Suitability of Monovision Laser Correction in Patients With Ocular Motility Disorders

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ABSTRACT

This paper presents two cases which illustrate the importance of a pre-operative orthoptic examination in patients with ocular motility disorders considering monovision laser correction. The relative influence of the pre-operative orthoptic examination on the advice given to patients seeking monovision is discussed.

Keywords: monovision, laser refractive surgery, ocular motility disorder

INTRODUCTION

Laser refractive surgery is a commonly performed procedure for people seeking independence from their glasses or contact lenses. With the onset of presbyopia, there are a significant number of patients considering monovision after the age of 40. Monovision is aimed at correcting presbyopia, where the dominant eye is usually focused for distance and the non-dominant eye is corrected for near [1-3]. This largely increases patients' independence from reading glasses. In this paper two case studies are presented to highlight the importance of performing a pre-operative orthoptic examination to assess binocular function of patients considering monovision laser vision correction.

CASE STUDY

Case 1

A 63-year-old male accountant presented expressing interest in determining his suitability for laser refractive surgery so that he could be without his glasses for distance and near work. On examination his unaided distance vision was right and left eye count fingers and unaided near vision were right and left less than N18. His best corrected vision was right eye 6/6 part and left eye 6/6-1. A dry and wet refraction were performed using tropicamide 1% and showed similar results: right eye -8.25/-0.50 x 85° and left eye -4.25/-1.00 x 132°.

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An ocular history revealed that he had strabismus surgery as a child, however, the patient was unable to provide any further information regarding the type of surgery. On cover test near and distance a large right exotropia of greater than 45 prism dioptres was found with the ability to freely alternate fixation. No diplopia was reported.

Ocular dominance was assessed using the 'hole-in-card'. The patient firstly holds a card with a central hole and is asked to binocularly align an object within the hole. When the patient alternately occludes either eye, only the dominant eye sees the object[1,3] . This test revealed he preferred left dominance as predicted.

Retinal and corneal examinations were unremarkable. Corneal topography was performed using the Orbscan and corneal thickness measured 509 microns right eye and 516 microns left eye.

After the initial assessment, a monovision contact lens trial was performed. Taking into consideration the patient's age and the type and amount of near work he performed, the target refraction of right eye was -2.00DS (with a contact lens script of -6.50DS), and left eye was plano (with contact lens script of -4.25/-1.00 x 132°). With monovision contact lenses the patient achieved right near vision of N5 and left distance vision of 6/6. Binocularly the patient was seeing 6/6 and N5. A cover test performed during the monovision trial showed no change to the deviation and no diplopia.

The patient wished to continue the monovision contact lens trial outside of the clinical setting, so extended wear contact lenses were prescribed. Monovision contact lenses were successful and worn for a period of 7 years. During this time the patient did not experience any diplopia or symptoms of imbalance and the visual acuity remained stable.

Seven years after the initial contact lens trial, the patient underwent bilateral LASIK. At 4 months post-surgery he achieved unaided 6/24 and 6/12 vision of the right and left eye respectively and bilateral unaided near vision of N5. A subjective refraction showed 6/6-2 vision of either eye with a correction of -1.50/-0.50 x 14° and +0.75/-0.25 x 47° of the right and left eyes respectively. The patient reported that the distance vision was "not so good" without glasses. His deviation remained similar; a large right exotropia of greater than 45 prism dioptres with the ability to freely alternate. The patient underwent a left LASIK enhancement procedure. At 6 months post-enhancement laser vision correction surgery the patient achieved distance vision of 6/6 unaided left eye and maintained near vision of N5 with both eyes open. The patient reported to be very happy with the results.

Case 2

A 52-year-old lady presented for a refractive consultation. Unaided visual acuities were right eye 6/15 and left eye 6/7.5. Wet refraction using tropicamide 1% revealed right eye +1.75/-1.00 x 176° and left eye +0.75/-0.75 x 21°, with best corrected vision of 6/6 right and left. The patient did not have any distance glasses. Corneal topography was performed and results were normal with central corneal pachymetry of right eye 574 microns and left eye 564 microns.

A cover test at near with glasses (right eye +3.75/-1.00x67 and left eye +3.75/-0.50x27) showed a large exophoria of 25 prism dioptres with good recovery, while a cover test in the distance without glasses revealed an intermittent right exotropia of 14 prism diopters. Due to the patient's refraction and age the prism cover test was not performed at near without glasses as the patient was having difficulty focusing on the near target. Ocular movements were full. The patient was found to be left eye dominant using the hole-in-card method.

