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Outcomes of Femtosecond Laser-Assisted Cataract and Refractive Lens Surgery in Patients with Prior Radial Keratotomy

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Introduction

Many prior RK patients are now of age where cataracts interfere with visual function

Intraoperative complications risk is higher

- intraoperative corneal wound dehiscence of old RK wounds
- anterior chamber instability
- Iris damage

- Postoperative dehiscence has been reported

In addition, good refractive outcomes can be challenging to achieve.

Optical coherence tomography (OCT)-guided femtosecond laser (FL)-assisted lens surgery can perform:

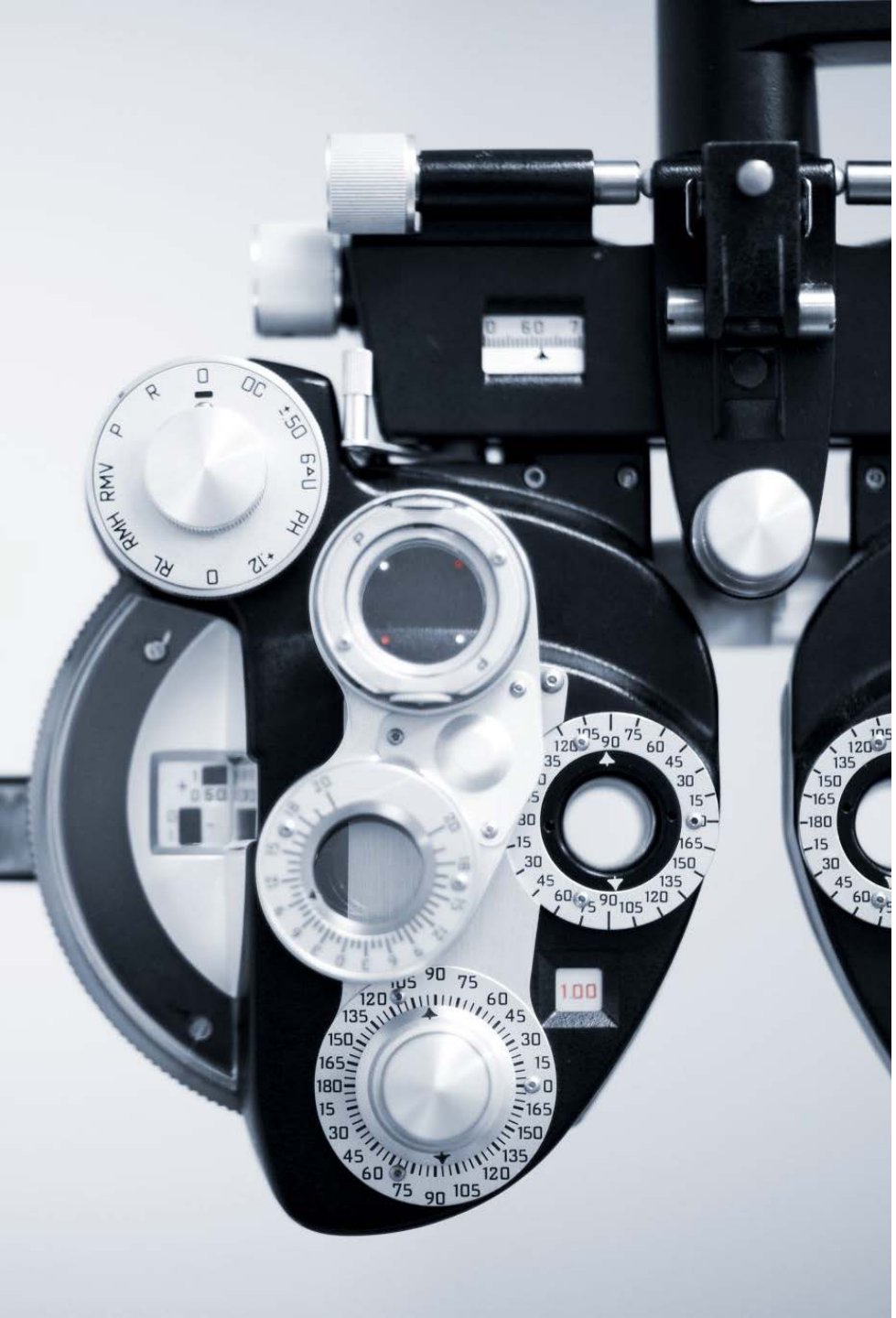
precise capsulotomy

lens fragmentation

corneal incisions

There is a paucity of data on the use of FL in eyes with prior RK

To the best of our knowledge, the current study is the largest to review the outcomes of femtosecond laser-assisted cataract surgery (FLACS) and femtosecond laser-assisted refractive lens exchange (FL-assisted RLE) in patients with prior RK incisions.



Purpose

Outcomes of femtosecond laser (FL-) assisted cataract surgery (FLACS) and refractive lens exchange (RLE) in patients with prior radial keratotomy (RK)

Setting: Single clinical practice.

Design: Retrospective observational case series.

Methods

Inclusion criteria:

All patients with prior RK undergoing FLACS- or FL-assisted RLE surgeries

2015-2020

Diurnal stability + stable manifest refraction

Single surgeon D.S.R.

Exclusion criteria:

Any other incisional corneal surgery

Macular or glaucomatous pathology

Vision loss from any other cause.

Methods

Data collected:

Demographics, visual acuity, laser settings, and intra- and postoperative complications.

Main outcome measures:

Intra- and postoperative complications and visual outcomes.

Safety and efficacy indices were evaluated.

IOL : Barrett True-K or Barrett True-K Toric IOL calculator.

Laser Settings:

- 4.8 mm circular diameter capsulotomy
