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# The Analysis of Eye Banking and Corneal Transplantation in New Zealand

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## **ABSTRACT**

The series of studies comprising this thesis was developed to answer a number of key inter-related questions in regard to eye banking and corneal transplantation in New Zealand.

The source and management of donor tissue procured by the New Zealand National Eye Bank (NZNEB) was analysed. Significant trends were identified with respect to donor demographics, donor procurement source, improved donor tissue processing and storage, decreased biological contamination, and increased utilization of corneal tissue.

Current trends and ethnicity differences in indications for penetrating keratoplasty (PKP) were investigated. Keratoconus was identified as the most common indication for PKP in New Zealand, accounting for a significantly higher proportion of PKPs than other published reports. Keratoconus was the most common indication for PKP throughout all ethnicity groups and was particularly common in the Maori and Polynesian populations. Significant trends were identified including an increase in the number of PKPs for re-graft and Fuchs' endothelial dystrophy and a decrease for aphakic or pseudophakic bullous keratopathy and viral keratitis.

Survival and visual outcome following PKP in New Zealand was investigated using univariate and multivariate analysis. Several independent risk factors were identified that influenced outcome of PKP. Active inflammation at PKP, pre-existing vascularisation, pre-operative glaucoma, small or large graft size, intra-operative complications, episodes of reversible rejection and a pre-operative

diagnosis of regrant, trauma or infection resulted in a significantly decreased survival rate. Advancing recipient age, active inflammation at the time of PKP, pre-existing vascularisation, pre-operative glaucoma, episodes of reversible rejection, bullous keratopathy, trauma and non-infective keratitis were associated with poor visual outcome.

Patient characteristics, indications, surgical details, and outcome of paediatric keratoplasty were analysed. Acquired non-traumatic indications accounted for the majority of paediatric keratoplasties in New Zealand. This study highlighted keratoconus as a particularly common indication for paediatric keratoplasty when compared to other countries. Survival and visual outcome was better for acquired compared to congenital indications.

The effects of corneal parameters on the measurement of endothelial cell density (ECD) in the normal eye were analysed. Corneal thickness appears to be negatively correlated to ECD in the normal cornea for all age groups. Corneal diameter is correlated to ECD measurement in children but not in adults. Corneal curvature was not significantly correlated to ECD measurement, but this needs further investigation.

Confocal microscopy and slit scanning topography were used to analyze endothelial morphology and function in the short and long term following PKP. The results of this study are in concordance with other published reports that have identified an accelerated loss of endothelial cells and more rapid development of abnormal endothelial cells in transplanted corneas compared to normal corneas.

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## LIST OF ABBREVIATIONS

ACD	Anterior chamber depth
ALK	Automated lamellar keratoplasty
ANOVA	Analysis of variance
BCVA	Best corrected visual acuity
BFS	Best fit sphere
BSCVA	Best spectacle corrected visual acuity
BSS	Balanced salt solution
CCT	Central corneal thickness
CI	Confidence interval
CI	Correction Index
COVA	Coefficient of variation for cell area
COVL	Coefficient of variation for cell length
CLs	Contact lens
cm	Centimeter
CSR	Corneoscleral rim
Cyl	Cylinder
D	Dioptre
DPI	Death to preservation interval
ECCE	Extracapsular cataract extraction
ECD	Endothelial cell density
FU	Follow-up
Hz	Hertz
IN	Inferonasal
IOL	Intraocular lens
IT	Inferotemporal
L	Left
LE	Left eye

LK	Lamellar keratoplasty
LogMAR	Base ten logarithm of the minimum angle of resolution
MCA	Mean cell area
MHz	Megahertz
MK	McCarey and Kaufman
m	Month
mJ	Millijoule
mm	Millimetre
µm	Micrometre
nm	Nanometre
NZNEB	New Zealand National Eye Bank
OCM	Organ culture medium
PAR CTS	PAR Corneal Topography System
PC IOL	Posterior chamber intraocular lens
PKP	Penetrating keratoplasty
R	Right
RE	Right eye
RK	Radial keratotomy
RMS	Root mean square
SD	Standard deviation
SIA	Surgically induced astigmatism
SEM	Standard error of the mean
SEQ	Spherical equivalent
SimK	Simulated keratometry
SN	Superonasal
SPSS	Statistical Program for Social Scientists
ST	Superotemporal
TMS	Topographic Modeling System

UBM	Ultrasound biomicroscopy
UCVA	Uncorrected visual acuity
US	Ultrasound
VA	Visual acuity