# THE EFFECTS OF DIFFERENT PTERYGIUM MORPHOLOGY ON ANTERIOR CORNEAL CURVATURE AND PREDICTING VISUAL OUTCOME

BY

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# ABSTRACT

This thesis aimed to investigate the effect of different pterygium morphology on anterior corneal curvature and predicting visual outcome after surgical intervention. A total of 93 primary pterygium participants were selected from patients who visited an ophthalmology clinic. This prospective cohort study involved pre and post-surgical assessment, with a total of 5 data collection sessions (Pre-surgical, 1, 3, 6, 12 months post-surgical. For pre-surgical, pterygium morphologies (redness, thickness, length, corneo-pterygium total area and dry weight were measured objectively. The association between pterygium morphologies (predictive factors) and predictive outcomes (SimK, CIM, SF, TKM, BCVA and CSF) were investigated. All participants underwent similar pterygium surgery procedures performed by a single surgeon. For all post-surgical assessment, identical measurements of topographic and clinical changes were made based on changes in its predictive outcomes. Comparisons in the magnitude changes between different types of pterygium were performed. Our result shows that fibro-connective components of pterygium were found able to provide the highest prediction with 27 – 55% of the predictive outcomes. With regards to types of pterygium, type III (fleshy) was found causing the biggest changes, followed by type II and I. Concisely, we found that single predictive factor is inadequate to either describe or predict changes on anterior corneal curvature and predicting visual outcome. We had demonstrated that utilizing pterygium morphologies, we were able to describe and predict changes in different types of pterygium better. We suggest that different types of pterygium would give rise to different magnitude changes on anterior corneal curvature and predicting visual outcome, thus we need to consider all pterygium morphologies in assessing pterygium.

# مـلـخص

هذه الأطروحة تهدف إلى دراسة تأثير مختلف التشكل الظفرة على الأمامي انحناء القرنية وتوقع نتائج البصرية بعد التدخل الجراحي. وقد تم اختيار ما مجموعه 93 مشاركا الظفرة الابتدائية من المرضى الذين زاروا عيادة طب العيون. وشملت هذه الدراسة الأتراب المحتملين قبل والتقييم بعد الجراحة، مع ما مجموعه 5 جلسات جمع البيانات (ما قبل العمليات الجراحية، 1، 3، 6، 12 شهرا بعد الجراحة. لمرحلة ما قبل العمليات الجراحية، الأشكال التضاريسية الظفرة (احمرار، سمك، طول تم قياسها القرنوي الظفرة المساحة الإجمالية والوزن الجاف بموضوعية. وقد تم التحقيق في العلاقة بين الأشكال التضاريسية BCVA، TKM، SF، CIM، SimKالظفرة (العوامل التنبؤية) والنتائج التنبؤية ( ). وخضع جميع المشاركين إجراءات جراحة الظفرة مماثلة يقوم بها جراح واحد CSFو للحصول على كل تقدير بعد العمليات الجراحية، وإجراء قياسات مماثلة من التغيرات الطبوغرافية والسريرية على أساس التغيرات في نتائجها التنبؤية. وقد أجريت مقارنات في التغييرات حجم بين أنواع مختلفة من الظفرة. وتبين لدينا نتيجة أن مكونات الليفي الضام لل تم العثور على الظفرة قادرة على توفير أعلى التنبؤ ب 27 - 55٪ من النتائج التنبؤية فيما يتعلق أنواع الظفرة، تم العثور على النوع الثالث (سمين) مما تسبب في أكبر التغييرات، تليها النوع الثاني والأول من الإيجاز، وجدنا أن عامل التنبؤية واحد غير كاف لأي وصف أو التنبؤ بالتغيرات في الأمامي انحناء القرنية وتوقع نتائج البصرية. كنا قد أثبتت أن استخدام الأشكال التضاريسية الظفرة، كنا قادرين على وصف والتنبؤ بالتغيرات في أنواع مختلفة من الظفرة أفضل. نقترح أن أنواع مختلفة من الظفرة أن تؤدي إلى تغييرات حجم مختلفة على انحناء القرنية الأمامية وتوقع نتائج البصرية، وبالتالي نحن بحاجة للنظر في جميع الأشكال التضاريسية الظفرة في تقييم الظفرة.