- horizontal spot spacing 4 μm
- vertical line spacing 9 μm
- pulse energy 4 μJ
- total energy of 0.7 J
- No side port or primary incision cuts

Laser: Catalys Precision Femtosecond Laser System (Optimedica, Johnson & Johnson, Santa Ana, CA, USA)

Phacoemulsification:
Infiniti system or Centurion system (Alcon Laboratories, Inc., Fort Worth, TX, USA)
Whitestar Signature Pro (J&J Vision, Santa Ana, CA, USA)

Anaesthesia:

- topical tetracaine + oral lorazepam (laser)
- IV midazolam/fentanyl and intracameral lignocaine (phaco)

Results

Table 1: Patient Characteristics, Complications and Visual Outcomes

			Preoperative			Intraoperative		Postoperative			
Case	**Age***	**RK[#] cuts**	**UDVA† (Snellen)**	**Manifest Refraction**	**CDVA‡ (Snellen)**	**Toric IOL**	**Complication**	**UDVA† (Snellen)**	**Manifest Refraction**	**CDVA ‡ (Snellen)**	**Complication**
1	62	8	20/80	+ 4.25 / -6.00 x 102	20/50	Yes	AC tear	20/50	+3.25 / -4.75 x 80	20/40	Late IOL dislocation requiring suturing
2	54[±]	N/A	20/80	+ 2.75 / -2.75 x 127	20/20	No		20/20	+0.75 / -1.25 x 142	20/20	
3	54[±]	N/A	20/150	+ 5.75 / -0.50 x 115	20/20	No		20/20	+1.00 / -0.75 x 105	20/15	
4	44	18	20/150	-8.5	20/70	No		20/40	+2.25 / -2.00 x 105	20/25	
5	44	20	20/400	-7.50 / -1 x 75	20/50	Yes		20/100	+3.75 / -2.00 x 166	20/50	
6	55	N/A	20/200	+ 5.50 / -1.25 x 60	20/15	Yes		20/20	0	20/20	
7	55	N/A	20/300	+ 5.25 / -2.00 x 122	20/15	Yes		20/25	+1.25 /-0.50 x 180	20/20	
8	75	N/A	20/60	+ 0.25 / -1.75 x 66	20/50	No		20/30	-0.50 / -0.75 x 90	20/30	
9	75	N/A	20/50	+ 1.5	20/30	No		20/25	-0.50 sphere	20/20	
10	64	8	20/70	0	20/70	No		20/25	-0.25 x 15	20/20	
11	64	8	20/200	0	20/200	No		20/25	-0.25 / -0.5 x 53	20/20	
12	53	N/A	CF	+ 8.25 / -0.75 x 110	20/20	No	AC tear	20/40	+1.00 / -0.50 x 115	20/20	
13	53	N/A	20/400	+ 7.50 / -1.25 x 100	20/25	Yes		20/50	-1.00 / -1.25 x 90	20/25	
14	70	16	20/50	+ 2.00 / -0.25 x 90	20/30	No		20/25	0	20/25	
15	70	8	20/100	-2.25	20/30	No		20/20	0	20/20	
16	67	8	20/300		20/200	No		20/50	+1.50 / -1.25 x 18	20/30	

