

## Research article

# Spherical equivalent (SE) outcomes after suture manipulation in post operative deep anterior lamellar keratoplasty (DALK) patients

D. C. Elvitigala<sup>1</sup>, S. C. De Silva<sup>2</sup>, K. Niruththan<sup>3</sup>, D. H. H. Wariyapola<sup>4</sup>

*The Journal of the College of Ophthalmologists of Sri Lanka 2022; 28: 79-82*

## Abstract

**Introduction:** Deep anterior lamellar keratoplasty (DALK) is a successful intervention among other surgical options for treating keratoconus. However after DALK surgery there are other post operative refractive morbidities which affects patient satisfaction. This study analyzes how suture manipulation in post-DALK patients affects the Spherical Equivalent (SE) outcome and whether it's adhering to the corneal coupling concept.

**Objective:** To determine the pre and post suture manipulations adhered to the concept of corneal coupling and the effect of timing of suture removal on the Spherical Equivalent (SE) outcome.

**Methodology:** This retrospective study involved 40 manipulations in 18 patients who underwent DALK from 2020 to 2021 for keratoconus. All the Surgeries performed by single Consultant Eye Surgeon using big bubble (BB) technique. All grafts anchored using 16 interrupted 10/0 nylon sutures. Data was obtained from hospital and patient records. Objective and Subjective SE, Mean K readings were monitored.

**Conclusion:** Pre and Post suture manipulations adhered to the corneal coupling and there was no statistically significant SE change. Furthermore, it was observed that delaying the removal of sutures resulted in minimal changes in the SE.

**Key words:** keratoconus, corneal coupling, deep anterior lamellar keratoplasty, spherical equivalent

## Introduction

Deep anterior lamellar keratoplasty (DALK) is a surgical technique where the host's corneal tissues anterior to the Descemet's membrane is replaced with a corneal graft. It's one of the popular surgical techniques to treat corneal ectatic diseases like keratoconus. Despite its surgical benefits, DALK is associated with post operative refractive morbidity which affects patient satisfaction.

This study analyzes how suture manipulation in post-

DALK patients affects the Spherical Equivalent (SE) outcome and whether it's adhering to the corneal coupling concept. Accordingly, the long-term post operative refractive outcome can be predicted, and it is useful in patient management.

## Concept of corneal coupling

The concept of corneal coupling was originally described in the late 1970s. Any incisions that are made in the cornea have the potential to change the curvature and therefore the dioptric power of the cornea in that meridian. Typically, corneal incisions cause flattening at the axis where they are made. Flattening Cornea by making incisions in one meridian will steepen it 90 degrees away, in a way that the pre and post incision Spherical Equivalent (SE) remains same.

Removal of sutures in DALK alters corneal curvature. Theoretically the concept of coupling should be valid in the suture removals in Post DALK patients.

## Methodology

This retrospective study was carried out in Sri Jayawardenapura General Hospital, Sri Lanka. It involved 40 manipulations in 18 patients who underwent DALK from 2020 to 2021 for Keratoconus. All the surgeries were performed by single Consultant Eye Surgeon using big bubble (BB) technique. All grafts anchored using 16 interrupted 10/0 nylon sutures. Patients who had pre-operative corneal scarring, intraoperative complications related to DALK were excluded from study.

Suture removal was initiated after at least 6 months post operative period. At each instance of suture removal, pre and post suture removal refraction and wavefront analyzer reports were obtained. The study parameters included subjective spherical equivalent, objective spherical equivalent, and mean corneal K readings.

<sup>1</sup>Registrar, <sup>2</sup>Registrar, <sup>3</sup>Senior Registrar, <sup>4</sup>Consultant Eye Surgeon, Sri Jayawardenapura General Hospital, Kotte, Sri Lanka.

Date: 2021-10-22  
 Age: 35  
 Gender: Female

Rx  
 Eye SPH CYL AXIS DVA PH ADD NVA  
 R -0.25 -2.00 60 6/9+ 6/9+ N5  
 L 0.00 -6.00 130 6/9- 6/9- N14

Prism Rx  
 Eye PR AXIS  
 R 0.0  
 L 0.0

Remarks:

Unaided VA  
 Eye Dist. Near  
 R 6/18- N5  
 L 2/60 N24

Refraction Objective / Subjective  
 Eye SPH CYL AXIS DVA PH PR AXIS ADD NVA  
 R -0.25 -2.00 60 6/9+ 0.0 N5  
 L 0.00 -6.00 130 6/9- 0.0 N14

Eye Pressure  
 Eye Press. Time  
 R  
 L

Present Glass Prescription  
 Eye SPH CYL AXIS PR AXIS ADD  
 R -0.25 -1.50 60  
 L -2.50 -1.25 130

Keratometry  
 Eye K-Reading  
 R 43.00X20/45.85X110  
 L 36.70X121/47.60X31

Figure 1. Refraction prescription.

