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EXPANDING VISION

VISUAL AND REFRACTIVE OUTCOMES OF COMBINED EXCIMER LASER ABLATION WITH ACCELERATED CORNEAL COLLAGEN CROSS-LINKING IN SUBCLINICAL KERATOCONUS

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- No financial to be disclosed

Introduction

- Laser in situ keratomileusis (LASIK) is contraindicated in patients with subclinical keratoconus, due to the high risk of progression to manifest keratectasia.
- While these patients could be offered photorefractive keratectomy (PRK)[1], the risk of progression to keratoconus after PRK still prevails.
    - As such, excimer laser ablation procedures are typically avoided in eyes with subclinical keratoconus.
- Corneal collagen cross-linking (CXL) mediated by riboflavin and UVA is a safe and efficacious procedure in halting the progression of keratoconus.
- Combining topography-guided PRK with CXL potentially decreases corneal irregularity, improves visual acuity, and, at the same time halts the progression of keratoconus.

1. Reznik et al. J Refract Surg 2008.

Purpose

- To evaluate visual, refractive, and safety outcomes of combined, same day topography-guided PRK followed by accelerated CXL in patients with subclinical keratoconus.

Methods

STUDY DESIGN

Retrospective.

RECRUITMENT CRITERIA

Subclinical keratoconus patients aged >18 years exhibiting stable corneal topography and refraction for at least 1 year; estimated residual bed thickness >350 µm.

STUDY POPULATION

75 consecutive patients (140 eyes) who underwent simultaneous topography-guided PRK with accelerated CXL (2.7 J/cm^2) between January 2011 and February 2013 and completed 10-year follow-up.

OUTCOME MEASURES

Uncorrected and corrected visual acuity (UDVA, CDVA), manifest refraction, and keratometry measured at baseline and at 1, 3, 6, and 12 months postoperatively.

Results: Summary Statistics

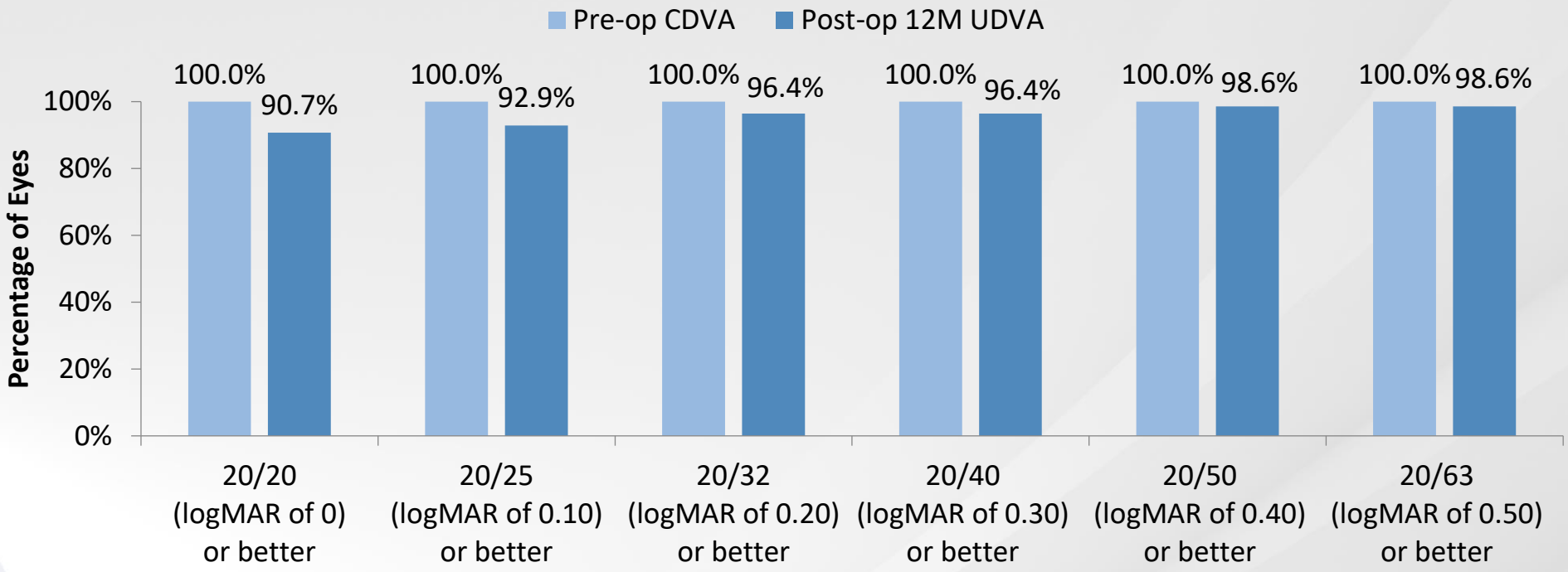
All refractive, keratometric, and uncorrected visual acuity parameters showed a statistically significant improvement from baseline to postop 12 months.