* Age at the time of surgery
[#] Radial Keratotomy cuts
[±] In case 2 and 3, refractive lens exchange was performed. All other cases were cataract extractions.
†UDVA - Uncorrected distance visual acuity
‡CDVA - Corrected distance visual acuity

Results

TOTAL FLACS/FL-RLE	**1057**		
With Prior RK	**16**		
Male	**11**	**Female**	**5**
Right	**9**	**Left**	**7**
FLACS - RK	**14**	**FL-RLE - RK**	**2**

Mean preoperative

- UDVA 0.9 ± 0.4 logMAR (Snellen 20/160)
- CDVA 0.2 ± 0.3 logMAR (Snellen 20/30)

Mean postoperative

- UDVA 0.2 ± 0.2 logMAR (Snellen 20/30)
- CDVA 0.1 ± 0.1 logMAR (Snellen 20/25)

CDVA improved in all eyes.

Preoperatively

- UDVA better than or equal to 20/40 = 0%
- CDVA better than or equal to 20/40 = 56.3% (n = 9)

Postoperatively

- UDVA better than or equal to 20/40 = 75% (n = 12)
- CDVA better than or equal to 20/40 = 93.8% (n = 15)

Mean residual refraction

- spherical +0.8 ± 1.3 D
- cylinder of -1.0 ± 0.6 D.

Results

- Intraoperative:
  - No Descemet detachments, zonular dialyses or rupture along any RK incision
  - Two cases of anterior capsular tears
    - The first anterior capsule tear extended towards the equator of the lens but did not result in a posterior capsule tear, and a single-piece IOL was successfully implanted within the bag.
    - The second tear appeared stable.
  - There were no dropped nuclei.

Results

- Postoperative
  - No cases of cystoid macular edema, retinal detachment, epiretinal membrane or prolonged inflammation.
  - One case of posterior capsular opacification (no treatment).
  - The second of the anterior capsule tears → late IOL dislocation at 3 weeks → additional suturing through the haptic with 9.0 Prolene suture and capsular tension ring

Safety index was found to be 1.6.

Efficacy index was 1.2.

Discussion Points

- Wound size was 2.2 mm +were no cases of intra- or postoperative RK wound dehiscence.
  - ? attributable to complete FL-assisted capsulotomy and lens fragmentation → less wound manipulation
- Two (12.5%) anterior capsule tears, is higher than expected compared to larger studies reporting anterior capsule tear rates of 0.5 to 1.84% or incomplete capsulotomy rates of 3.6% in the literature
  - Unseen tags
  - FL-introduced biomechanical weakness
  - Opacities (scars) reduce effective laser penetration

Discussion points

- Toric Outcomes:
  - over 40% of eyes (n = 7) within ± 0.5 D, further 37.5% (n = 6) within ± 1 D
    - At least three toric IOLs had no or low effect at astigmatism reduction
    - one patient had increased astigmatism
    - another suffered an IOL dislocation requiring suturing and was left with residual astigmatism of 4.75 dioptres
  - Therefore
    - Toric IOLs may not be a great choice for higher intraoperative risk cases
    - Low dioptric powers also did not appear to reduce astigmatism

Conclusions

FLACS- or FL-assisted RLE surgery in RK patients has a high risk of anterior capsule tear and should be avoided.

Thickened incisional scars are potential sources of incomplete laser penetrance.

Toric lens implantation in RK eyes provide unpredictable astigmatic correction and should also be avoided.