Corneal endothelial cell density in twins

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SUMMARY Corneal endothelial cell density was measured in normal subjects and in a group of monozygotic and dizygotic twins. Cell density was found to decline with age and to be similar in right and left eyes in normal subjects. Both monozygotic and dizygotic twins were found to have very similar mean endothelial cell densities and particularly so in like-sided eyes.

Corneal endothelial cell density estimations for normal subjects have been previously reported by several authors.¹⁻⁵ Although it is known that some endothelial dystrophies have a genetic component,^{6,7} no studies have been reported in which the familial inheritance of endothelial cell density in normal persons has been examined.

The purpose of this paper is to report a study to determine endothelial cell densities in a group of mono- and dizygotic twins and to compare these with a large normal population.

Materials and methods

Axial endothelial photographs were taken of 285 eyes after it had been established they had no ocular pathology other than senile cataract. Included in this series are 32 eyes from 8 pairs of dizygotic twins and 28 eyes from 7 pairs of monozygotic twins.

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All photographs were taken with a Nikon non-contact endothelial camera. The films were processed and prints made as previously described, and cell density estimated by fixed frame analysis of 3 prints for each eye.⁸ The area of cells counted was equivalent to an endothelial area of between 0.025 mm² and 0.20 mm² in each photograph (Fig. 1).

All cell density estimations were performed by one of the authors. For a group of 9 prints counted on 3 separate occasions in a 'blind' manner the coefficient of variation in estimated cell density for prints of a high standard was found to be 2.1%.

Results

Endothelial cell density was found to decrease significantly with age (Fig. 2), although as previously reported there is a wide range of densities for any given age.

For 58 eyes photography was repeated after one month, and a high degree of correlation was found

Fig. 1 Endothelial photograph to show field of Nikon endothelial camera.

Fig. 2 Endothelial cell density vs. age: normal subjects.

between the estimated cell density on the 2 occasions ($r=0.91$) (Fig. 3). In a group of 83 patients cell density was compared for the 2 eyes (Fig. 4), and a high degree of correlation between the 2 eyes was found ($r=0.92$).

The twins, as expected, showed a similar high degree of correlation when their 2 eyes were compared (r monozygotic= 0.91 , r all= 0.89) (Table 1).

When mean cell density for the 2 eyes of a twin was compared with the mean cell density of the other twin, the 7 pairs of monozygotic twins showed an even higher correlation coefficient ($r=0.93$), while that for the whole population remained unchanged ($r=0.89$) (Fig. 5). A comparison of cell densities between eyes of the same side (i.e., R:R or L:L) in

Table 1 Endothelial cell density in twins

1. Monozygotic				2. Dizygotic			
Case no.	Age	Cell density		Case no.	Age	Cell density	
		Right	Left			Right	Left
1A	11	2799	3089	8A	12	3222	3140
1B		2962	3184	8B		3133	2978
2A	11	3120	3147	9A	12	3300	3040
2B		3037	3187	9B		3226	3140
3A	13	2913	3115	10A	14	3234	3467
3B		3067	3002	10B		3317	3203
4A	14	2827	2782	11A	14	3076	3137
4B		2848	2929	11B		2902	2913
5A	14	3756	3573	12A	15	3468	3400
5B		3657	3687	12B		3769	3640
6A	31	3107	3196	13A	16	3134	3396
6B		3200	3194	13B		3089	3548
7A	72	3000	2647	14A	26	2784	2807
7B		2760	2400	14B		3142	3154
				15A	76	2247	2400
				15B		2320	2420

twins showed correlation coefficients of 0.90 for monozygotic twins and 0.91 for the whole twin population.

The cell densities of 'opposite' eyes within a pair of twins showed a correlation coefficient of 0.77 whether mono- or dizygotic.

Discussion

The close correlation achieved on repeated axial photography suggests an accuracy in photographic method comparable with that of Olsen.⁵ The coefficient of variation is similar to that quoted by Waring *et al.*⁹

Endothelial cell density falls by 30 to 50% between the ages of 20 and 80, and there is no statistical

Fig. 3 Endothelial cell density calculated on 2 visits at least 30 days apart.

Fig. 4 Endothelial cell density R vs. L eyes.

Fig. 5 Mean endothelial cell density of both eyes, twin 1 vs. twin 2.

difference between the sexes. In normal patients the cell density of the 2 eyes is also similar.¹⁻⁵

From our results it appears that both monozygotic and dizygotic twins have virtually identical endothelial cell densities, the correlation being particularly close between like-sided eyes. While it is true that most of our twins were young (11 out of 15 pairs were less than 20 years old) and may be expected to show high cell density and therefore close correlation, the results remain significant when it is remembered that we found a variation in cell density of about 30% within the 16 eyes of 14-year-olds examined.

The 4 pairs of twins over 20 years of age also

showed a close correlation between like-sided eyes ($r=0.99$), suggesting that in the absence of ocular pathology the endothelial cell densities of twins decline at the same rate with age.

Such close correlation between endothelial cell densities in twins may be due to genetic factors or to environmental influences in utero. A study of siblings of closely related ages would be necessary to identify the relative importance of these influences.

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