Parameters (N = 140)	Preoperative (Mean ± SD)	Postoperative (Mean ± SD)			
		1 month	3 months	6 months	12 months
UDVA (logMAR)	0.30 ± 0.39	0.03 ± 0.10	0.05 ± 0.17	0.04 ± 0.15	0.03 ± 0.11
CDVA (logMAR)	0.00 ± 0.00	0.03 ± 0.09	0.04 ± 0.17	0.04 ± 0.15	0.03 ± 0.11
Flat K (D)	44.05 ± 1.74	41.17 ± 4.09	41.54 ± 2.00	41.50 ± 2.08	41.53 ± 2.04
Steep K (D)	45.31 ± 1.67	42.33 ± 4.21	42.44 ± 2.03	42.34 ± 2.02	42.25 ± 2.09
Average K (D)	44.68 ± 1.63	41.75 ± 4.14	41.99 ± 2.01	41.92 ± 2.01	41.89 ± 2.06
Corneal Astigmatism (D)	1.26 ± 0.96	1.16 ± 0.71	0.90 ± 0.45	0.85 ± 0.75	0.72 ± 0.44
Refractive Cylinder (D)	−0.89 ± 0.71	-0.61 ± 0.42	−0.44 ± 0.36	−0.30 ± 0.35	−0.17 ± 0.32

N: Number of eyes; CDVA: Corrected distance visual acuity; UDVA: Uncorrected distance visual acuity; K: Keratometry; logMAR: Logarithm of the minimum angle of resolution; SD: Standard deviation.