A monovision contact lens trial was performed with a -1.50DS refraction target for the right eye (with contact lens +3.25DS) aiming for N6 near vision. The target refraction of the left eye was plano (with contact lens +0.75DS) with an aim for distance vision of 6/6. During the monovision contact lens trial a cover test was performed. There was no change to the deviation at near. However, a cover test in the distance revealed a constant right exotropia with intermittent diplopia. With the monovision contact lenses in place the deviation increased to 20 prism dioptres. The patient achieved distance vision of 6/6 and near vision of N5 with both eyes open during the monovision contact lens trial. Despite good potential distance and near vision it was advised that the patient should not proceed with monovision refractive surgery given the increased deviation size and appreciation of diplopia.

DISCUSSION

Monovision compromises binocular visual function due to a decrease in vision in one eye causing anisometropia. This can lead to an interruption of fusion, therefore a pre-operative orthoptic examination is essential[4]. Orthoptists perform a variety of tests to assist in deciding whether a patient is an ideal candidate for monovision. Orthoptists also provide pre-operative counseling to potential monovision candidates. Standard testing includes patient history, unaided and best corrected vision for distance and near, a dry and wet refraction, pupil reactions, ocular dominance testing, corneal topography, measurement of intraocular pressure, ocular motility assessment, and a monovision contact lens trial. An extended orthoptic examination includes measurement of the deviation using a prism cover test and the assessment of stereopsis. Stereopsis is also performed before and during the monovision contact lenses trial if patients complain of imbalance, disorientation, hazy or blurred vision with monovision contact lenses despite achieving good distance and near vision uniocularly.

The length and level of the monovision contact lens trial can vary amongst patients, depending on their visual plasticity and their ability to adapt. Table 1 shows a guideline for the amount of anisometropia given to specific age groups, which can be modified depending on the patient's visual expectations, lifestyle or occupational needs. During the monovision contact lens trial we counsel the patients to ensure they understand that monovision compromises their binocular visual acuity, stereoacuity, contrast sensitivity and binocular function[5]. A questionnaire is also given to patients prior to the monovision trial to provide an overview of their visual expectation following surgery. This alerts the patient that monovision will not necessarily mean they will be free of glasses for all activities and that they may still need mild magnifying glasses for close work some of the time. It also alerts the clinician of the patients' expectations of surgical outcomes.

Warning signs that may indicate a patient is not suitable for monovision correction include: a large latent deviation with poor recovery, a decompensating latent deviation

Table 1. Guideline for monovision corrections

Age	Monovision Target Refraction
40-43	-0.50
44-45	-0.75
46-47	-1.00
48-50	-1.25
51-53	-1.50
54-57	-1.50 to -1.75
>57	-1.50 to -2.00.

or diplopia at any time during the monovision trial, or an increase in the deviation size with monovision. In addition, if after a monovision contact lens trial the patient lacks comprehension of the surgical endpoint, or appears unable or unwilling to accept a binocular compromise, it is advised that they do not proceed with monovision refractive surgery.

Reduced stereoacuity with monovision can also affect the success of monovision laser correction. Dimitri et al[5] has noted that successful monovision patients show less of a difference in stereoacuity before and during their monovision contact lens trial. Unsuccessful monovision patients, however, showed a greater reduction of stereoacuity during their monovision contact lens trial compared to successful monovision patients[6]. Anecdotally, we have found that if stereopsis (using a TNO) decreases by more than 30 seconds of arc during the monovision trial, the patient is less likely to become a successful monovision candidate.

Returning to the case studies, it is clear the effect of monovision on the patients' deviation influenced the surgical recommendation. In Case 2 monovision correction was not recommended due to her right exotropia becoming more marked during the monovision contact lens trial and the recognition of intermittent diplopia[6]. It was also expected over time that the patient's exotropia may become more marked and possibly require strabismus surgery. The patient in Case 1, on the other hand, was suitable for monovision as he had a monovision contact lens trial for many years without symptoms. He also clearly illustrates that monovision can be performed on patients with a manifest strabismus provided they have a thorough orthoptic examination and an appropriate monovision contact lens trial[7].

In conclusion, it is important for all patients considering monovision refractive surgery to have a pre-operative orthoptic examination to investigate their binocular functions in order to achieve an optimal post-operative outcome. A patient is an ideal candidate for monovision laser vision correction and likely to achieve a positive post-operative outcome if they: understand monovision, have reasonable post-operative expectations, if during the monovision contact lens trial the ocular motility examination is favorable and if the patient experiences comfortable vision during the trial.

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