

Discordant Unilateral Myopia in Adult Female Monozygotic Twins

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ABSTRACT

Purpose: We present the first single case study of extremely discordant monozygotic twins for refraction, which provides an insight into the complexity of myopia.

Method: The twins were recruited through the Australian Twin Registry (ATR). Each individual completed a general questionnaire, vision examination and a blood test. Visual acuity was examined using the LogMAR chart at 3m. Cycloplegic (tropicamide 1%) refraction using the Topcon (KR 8100 model) auto-refractor and ocular dimensions (axial length, keratometry, anterior chamber depth) were obtained using the IOL master (Carl Zeiss P/L).

Results: A pair of female monozygotic twins aged 62 years with highly discordant refraction is reported. One twin

member has myopic anisometropia with a difference of 7D while her identical twin has no evidence of anisometropia and is mildly hypermetropic in both eyes.

Conclusion: The twins medical and birth history fail to explain the discordance in refraction between the twin pair. There is no marked difference in environmental exposures and medical history between the twins to explain the discordance in refraction. It is possible that the discordant refraction is a result of inter-uterine trauma to twin one during embryonic development or possible injury of being born second to her twin.

Key Words: Anisometropia, discordant, heritability, myopia, refraction.

INTRODUCTION

In Australia, approximately 1 in 40 live births are twins of which 30% are monozygotic (MZ)¹. MZ twins (genetically identical) arise from the same fertilised egg (zygote) with division of the zygote usually occurring between the 3rd and 6th day of embryonic development.

Studies have previously reported the occurrence of discordant refraction in MZ twins with a difference between 3.00 to 5.50 diopters (D)²⁻³. However, one study has reported a high discordance of 26D⁴. Higher degrees of refractive discordance in MZ twins were primarily due to anisometropia, strabismus and myopic retinopathy, where both eyes of the

twins are affected. However, there is no reported case of MZ twins where only one twin presents with a single highly myopic eye or where there is no previous ocular or systemic history or signs of pathology in the myopic eye.

METHOD

This twin pair were part of a larger twin study being conducted in Victoria. The twins were recruited through the Australian Twin Registry (ATR). Each individual completed a general questionnaire, vision examination and a blood test. The mono-zygosity of this twin pair was confirmed by standard genotyping using a series of 11 polymorphic markers performed by the Australian Genome Research Facility, Melbourne.

Visual acuity was examined using the LogMAR chart at 3m. Cycloplegic (tropicamide 1%) refraction using the

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Topcon (KR 8100 model) auto-refractor was obtained and then checked subjectively. Ocular dimensions (axial length, keratometry, anterior chamber depth) were measured using the IOL master (Carl Zeiss P/L).

RESULTS

Both twins were born 2 weeks premature and weighed approximately 1.6kg at birth each. There was no history of low birth weight complications. This MZ pair of female twins, aged 62 years, both have hypertension that has been treated for the last ten years. Twin one has two children now aged 35 and 39 years and both have a history of strabismus. There was no other significant family history of ocular disorders.

TWIN ONE: VISION EXAMINATION

Uncorrected visual acuity was <6/60 (pinhole = 6/24) in the right eye (RE) and 6/5+ in the left eye (LE). A subjective refraction of -7.00/-1.00 x 85° in the RE and +0.50/plano in the LE improved the visual acuity to 6/9 and 6/4, respectively. From the latter results, twin one can be classified as having anisometropic amblyopia. No distance prescription has been prescribed due to the experience of binocular vertical diplopia (right image higher than left) caused by the myopic anisometropia, although reading glasses (+1.50D) have been worn since the age of 13 years. Ocular motility findings were all within normal limits with no signs of ocular muscle imbalance or deviation.

Ocular Dimensions

A difference in axial length of 3mm was observed with the myopic eye being elongated (25.25mm) compared to the non-myopic eye (22.21mm) (Table 1).

TWIN TWO: VISION EXAMINATION

Uncorrected visual acuity was 6/6 in the RE and 6/6 in the LE. Best-corrected visual acuity was 6/4.8 in the RE (+1.00/-0.50 x 85°) and 6/3.8 in the LE (+0.50). No signs of strabismus or muscle imbalance were detected upon examinations.

Ocular Dimensions

Twin two demonstrated a difference in axial length of 0.01mm (Table 1).

DISCUSSION

We report a case of extremely discordant monozygotic twins for myopic anisometropia. Myopic anisometropia in the right eye was found in twin one while her identical twin was marginally hypermetropic in both eyes. The high myopia

Table 1. Biometric readings (AL = Axial Length)

	Right Eye AL (mm)	Left Eye AL (mm)
Twin One	25.25	22.21
Twin Two	22.19	22.18

found in twin one has been present since early childhood and has remained stable during adulthood. There was no past systemic or ocular history to explain the high myopia found in the right eye of twin one. There have been reported cases of identical twins being discordant for refraction²⁻⁴, although reports of myopic anisometropia are extremely rare in identical twins and the general population.

Refractive errors and axial length measurements in the left eye in both twins were highly concordant. However, axial length measurements for the right eye in twin one were approximately 3mm longer compared to twin two. The discordance for refraction between the twins seems to predominantly reflect this increase in axial length of twin one.

Both refraction and axial length measurements have previously been shown to be highly concordant in MZ twins compared to dizygotic (DZ) twins, thus supporting a significant genetic component⁵. However, this case study indicates that MZ twins can also be discordant for refraction and axial length. It is unclear how this difference in refraction could have occurred without the involvement of obvious pathology. There is no significant difference in environmental exposures between the twins to explain the discordance in refraction. Both twins weighed the same at birth, were equally healthy as children and were brought up in a very similar environment. It is possible, however, that the discordant refraction may be a result of inter-uterine trauma to twin one during embryonic development or possible injury of being born second to her twin.

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