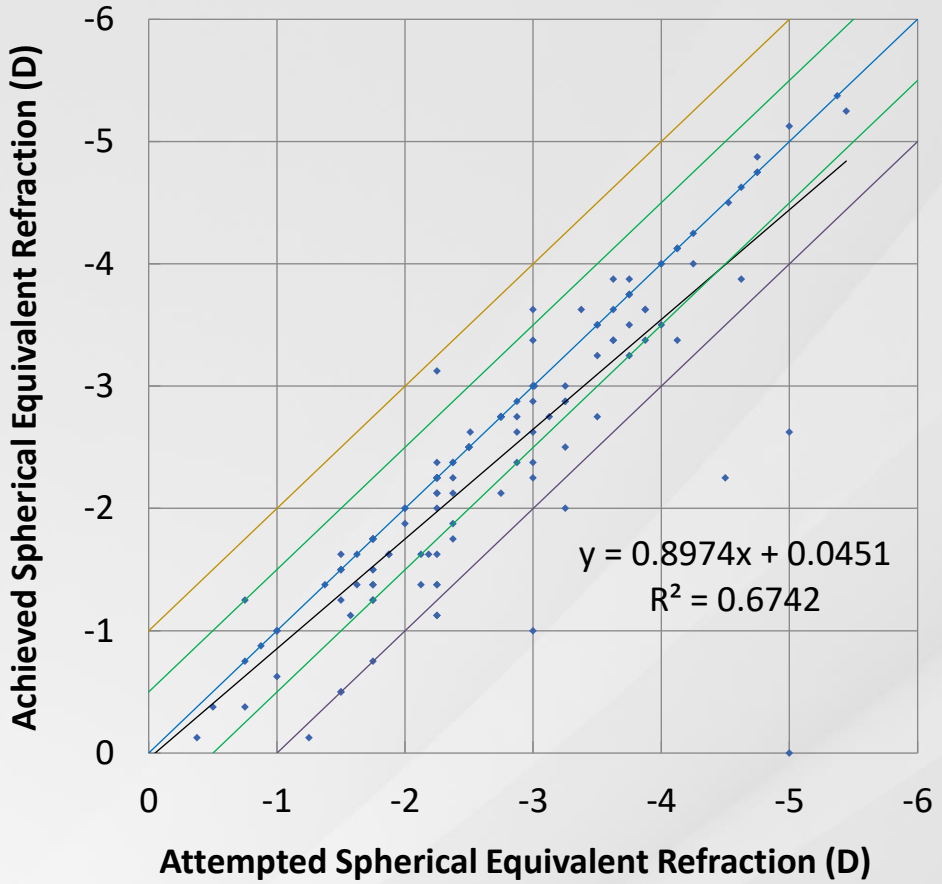
Results: Efficacy

- At postoperative 12 months, 92.9% of eyes achieved UDVA of 20/25 or better.



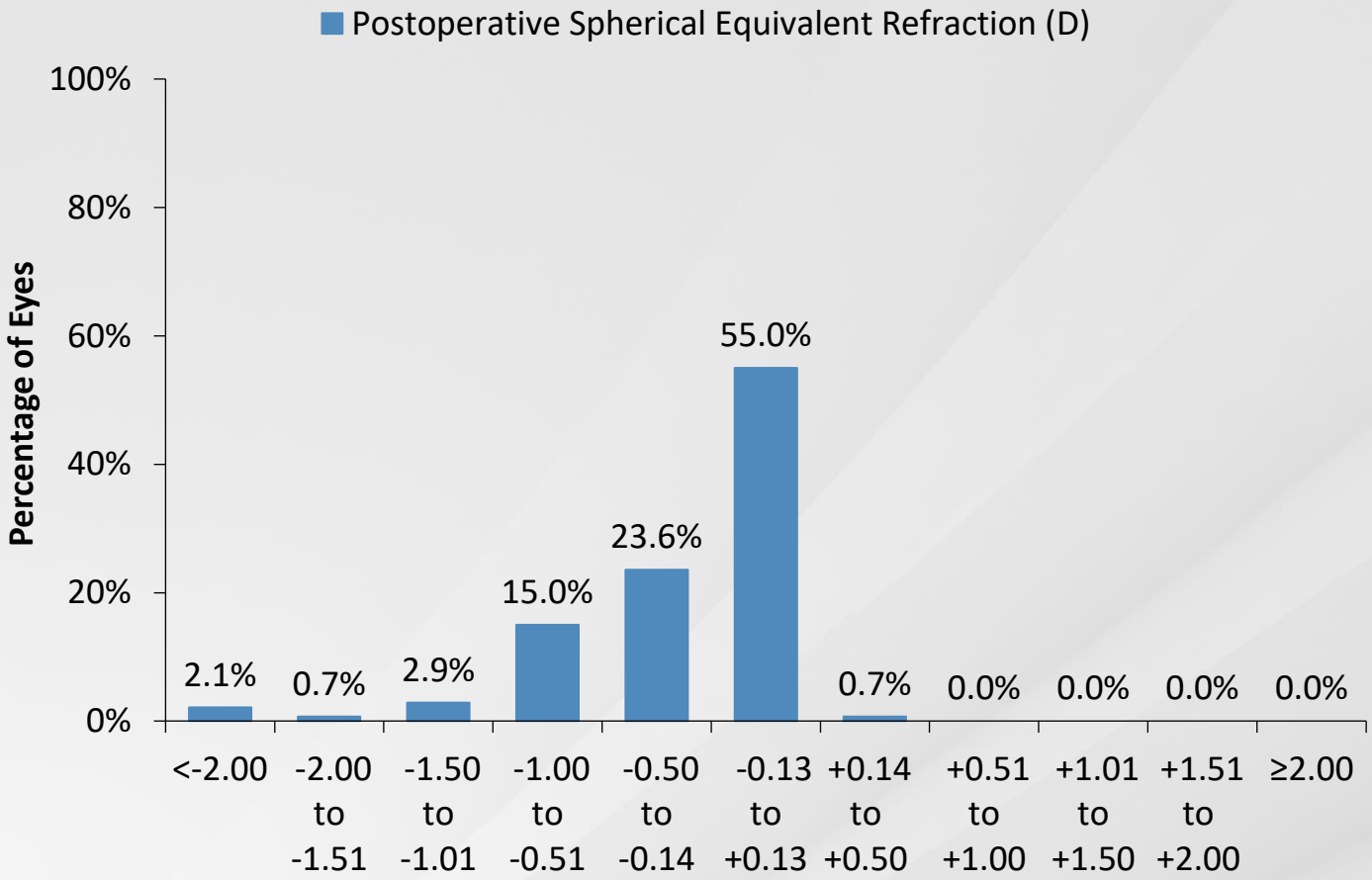
Results: Predictability

- Scatterplot of attempted versus achieved MRSE at postop 12 months.



