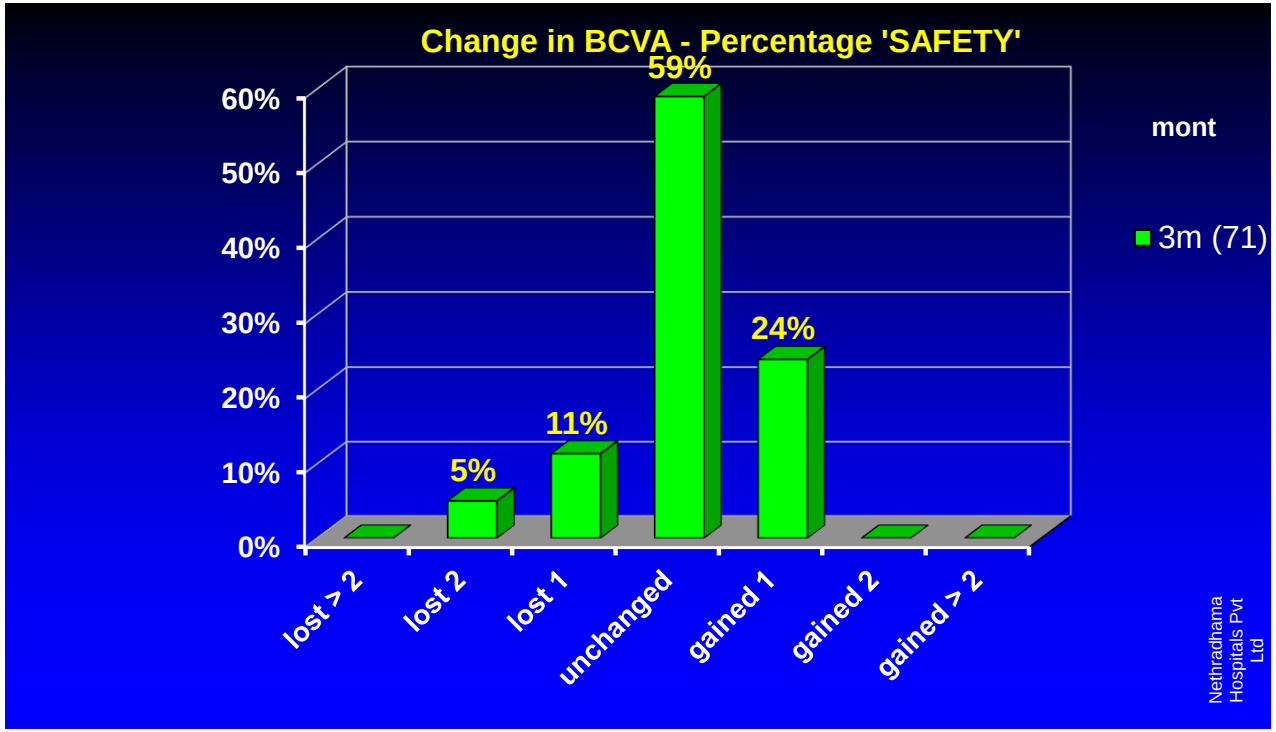
COMPENSATION GROUP



SAFETY/CHANGE IN BCVA

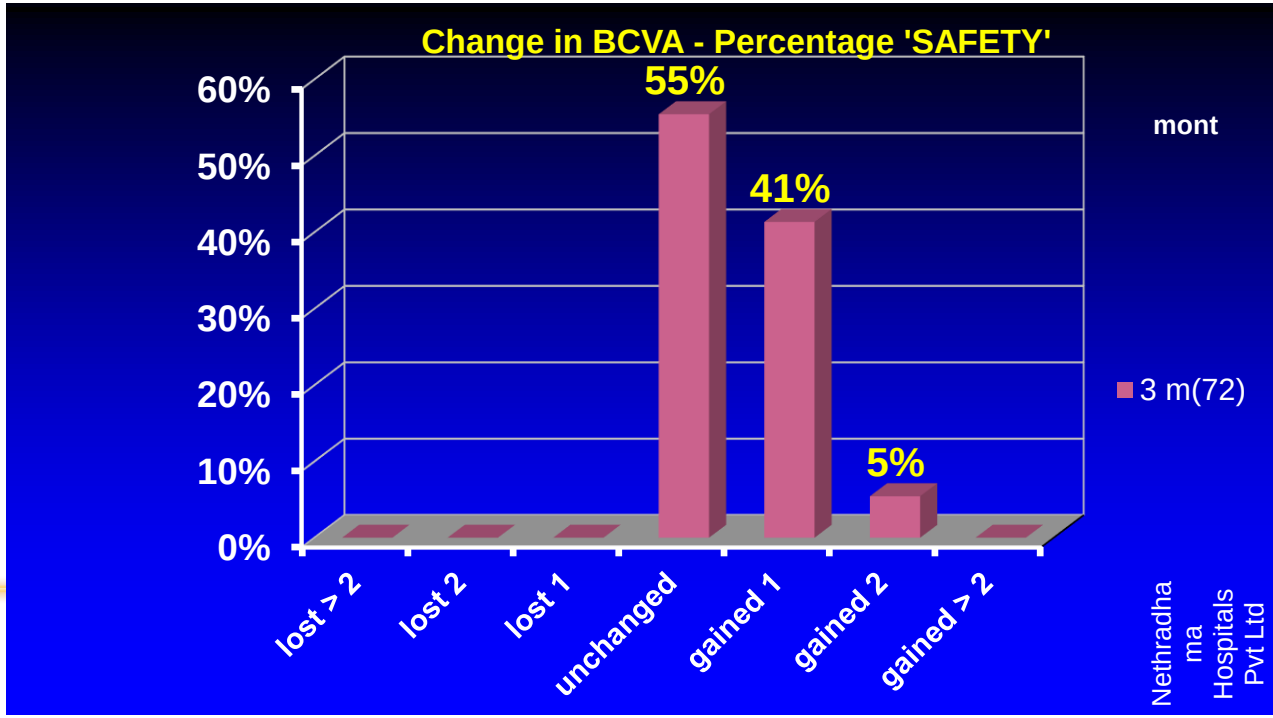