# APPROVAL PAGE

The thesis of Mohd Radzi Bin Hilmi has been approved by the following

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# DECLARATION PAGE

I hereby declare that this thesis is the result of my own investigations, except where otherwise stated. I also declare that it has not been previously or concurrently submitted as a whole for any degrees at IIUM or other institutions.

Mohd Radzi Hilmi

Signature:……. Date:……..

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Affirmed by Mohd Radzi Bin Hilmi

…….. …….

Signature Date

*This thesis is dedicated to my beloved parents for laying the foundation of what I turned out to be in life. And not to mentioned, this thesis also dedicated to my dear wife and two lovely daughters*

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| | | | |
|---|---|---|---|
| µg | Microgram | AS-OCT | Anterior Segment Ocular Coherence Tomography |
| gutt | Drops | CA | Corneal Astigmatism |
| qid | Four times a day | WTR | With-the-rule |
| ml | Milliliter | ATR | Against-the-rule |
| % | Percentage | SAI | Surface-Asymmetry Index |
| ® | Registered | SRI | Surface-Regularity Index |
| ™ | Trademark | CCLRU | Cornea and Contact Lens Research Unit |
| D | Diopter | $D_2O$ | Heavy water(Deuterium Oxide) |
| SimK | Simulated-K | ROI | Region of Interest |
| CIM | Corneal Irregularity Measurement | LoA | Limits of Agreement |
| SF | Shape Factor | $mm^2$ | square milimeters |
| TKM | Toric Mean Keratometry | JPEG | Joint Photographic Experts Group |
| BCVA | Best-corrected visual acuity | CI | Confidence Interval |
| CS | Contrast Sensitivity | $R^2$ | Coefficient of determination |
| LogMAR | Logarithm of the Minimum Angle of Resolution | ∞ | Correlate |
| SD | Standard Deviation | KMK | Khairidzan Mohd Kamal |
| SLB | Slit-lamp biomicroscopy | CSF | Contrast sensitivity function |
| ZAR | Zulhilmi Abdul Razak | | |

# CHAPTER 1

# GENERAL INTRODUCTION

## 1.1 BACKGROUND AND RESEARCH QUESTIONS

Understanding the mechanism of pterygium effect in contributing changes to corneal curvature and its impact on vision is essential for gaining insight into more complex issues such as induced corneal astigmatism as reported in numerous studies (Lin & Stern, 1998; Tomidokoro et al., 2000; Yasar et al., 2003; Oltulu et al., 2013; Misra et al., 2014; Sarac, Demirel & Oltulu, 2014)

The cornea and conjunctiva, which form the anterior ocular surface of the eye, are constantly exposed to external environmental challenges such as ultraviolet (UV) rays. Pterygium has been dubbed as an abnormal growth due to prolong exposure to UV light (Solomon, 2006; Bradley et al., 2010; Chui, et al., 2011; Oellers et al., 2013). The progressions of pterygium are rather simple as it originates from conjunctiva and progresses towards cornea. However, along this process, some changes on the corneal curvature have been noted and the impact of its presence has been widely studied and discussed (Lin & Stern, 1998; Tomidokoro et al., 2000; Bahar et al., 2004; Walkow et al., 2005; Errais et al., 2008; Shiroma et al., 2009; Kheirkhah et al., 2012).

Pterygium morphology has been studied as possible factors which led to visual impairment due to induced corneal astigmatism. Pterygium length (commonly known as extension) and total area has been taken as crucial factor to determine the impact of pterygium on cornea (Kampitak 2003; Muhammad-Salih & Sharif, 2008).