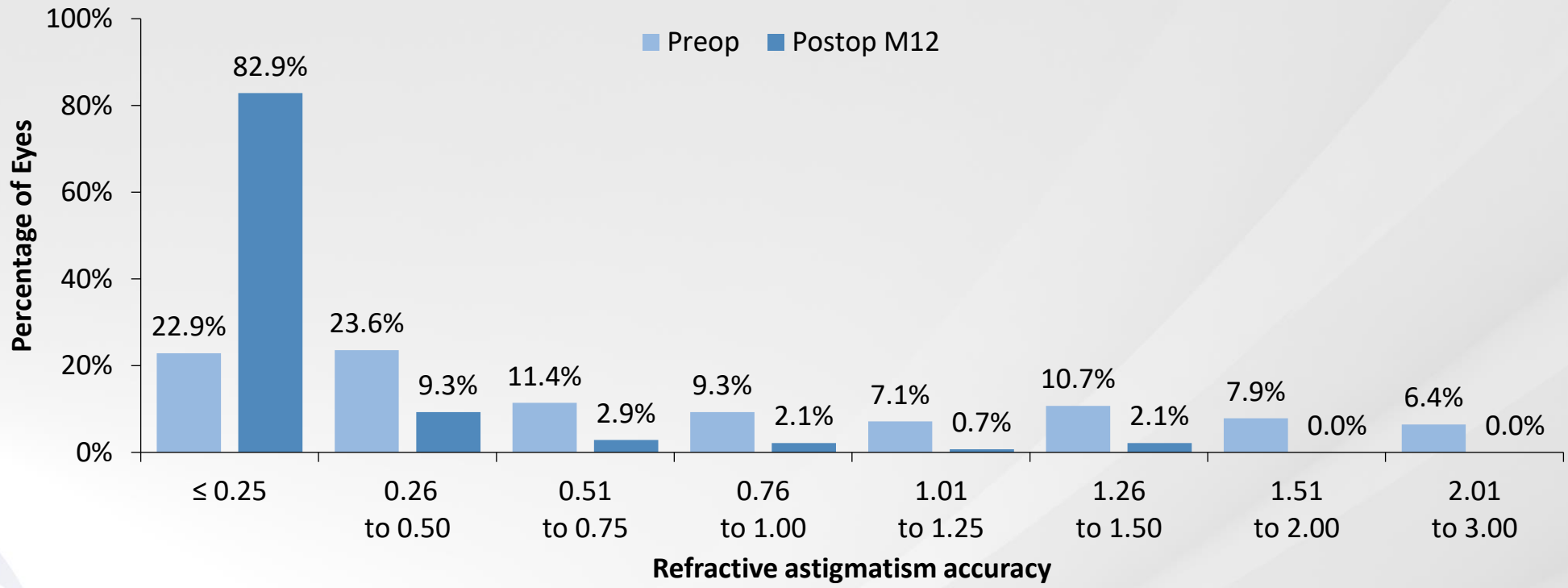
Results: Predictability

- At postoperative 12 months, 79.3% of eyes were within ±0.5 D of attempted refractive correction and 94.3% of eyes were within ±1.00 D of attempted refractive correction.



