

**UNIVERSITI TEKNOLOGI MARA**

**EVALUATION OF BIOMETRIC  
PARAMETERS, CORNEAL HEALTH  
AND  
BINOCULAR VISION STATUS  
AFTER USING  
MENICON Z-NIGHT  
ORTHOKERATOLOGY (OK)  
LENSES AMONG  
YOUNG MALAY ADULTS**

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## ABSTRACT

Myopic power can be reduced using Menicon Z-Night orthokeratology (OK) lens. No study has reported on the success of this lens among Malays. The aim of this study was to determine changes in biometric parameters, corneal health and binocular vision status in young Malay adults after wearing this OK lens for six months. Purposive sampling was used in this Quasi experimental longitudinal study and participants were recruited through advertisements placed around campus and by personal invitation. Visual acuity (VA) was recorded using a Snellen chart and later converted to logarithm of the Minimum Angle of Resolution (logMAR) unit, refractive power was measured subjectively, and steep and flat central corneal curvature (Ks and Kf) was measured using corneal topographer. Anterior segment length was measured using a A-Scan ultrasonography. Corneal thickness was measured using pachymeter. Endothelial cornea health was assessed using specular microscopy. Phoria was measured using Howell card at distance and near. The amplitude of accommodation (AA) and near point of convergence (NPC) were measured using Royal Air Force (RAF) ruler, accommodative response (AR) was measured using monocular estimated method (MEM) retinoscopy, the fusional reserve was measured using a rotating prism and accommodative facility (AF) was measured using a lens flipper. Baseline data were recorded prior to lens delivery and the same measurements were noted after 24 hours, one week, one month, three months and six months. Total of 20 participants completed this study. Their mean of age was  $22.45 \pm 1.19$  years old. There were significant changes in the following parameters before and after six months of OK lens wears for right and left eye, respectively. Unaided VA: at baseline,  $1.06 \pm 0.22$ ,  $1.04 \pm 0.23$ ; 6 months,  $0.01 \pm 0.05$ ,  $0.03 \pm 0.14$  logMAR. Spherical equivalent refraction (SER):  $-2.84 \pm 0.87$  D,  $-2.89 \pm 0.94$  D; 6 months,  $-0.12 \pm 0.21$  D,  $-0.33 \pm 0.51=3$  D. Ks:  $44.13 \pm 0.87$  D,  $44.08 \pm 1.34$  D; 6 months:  $42.26 \pm 1.25$  D,  $42.44 \pm 1.02$  D. Kf:  $43.20 \pm 1.42$  D,  $43.08 \pm 1.44$  D; 6 months:  $41.24 \pm 1.43$  D,  $41.30 \pm 1.50$  D. Central corneal thickness:  $542.56 \pm 36.70$   $\mu\text{m}$ ,  $547.80 \pm 32.66$   $\mu\text{m}$ ; 6 months,  $538.19 \pm 30.28$   $\mu\text{m}$ ,  $547.94 \pm 30.05$   $\mu\text{m}$ . Anterior chamber depth (ACD):  $3.69 \pm 0.21$  mm,  $3.74 \pm 0.20$  mm; 6 months,  $3.53 \pm 0.22$  mm,  $3.60 \pm 0.20$  mm. Crystalline lens thickness (CLT):  $3.49 \pm 0.15$  mm,  $3.45 \pm 0.14$  mm; 6 months,  $3.58 \pm 0.17$  mm,  $3.52 \pm 0.14$  mm. Endothelial cell density (baseline:  $28.75.88 \pm 172.11$  cell/ $\text{mm}^2$ ,  $2851.75 \pm 230.41$  cell/ $\text{mm}^2$ ; 6 months,  $2851.81 \pm 263.07$  cell/ $\text{mm}^2$ ,  $2853.19 \pm 240.48$  cell/ $\text{mm}^2$ ), coefficient of variance (baseline:  $37.81 \pm 5.27$ ,  $38.06 \pm 6.49$ ; 6 months,  $36.81 \pm 4.22$ ,  $38.25 \pm 6.27$ ) and percentage of hexagonality (baseline:  $54.19 \pm 6.39$  %,  $55.25 \pm 7.44$  %; 6 months,  $56.00 \pm 5.40$  %,  $55.38 \pm 9.44$  %), near phoria (baseline:  $0.25 \pm 1.36$  exophoria; 6 months:  $3.67 \pm 5.65$  exophoria) and other parameters remain unchanged. The Menicon Z-Night OK lens has significantly improved unaided VA for young Malay adults by flattening the central corneal curvature and reducing the myopic power, accompanied by shortening of ACD and thickening of CLT. OK lens wear showed significant exophoric shift at near after wearing OK lens for six months. The Menicon Z-Night lens did not affect corneal health and other binocular vision elements.

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# CHAPTER ONE

## INTRODUCTION

### 1.1 Overview

The prevalence of myopia is increasing worldwide, and it is of concern to the global community. It is refractive in nature and the actual cause is not known. High myopia poses risks that may lead to visual impairment and blindness. There are many refractive treatments meant to correct myopia in the hope of reducing its prevalence in the future.

Orthokeratology (OK) is the process whereby specially designed rigid gas permeable lenses are worn at night to reshape the cornea so that its refractive power becomes plano. This means that myopes who wear the specially designed lenses may have their power reduced to plano and do not need glasses during the day. Unlike any other invasive refractive treatments such as laser assisted in-situ keratomileusis (LASIK), OK lens effects on the cornea are reversible and wearers have the option to discontinue wearing the OK lenses if they are dissatisfied with the outcome.

The OK lens can be used as an alternative treatment for adults who do not want to wear spectacles or intolerant to conventional contact lenses wear. Adults who have active lifestyle that require spectacle-freedom and profession such as divers or athletes may also benefit from OK treatment.

Eye structures and systems are involved in adapting to the effects of OK lens on the eye. Biometric parameters that change may include corneal curvature, corneal thickness and length of the eyeball. Corneal health may be measured by examining changes in the endothelial cells. Binocular vision system that change as result of wearing OK lenses may be measured using conventional methods in clinical optometry. However, results reported by various studies on significant exophoric shift of near phoria, changes on fusional vergence reserve and reduction of accommodative element after OK treatment are still in controversial.

### 1.2 Research Background

Prevalence of myopia increases every year especially among Asians (Aller, 2014; Sankaridurg & Holden, 2014). Prevalence of myopia among Malays adult is