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Warfighter Refractive Eye Surgery Program & Research Center at Fort Belvoir

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Optical Quality and Levels of Tear Protein Lacritin after Photorefractive Keratectomy

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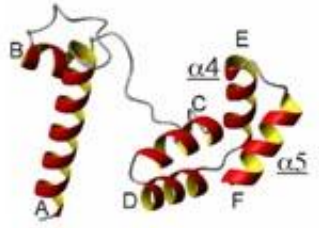
Background

Lacritin is a naturally occurring tear protein capable of:

- Stimulating mitogenesis in human corneal epithelial cells (HCE)[1]
- Promoting production of tears[2-4]
- Protecting cells against interferon gamma / tumor necrosis factor- dependent cell death[5]
- Protecting cells against benzalkonium chloride induced damage[6]



[2]Lacritin Size 12.3 kDa

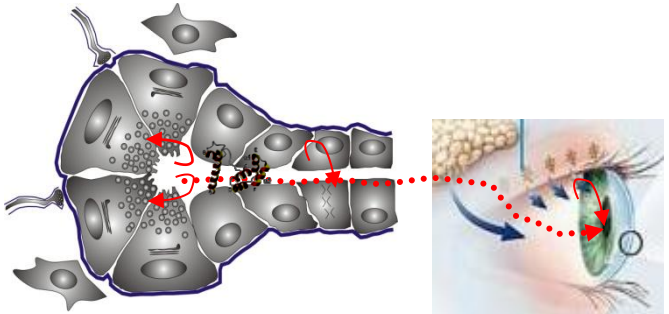
Background

- Because of its ability to stimulate regeneration of HCE, lacritin may promote re-epithelialization following PRK.
- Native lacritin and its constructs have been shown to have a significant antimicrobial effect in vitro.[7]

Lacritin's properties make it an intriguing and potentially potent therapeutic adjunct in the modulation of post-refractive surgery wound healing.

Purpose

The purpose of this study was to determine whether the level of tear protein lacritin affects optical quality following photorefractive keratectomy (PRK).



[1]*Lacritin flow*

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Methods

Prospective study of 52 myopic patients undergoing PRK:

- PRK Procedure:
  - Epithelial debridement using Amoils brush
  - Photoablation using the Allegretto Wavelight Eye Q Excimer Laser System
  - Prophylactic mitomycin C (MMC) used when ablation depth greater than 75 microns.
  - Bandage contact lens applied (Omafilicon-A, Proclear®)
- Topical Postoperative regimen:
  - Moxifloxacin 0.5% 4x daily for 1 week or until complete re-epithelialization
  - Fluorometholone 0.1% 4x daily for 4 weeks followed by a 6-week taper
  - Preservative-free ketorolac 0.5% up to 4x daily for 48 hours
  - Preservative-free carboxymethylcellulose 0.5% 1 drop every hour for the first week, then at least every 2 hours or more for several months
- Tear samples from the left eye were collected preoperatively and postoperatively on day 1, week 1, months 1, 3 and 6:
  - One drop of proparacaine 0.5%
  - After 2 minutes, tears were collected from lower conjunctival cul-de-sac using polyester fiber wick (Filtrona, Richmond, VA)

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Methods

- Optical quality was assessed using the following indices (Tomey TMS-4, Tomey Inc, NY):
  - Surface Regularity Index (SRI)
  * Measures local fluctuations in central corneal power and its impact on optical quality. Elevated SRI is indicative of corneal surface irregularity. High SRI has been noted in dry eye.[8]
  - Surface Asymmetry Index (SAI)
  * Measures the difference in corneal power over the entire corneal surface. Eyes with elevated SAI cannot achieve optimal spectacle correction.
  - Irregular Astigmatism Index (IAI)
  * Measures average power variation along every meridian of the corneal surface. IAI increases as irregularity increases.
- James Madison University completed tear sample analysis for lacritin levels using enzyme-linked immunosorbent assay (ELISA). Each tear sample was analyzed in triplicate with its own standard curve and repeated on a second microtiter plate.
- Data analysis
  - Repeated measures analysis of variance was used to compare baseline optical quality and lacritin to post-surgical levels. Test results from left eye were used for data analysis.
  - Multivariate analysis of variance was performed to determine if lacritin had any significant correlation with optical quality.

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Results

The mean age was 30.5±6.7 years with 34.6% of the participants being female.

MMC was used in 17.3% of cases. The average percentage of lacritin preoperatively was 12.1±2.6 (expressed as nanograms [ng] lacritin/ 100 ng total protein.