The subjective spherical equivalent was calculated based on the sphere and cylinder readings from the refraction prescription (Figure 1), while the objective spherical equivalent was determined using the sphere and cylinder readings from the wavefront analyzer reports (Figure 2). Mean corneal K readings were calculated from wavefront analyzer reports as well. All tests were conducted using the same machine and by the same technician to ensure consistency. Paired t test used to compare means using SPSS software.

## Results

Out of the total 18 patients included in the study, 11 (61%) were males and 7 (39%) were females. The mean age of the patients was  $28.17 \pm 7.2$  years, with a range of 17 to 40 years.

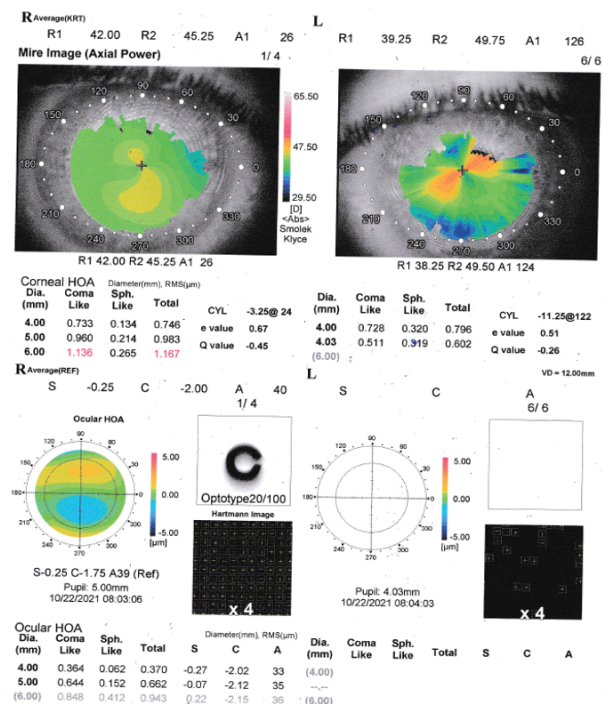


Figure 2. Wavefront analyzer report.

A total of 40 suture manipulations were performed among these patients. The average time for suture removal was  $12.71 \pm 4.58$  months, ranging from 6 to 20 months.

## Subjective spherical equivalent (SSE)

The mean pre suture subjective SE was  $-1.55 \pm 1.65$  diopters and mean post suture subjective SE was  $-1.56 \pm 1.62$  diopters. Average absolute subjective SE change between pre and post suture removal was  $0.95 \pm 0.89$  diopters. There was no statistically significant difference between pre and post suture removal absolute subjective spherical equivalent means ( $p > 0.05$ ).

Chart 1 illustrates the mean absolute change in subjective SE based on the period of suture removal.

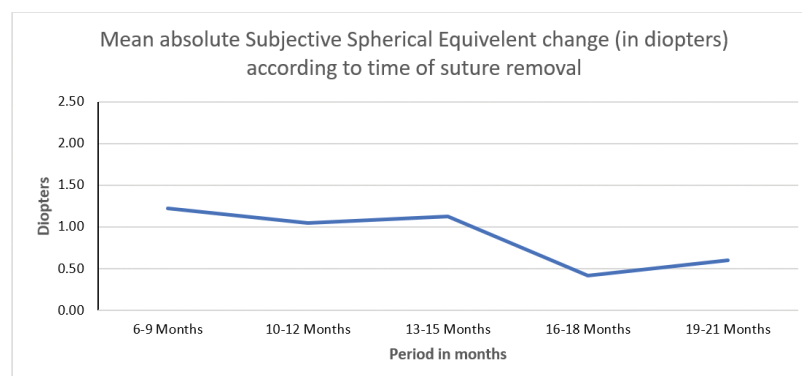


Chart 1.

### Objective spherical equivalent (OSE)

The mean pre-suture objective spherical equivalent (SE) was found to be  $-1.45 \pm 2.27$  diopters, while the mean post-suture objective SE was  $-1.61 \pm 2.32$  diopters. The average absolute change in objective SE between pre and post suture removal was  $0.92 \pm 0.60$  diopters. Statistical analysis revealed that there was no significant difference between the mean pre and post suture removal absolute objective SE ( $p > 0.05$ ).

Chart 2 presents the mean absolute change in Objective SE based on the period of suture removal.

