



ORIGINAL ARTICLE

Baseline peripheral refractive error and changes in axial refraction during one year in a young adult population



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KEYWORDS

Myopia;
Progression;
Peripheral refraction;
Axial length

Abstract

Purpose: To determine whether the initial characteristics of individual patterns of peripheral refraction relate to subsequent changes in refraction over a one-year period.

Methods: 54 myopic and emmetropic subjects (mean age: 24.9 ± 5.1 years; median 24 years) with normal vision were recruited and underwent conventional non-cycloplegic subjective refraction. Peripheral refraction was also measured at 5° intervals over the central 60° of horizontal visual field, together with axial length. After one year, measurements of subjective refraction and axial length were repeated on the 43 subjects who were still available for examination.

Results: In agreement with earlier studies, higher myopes tended to show greater relative peripheral hyperopia. There was, however, considerable inter-subject variation in the pattern of relative peripheral refractive error (RPRE) at any level of axial refraction. Across the group, mean one-year changes in axial refraction and axial length did not differ significantly from zero. There was no correlation between changes in these parameters for individual subjects and any characteristic of their RPRE.

Conclusion: No evidence was found to support the hypothesis that the pattern of RPRE is predictive of subsequent refractive change in this age group.

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PALABRAS CLAVE

Miopía;
Progresión;
Refracción periférica;
Longitud axial

Error refractivo periférico basal y cambios de la refracción axial durante un año, en una población adulta joven**Resumen**

Objetivo: Determinar si las características iniciales de los patrones individuales de la refracción periférica guardan relación con los cambios subsiguientes de la refracción, durante un periodo de un año.

Métodos: Se reunió a 54 sujetos con miopía y emetropía (edad media: $24,9 \pm 5,1$ años; mediana: 24 años) con visión normal, sometiéndoles a una refracción subjetiva no ciclopéjica. Se midió también la refracción periférica a intervalos de 5 grados, sobre los 60 grados centrales del campo visual horizontal, al igual que la longitud axial. Al cabo de un año, se repitieron las mediciones de la refracción subjetiva y de la longitud axial a los 43 sujetos que se hallaban disponibles para la realización del examen.

Resultados: En consonancia con los estudios previos, los grandes miopes tendieron a reflejar una hiperopía periférica relativa superior. Sin embargo, se produjo una variación considerable entre los sujetos, en cuanto al patrón del error refractivo periférico relativo (RPRE) a cualquier grado de la refracción axial. Dentro del grupo, los cambios medios de la refracción axial y la longitud axial al cabo de un año no difirieron significativamente de cero. No se produjo correlación entre los cambios de estos parámetros en los sujetos, y cualquier característica del RPRE.

Conclusión: No se halló evidencia alguna que apoyara la hipótesis de que el patrón del RPRE es predictivo de un cambio refractivo subsiguiente en este grupo de edad.

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Introduction

Early measurements of the distribution of ametropia usually showed that a relatively broad distribution in early life became markedly narrower and peaked near emmetropia by the age of about 8 years.^{1,2} Although the distribution became more skewed beyond this age, most young adults remained near-emmetropic e.g. Weale.³ However, in contrast to these earlier results, recent decades have seen a marked, progressive increase in myopia through childhood in some parts of the world, particularly Asia e.g. Lin et al.⁴ This has led to a search for the factors that may influence the development and progression of myopia, in the hope that strategies to inhibit or retard progression may be introduced.

Various possible causative factors have been proposed, including genetics (for review⁵), near work (for review⁶), outdoor activities,⁷ lighting,⁸ and concentration of vitamin D in the blood.⁹ A further possibility is peripheral refraction. Comparisons of the patterns of relative peripheral refractive error (RPRE) of human eyes indicate that, on average and in contrast to emmetropes and hyperopes, myopes have a relatively hyperopic defocus in the periphery e.g. Mutti et al.¹⁰ Largely on the basis of the study of late-onset myopia in trainee pilots by Hoogerheide et al.¹¹ it has been postulated that these differences arise because relative peripheral hyperopia has a causative effect for the development of axial myopia.¹²⁻¹⁴ This suggestion is apparently supported by animal studies, which show that the emmetropisation process is visually guided and may involve both central^{15,16} and local effects,¹⁷⁻¹⁹ and that peripheral refraction can guide emmetropisation even in the absence of an axial image.²⁰ These ideas have led to trials in humans of

contact and spectacle lenses designed to reduce peripheral hyperopia, in the hope that this might in turn reduce the rate of myopia progression: a minimal, but significant reduction in progression has been found.²¹⁻²³ On the other hand, some authors²⁴ have suggested that the findings of Hoogerheide et al.¹¹ may have been misinterpreted and that the different patterns of relative peripheral refractive error (RPRE) associated with different refractive groups are the result of the ametropia rather than its cause.²⁵

In view of these contradictory opinions, the aim of the present study was to measure the initial peripheral refractive errors along the horizontal meridian in a group of young adults, and their axial refractive error at baseline and twelve months later. It was hoped that this would allow the relationship, if any, between an individual's initial peripheral refractive parameters and any changes in central refractive error over a one-year time interval to be determined, so that any parameter holding promise of offering a predictive effect for myopisation could be identified. In particular, the hypothesis that a hyperopic RPRE is a precursor to myopic change could be tested. While usually progression of myopia has ceased by early adulthood²⁶ it was expected that, in a population consisting of undergraduates and postgraduates undergoing intensive studies, some cases of late-onset myopia or myopia progression might occur e.g.^{11,27-33}

Methods

Fifty-four subjects (20 male and 34 female) were recruited. The majority of subjects were undergraduate or postgraduate students. The age of the subjects ranged between 19 and 38 years (mean: 24.9 ± 5.1 years; median 24 years). All

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