(NO COMPENSATION GROUP)

24 % EYES GAINED 1 LINE, 11% LOST 1 LINE, 5% LOST 2 LINES

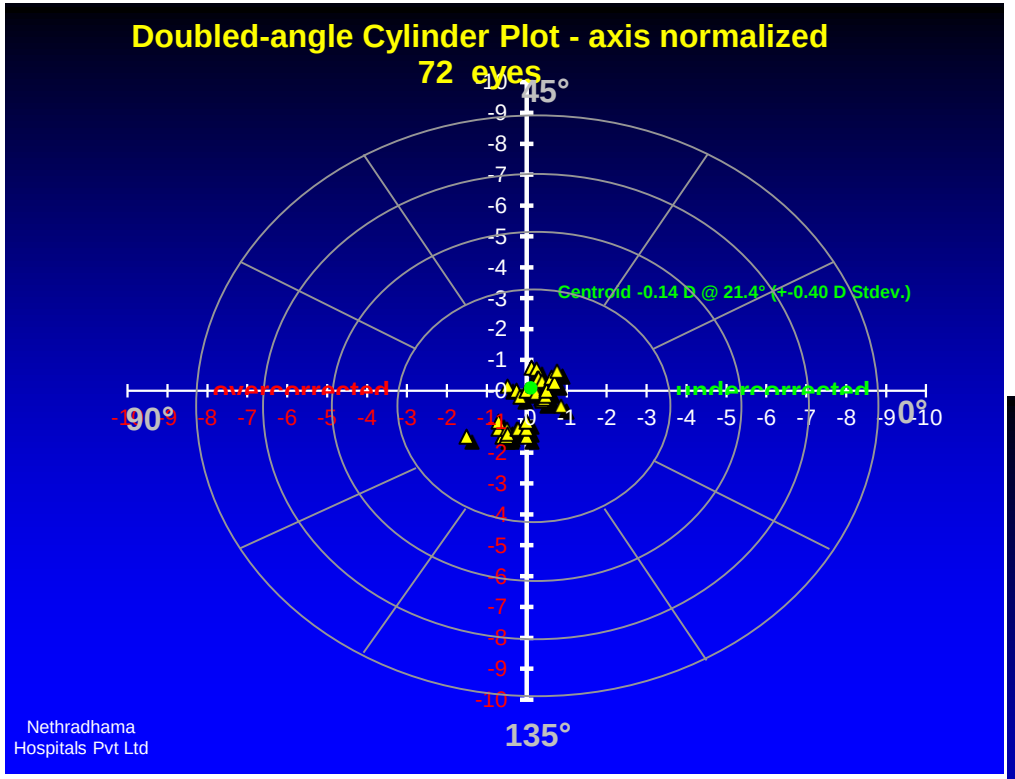


(COMPENSATION GROUP)