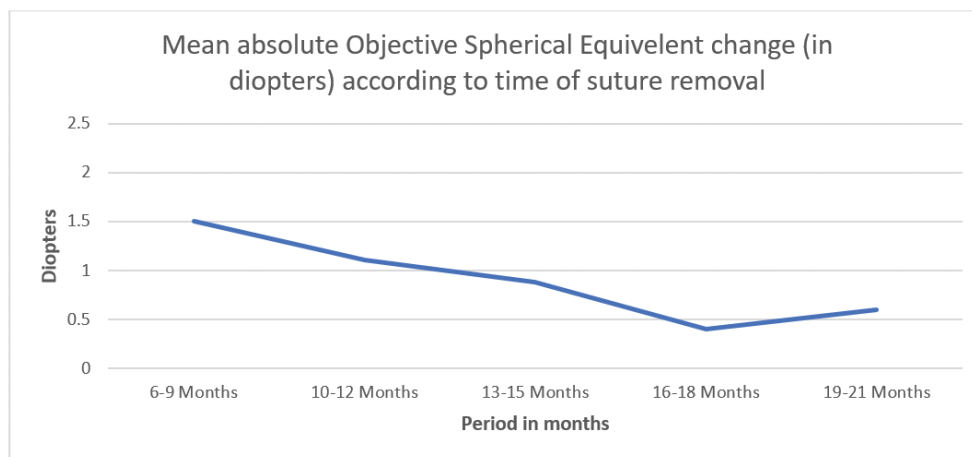


Chart 2.

### Mean K value

The average pre-suture mean K value was  $44.90 \pm 1.67$  diopters, while the average post-suture mean K value was  $44.88 \pm 1.72$  diopters. The average absolute change in mean K value between pre and post suture removal was  $0.67 \pm 0.53$  diopters. Statistical analysis indicated that there was no significant difference between the mean pre and post suture removal mean K values ( $p > 0.05$ ).

The mean absolute K value changes according to the period of suture removal reported in Chart 3.

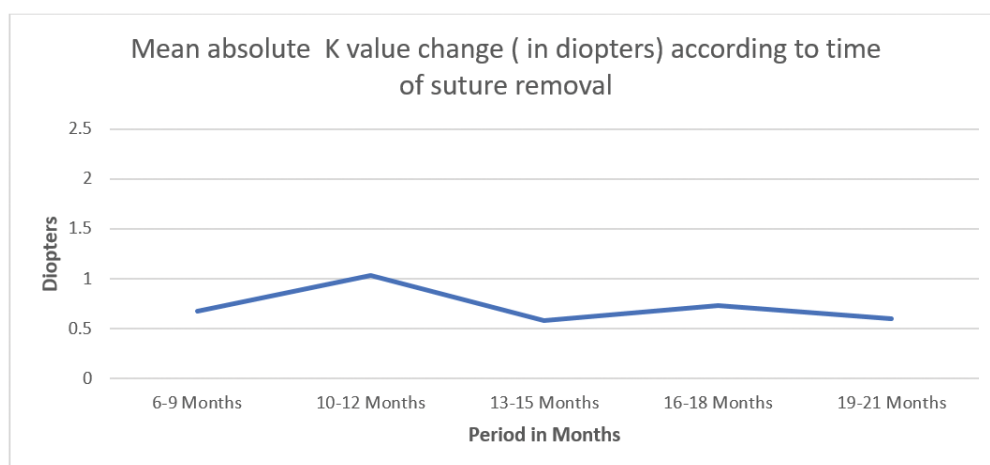


Chart 3.

## Conclusion

The findings of this study demonstrate that the suture manipulation in DALK procedures adhered to the concept of corneal coupling. The results obtained from three key parameters, namely subjective SE, objective SE, and mean corneal K values, support this conclusion. Additionally, the study revealed that a longer waiting period before suture removal was associated with minimal changes in the spherical equivalent. This finding has important implications for predicting the long-term refractive outcomes of DALK patients. It enables healthcare professionals to provide patients with informed guidance on the need for additional refractive aids following the procedure.

## Study limitations and recommendations on future research

This study has certain limitations that should be taken into consideration. Firstly, the sample size was relatively small, which may limit the generalizability of the findings. Therefore, conducting future studies with a larger sample size would provide a more comprehensive understanding of the relationship between suture manipulation and refractive outcomes in DALK patients.

Additionally, the follow-up period in this study only extended up to 20 months postoperatively. To obtain a more complete picture of the long-term effects of suture manipulation, it is recommended to extend the follow-up period until total suture removal. This would allow for a more comprehensive assessment of the refractive outcomes and provide insights into any potential changes that may occur beyond the suture removal stage.

By addressing these limitations in future studies, a more robust understanding of the impact of suture manipulation in DALK procedures can be achieved, leading to improved clinical decision-making and patient care.

## References

1. Feizi S, Javadi MA. Factors Predicting Refractive Outcomes after Deep Anterior Lamellar Keratoplasty in Keratoconus. *Am J Ophthalmol* [Internet]. 2015; **160**(4): 648-53.e2. Available from: <http://dx.doi.org/10.1016/j.ajo.2015.07.005>
2. Feizi S, Ali Javadi M, Behnaz N, Fani-Hanife S, Reza Jafarinasab M. Effect of suture removal on refraction and graft curvature after deep anterior lamellar keratoplasty in patients with keratoconus. *Cornea* 2018; **37**(1): 39-44.