Preoperative clinical data (n=52)	
Manifest Sphere (diopters)	-2.59 ±1.72
Manifest Cylinder (diopters)	-0.55 ±0.55
Manifest Spherical Equivalent (diopters)	-2.86 ±1.70
Ablation depth (microns)	46.17 ±21.6
Best Corrected Visual Acuity (logMAR)	-0.11 ±0.03

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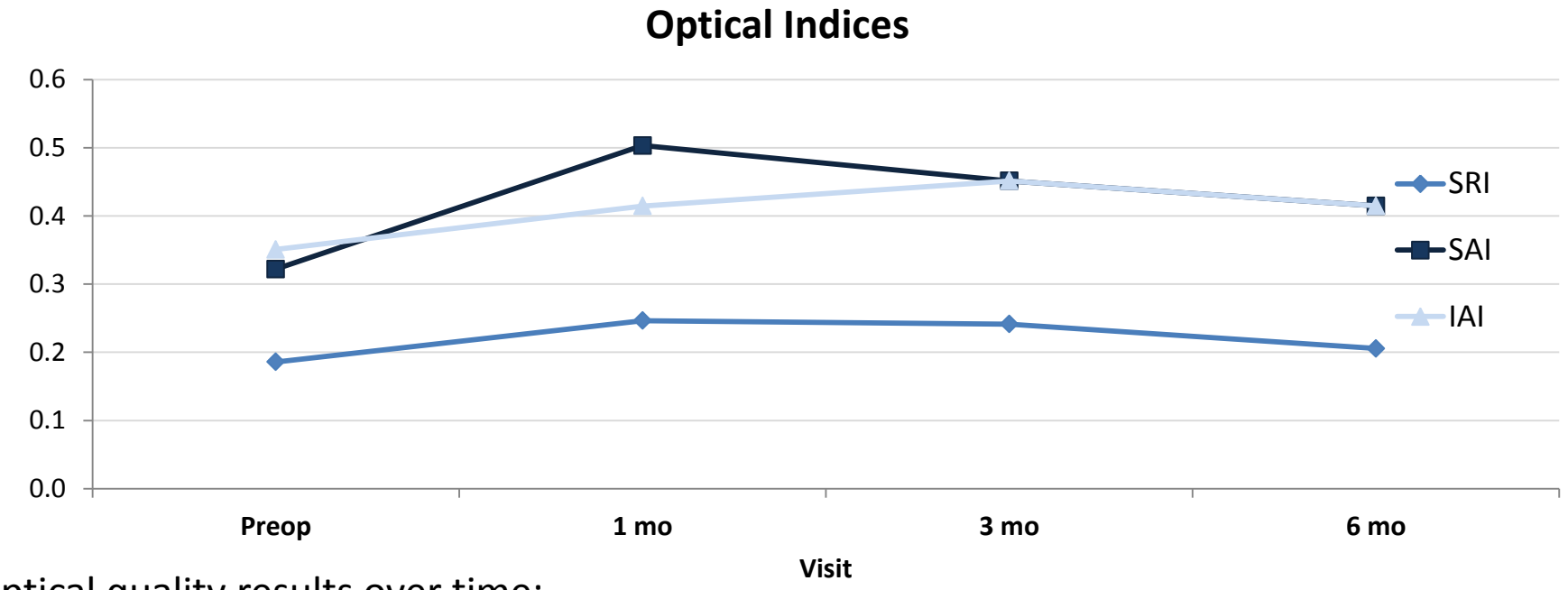
Results



Optical quality results over time:

- Postoperative SRI did not change significantly over time (p=0.76).
- SAI changed significantly over time (p<0.01) most notably at 1 month post-op (P=0.01).
- IAI changed significantly over time (P<0.01) most notably at 1 month post-op (P<0.01).

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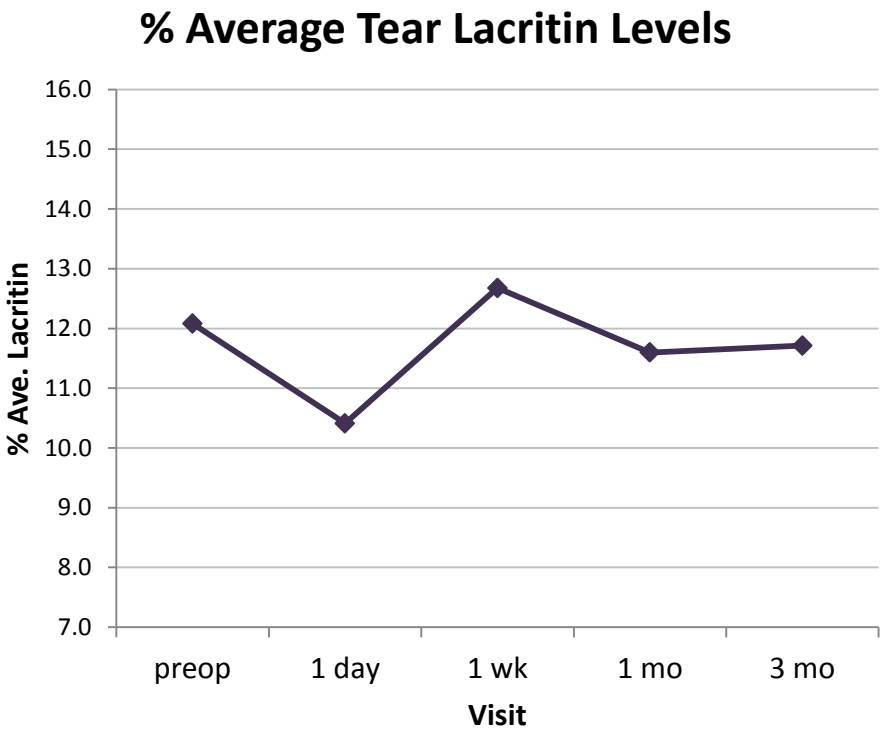
Results



