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Changes in higher-order aberrations before and after pterygium surgery

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Abstract: Using a wavefront analyzer, we assessed changes in higher-order aberrations before and after pterygium surgery. Both cases demonstrated that surgical excision of the pterygium improved uncorrected visual acuity, best corrected visual acuity, and higher-order aberration.
Keywords: Pterygium, Higher-order aberration, Astigmatism.

INTRODUCTION

Pterygium is a fibrovascular proliferative disorder in which conjunctival tissue grows medially to cover the clear cornea [1-10]. An advancing pterygium can produce marked changes in the refractive state and curvature before entering the optical zone. This can result in visual impairment [1-6]. The refractive change is usually characterized as with-the-rule astigmatism resulting from localized flattening of the cornea central to the leading apex [1-6]. Although several reports have evaluated the effect of pterygium surgery on corneal astigmatism and corneal topographic changes [1-6], few have investigated wavefront aberrations [7-10]. Herein, we report changes in higher-order aberrations before and after pterygium surgery in two cases as examined by wavefront analyzer.

CASE REPORT

CASE 1

A 68-year-old woman presented with a slow-growing wing-shaped ocular surface lesion in her right eye. Slit-lamp examination showed a marked pterygium that extended from the nasal side of the bulbar conjunctiva onto the cornea (Figure 1A). Her uncorrected visual acuity (UCVA) and best-corrected visual acuity (BCVA) in the right eye were 0.4 and 0.8 with +2.75Dcyl-1.25DA110°, respectively. The ocular and corneal higher-order aberrations were measured using a Hartmann–Shack wavefront sensor (KR-1W; Topcon Corporation, Tokyo, Japan). The aberrations were measured in a 4mm optical zone across the undilated pupil. A 4-mm region of the pupil was chosen to reduce the likelihood of artifacts associated with the leading edge of the pterygium while including a significant portion of the optical pathway. The Zernike coefficients were determined up to the fifth order. Root mean square (RMS) values of the total and higher-order aberrations were obtained.

The corneal higher-order aberration was 0.499 μm (Figure 1C). Inferior conjunctival autograft transplantation was performed (Figure 1B). After surgery, her UCVA and BCVA improved to 0.7 and 1.2 with +2.25Dcyl-1.25DA90°. The higher-order aberration was reduced to 0.168 μm (Figure 1D).

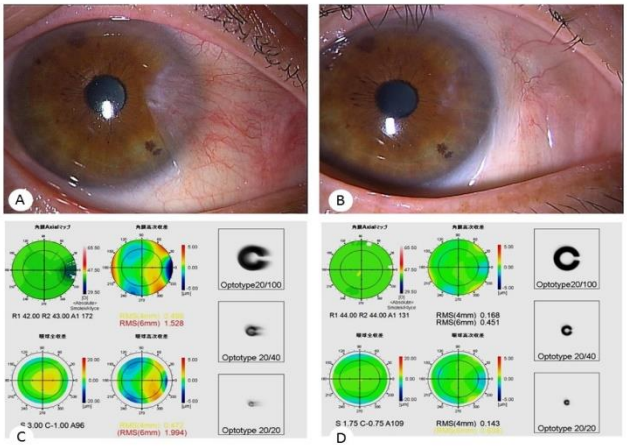

Fig-1: Preoperative (a, c) and postoperative (b, d) photographs and wavefront map

CASE 2

A 73-year-old man presented with a marked pterygium that extended from the nasal side of the bulbar conjunctiva onto the cornea in the right eye (Figure 2A). The patient's UCVA and BCVA in the right eye were 0.2 and 0.5 with +1.50D, respectively. The higher-order aberration was 0.645 µm (Figure 2C). Inferior conjunctival autograft transplantation was performed (Figure 2B). After surgery, his UCVA and BCVA improved to 0.5 and 0.9 with +1.50Dcyl-0.75DA110°. The higher-order aberration was reduced to 0.193 µm (Figure 2D).

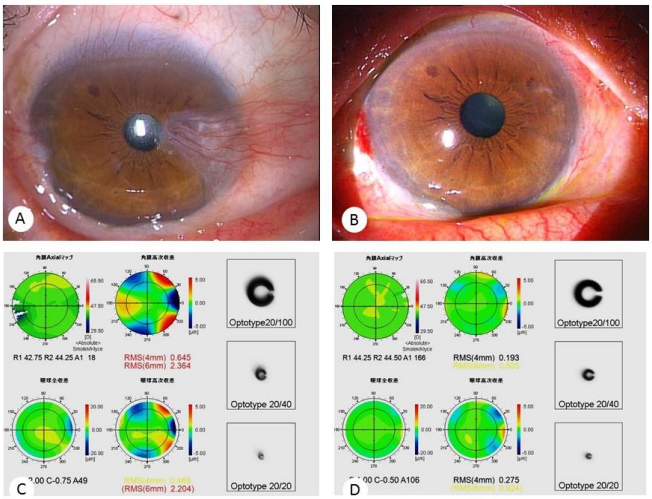

Fig-2: Preoperative (a, c) and postoperative (b, d) photographs and wavefront map

DISCUSSION

Bahar *et al*. [1] reported a significant decrease in corneal astigmatism after pterygium surgery. Tomidokoro et al. [4] similarly reported that surgery decreases corneal astigmatism with no change in the axis. The surgically induced changes in spherical power and corneal astigmatism significantly correlate with the preoperative extent of the pterygium [4].

Few reports have investigated the effect of a pterygium on corneal wavefront aberrations [7-10]. According to previous studies, most of the higher-order aberrations are eliminated after surgical excision of the pterygium. Pesudovs et al. [7] determined the higher-order aberrations at the corneal surface before and after pterygium surgery. They showed that pterygium excision significantly reduced wavefront aberrations. Zare *et al*. [8] demonstrated that pterygium had a significant influence on higher-order aberrations, and this influence was dependent on the size of the pterygium. The larger the size of the pterygium, the more higher-order the ocular aberrations were measured. In Case 1, the head of the pterygium existed between the limbus and a point midway between the limbus and pupillary margin. In contrast, the head of the pterygium presented between a point midway between the limbus and pupillary margin in Case 2. The higher-order aberration in Case 2 was larger than that in Case 1. Additional studies and cases will be necessary to evaluate the relationship between higher-order aberrations and the pterygium's preoperative extension.

Based on our two cases, successful pterygium surgery not only improved UCVA and BCVA, but also reduced topographic astigmatism and higher-order aberrations. We consider that wavefront analysis can provide a better assessment of the pterygium-induced higher-order aberrations, its effects on the eyesight, and the impact of surgery on restoration of normal vision.

Disclosure

No conflicts of interest are declared in relation to this paper.

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