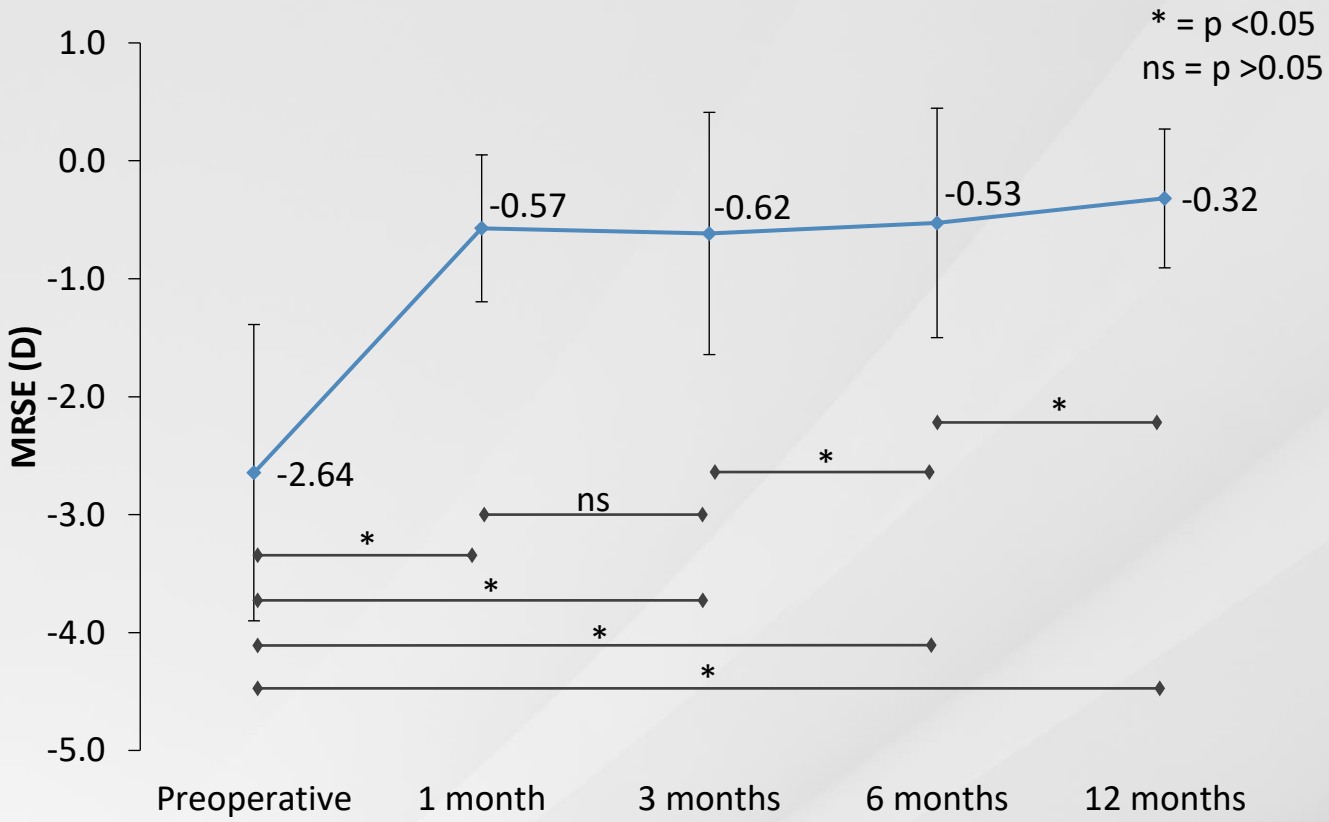
Results: Predictability

- At postoperative 12 months, 82.9% of eyes had ≤0.25 D astigmatism.