- Lacritin concentration over time: Lacritin levels changed significantly over time ($p<0.01$) with a notable decrease from pre-op levels one day postoperatively ($P=0.03$).
- Lacritin did not correlate with TMS indices at pre-op ($P=0.20$), at 1M ($P=0.70$), or at 3M postop ($P=0.78$).

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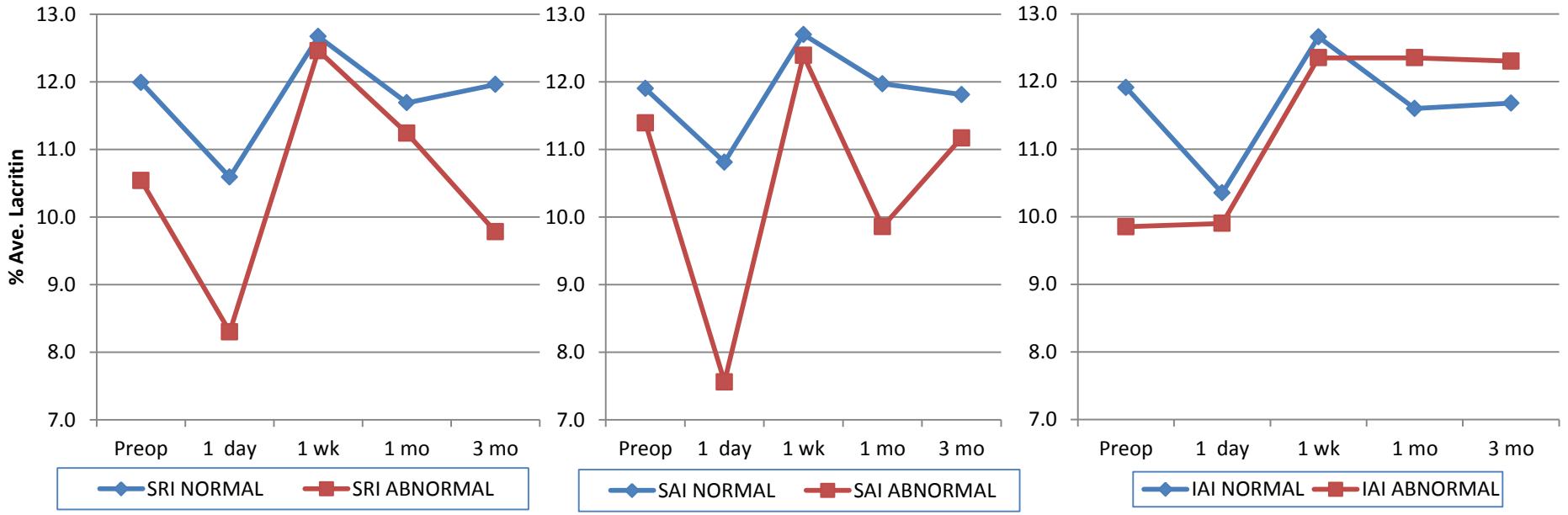
Results

- In participants with abnormal optical indices (noted as > 0.50) six months post-operatively, there was no significant difference in percentage of average lacritin between the participants with normal SRI, SAI, and IAI 6 months post-PRK compared to the participants with abnormal SRI (P=0.53), SAI (P=0.19), and IAI (P=0.73).



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Conclusions

- Average percentage of lacritin decreased significantly in the early post-operative period. The cause and significance of this finding is still being explored.
- Initial results showed lacritin levels did not correlate with optical quality, as measured by surface regularity, surface asymmetry and irregular astigmatism indices.
- The average percentage of lacritin in the early postoperative period does not appear to affect optical quality in those participants with chronic abnormal optical indices in the late postoperative period.
- The association between LASIK and lacritin is still being investigated as part of an ongoing study.

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