46% EYES GAINED 1 OR MORE LINES, NO EYE LOST LINES OF BCVA

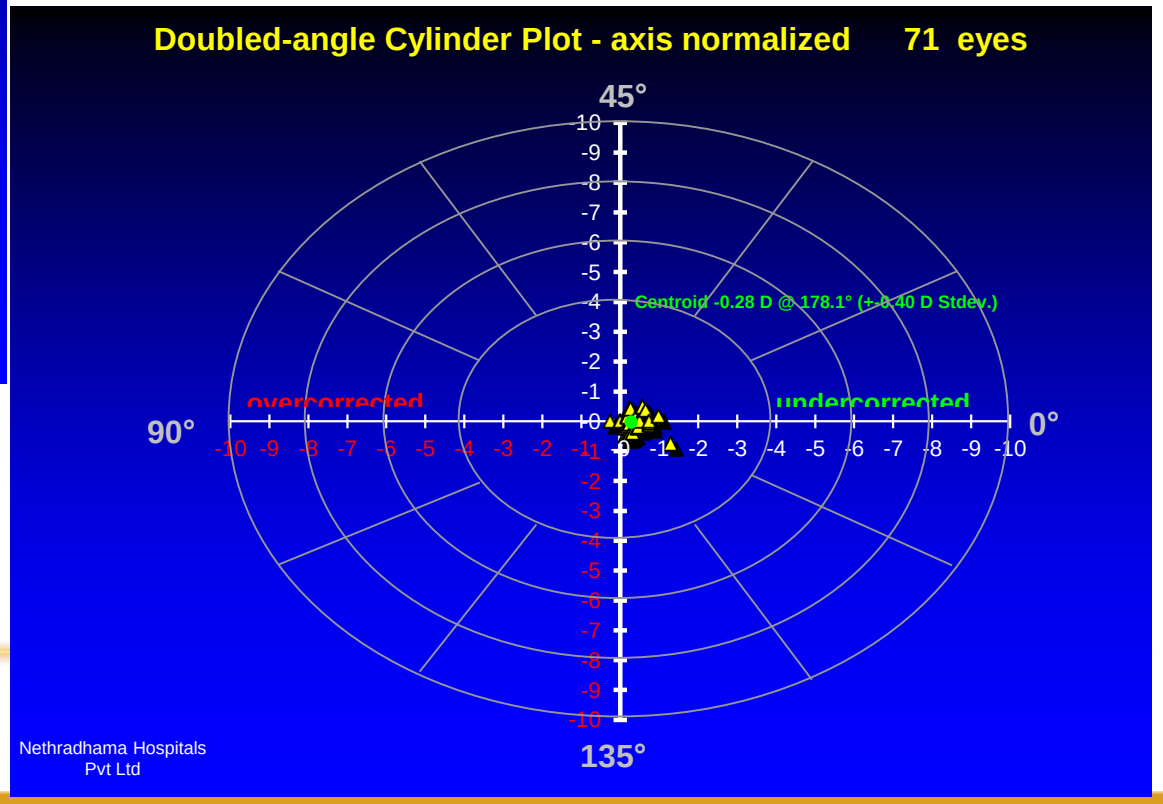


ACCURACY OF CORRECTION



← No Compensation group

Compensation group →



STABILITY OF CYLINDER CORRECTION

	No compensation group	Compensation group	P-value
No. of Eyes	72	71	P=0.45
Mean Cylinder(D) (Pre)	-2.09 ± 0.50	-2.46 ± 0.70	P=0.78
2 weeks	-0.65±0.21	-0.21±0.32	P=0.047
6 months	-0.61 ± 0.40	-0.25 ± 0.23	P=0.038

CONCLUSION

- Magnitude of intra-op cyclotorsion : **upto 15-20 degrees**
- **Important to compensate** for cyclotorsion
- Significantly better outcomes achieved for astigmatism correction in cyclotorsion compensation compared to non-compensation group
- **Manual compensation of cyclotorsion – safe and effective method to improve outcomes of SMILE** in eyes with significant astigmatism.

THANK YOU