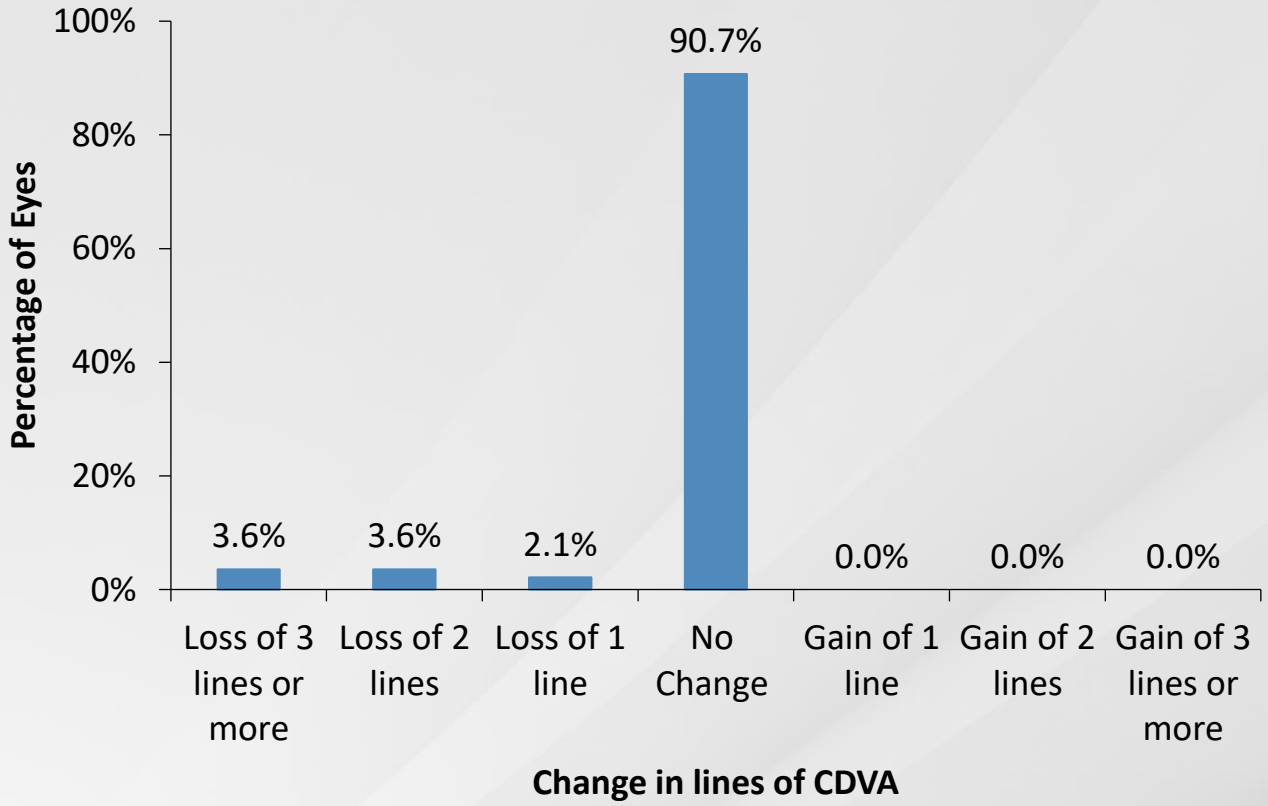
Results: Stability

- Mean MRSE improved statistically significantly from baseline to all postoperative time points.
- At postop 6 and 12 months, a slight improvement in MRSE was observed.



Results: Safety

- 90.7% of eyes maintained their preoperative CDVA, and 3.6% of eyes lost more than 2 lines of CDVA.
- **Complications:** Mild corneal haze was observed in 10 eyes (7.14%) and corneal ectasia developed in 1 eye (0.7%) postoperatively.



Results:
Safety

- None of them developed ectasia after 10-year FU.

Discussion

- It is postulated that energy settings may be lower for low-risk eyes than conventional cross-linking treatment for eyes with keratoconus (5.4 J/cm^2).
- Due to the much lower severity of ectasia in eyes with subclinical keratoconus, a total energy of 2.7 J/cm^2 was used in the present study.
- Beyond 3 months, further improvement in the myopic refraction was observed at 6 and 12 months postoperatively.
  - It was potentially due to the gradual flattening of the cornea after the initial steepening associated with CXL.
- In one eye, ectasia developed during the 1-year follow-up.
  - The CXL procedure with a higher total energy of 7.2 J/cm^2 was repeated in this eye.
  - After repeat CXL, no further progression was observed until the last follow-up visit at 1 year.

Discussion

- These findings demonstrate that the use of 2.7 J/cm^2 energy may not be adequate to halt the progression in patients with subclinical keratoconus.
- The standard protocol involving an irradiation dose of 5.4 J/cm^2 with 3 mW/cm^2 for 30 minutes or another value higher than 2.7 J/cm^2 might be more safe in eyes with subclinical keratoconus.
- Future studies are needed to evaluate the efficacy of a dose higher than 2.7 J/cm^2 to obtain more objective information.

Conclusion

Combined topography-guided PRK and accelerated CXL provided good visual and refractive outcomes, offering spectacle independence in subclinical keratoconus eyes. However, an irradiation dose higher than 2.7 J/cm^2 may be more appropriate to prevent the risk of keratoconus progression.

THANK YOU