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Refractive error changes in cortical, nuclear and posterior subcapsular cataracts.

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Purpose

- To determine the effect of the three main morphological types of age-related cataract on refractive error.

Background

- The increase in myopia in some patients with age-related nuclear cataract is well known (Brown & Hill, 1987). This change accounts for the “second sight of the elderly” in which the myopic shift provides normal reading ability without the need for spectacles. Distance vision, however, worsens.
- Planter (1981) suggested that cortical opacity can induce hyperopic shifts. However, this claim has not been repeated since and no firm evidence is available.
- Review papers suggest that cortical opacity can induce astigmatic changes (Brown, 1993). However, these reports were based on clinical impression with no supporting data.
- . The prevalence of uncorrected refractive error in the elderly population is high (Wormald et al., 1992). It is likely that a reasonable proportion of these patients have refractive error changes induced by cataract.
- It has been suggested that a delay in operating on age-related cataract of 10 years could reduce the number of patients requiring cataract surgery (Kupfer, 1985). The possible role of correcting cataract-induced refractive error to delay the need for surgery should be explored.

Subjects

- 98 elderly subjects (mean age 67 ± 8 years) were recruited.
- 77 subjects had one type of morphological cataract: 34 subjects had cortical cataract, 21 had nuclear cataract and 21 had posterior subcapsular cataract (PSC).
- 22 subjects had normal, healthy eyes.
- Ocular screening excluded amblyopia, strabismus, eye disease or surgery.

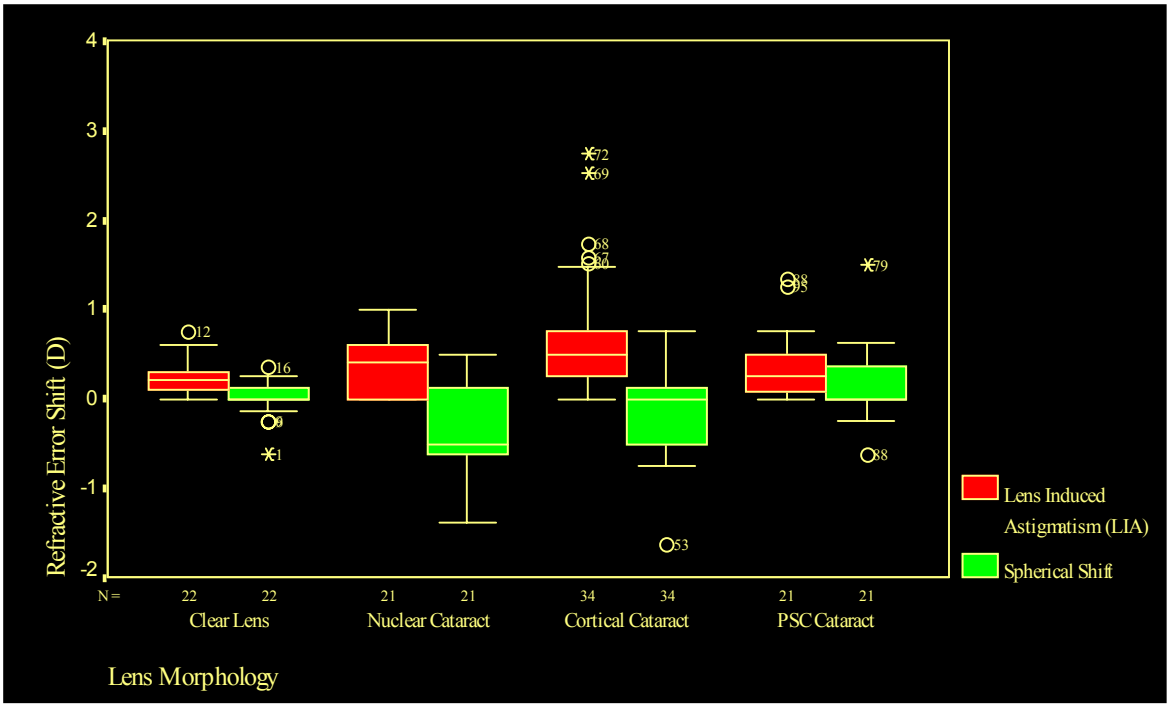
Methods

- Cataracts were classified with the LOCS III system (Chylack et al., 1993).
- For the purposes of the study, nuclear or cortical opacities less than LOCS 2.0 were regarded as normal, ageing changes: e.g. a subject with opacity graded as Nuclear 3.2, Cortical 1.8 was regarded as having nuclear cataract only.
- Optimal refractive correction determined by retinoscopy and subjective refraction. The Jackson cross-cylinder was used to determine astigmatism subjectively.
- Changes in refractive error were defined as the difference between the optimal refractive correction and that taken from the patient's spectacles.
- Spherical changes were calculated from the spherical equivalent value (sphere + 1/2 cylinder.
- Cylindrical changes were determined by vector analysis (Alpins, 2001) which combines the changes in cylinder power and axis. The term lens induced astigmatism (LIA) is coined to express the vector difference between the subjects' spectacle correction and the optimal refractive correction.

Results

- The differences in mean sphere are shown as positive if the optimal refractive correction was more hyperopic (less myopic) than the patient's spectacles and negative if the optimal refractive correction was more myopic (less hyperopic) than the patient's spectacles.
- Lens induced astigmatism is recorded as positive.

- Spherical refractive error shift and lens induced astigmatism are shown in the figure below for each of the group of subjects.



- The mean minus shift in the nuclear cataract group was -0.38DS, compared to shifts in the other groups of -0.18DS (cortical), +0.15 (PSC) and +0.02 (clear lenses).
- These changes in the spherical refractive correction were significantly different between the four groups (ANOVA, $F_{3,94}$= 5.9, p = 0.001).
- Post-hoc analysis using the ScheffeF-test indicated that this was due to differences between the nuclear cataract group and the clear lens and PSC groups ($p<0.05$).
- The mean lens induced astigmatism in the cortical cataract group was 0.71D, compared to shifts in the other groups of 0.38D (nuclear), 0.34D (PSC) and 0.20D (clear lenses).
- These changes in lens induced astigmatism were significantly different between the four groups (ANOVA, $F_{3,94}$= 5.4, p = 0.0018).
- Post-hoc analysis using the ScheffeF-test indicated that this was due to differences between the cortical cataract group and the clear lens group ($p<0.05$).

Conclusions

- Cortical cataract can cause significant astigmatic shifts. In our small sample, this occurred in about 25% of cases of eyes with cortical cataract.
- As previously reported, Nuclear cataract can cause significant myopic shifts. In our small sample, this occurred in about 40% of cases of eyes with nuclear cataract.
- Posterior subcapsular cataract showed refractive changes similar to an age-matched normal group.
- There was a slight minus shift in the cortical cataract group. We suggest that this is likely to be caused by slight nuclear cataract (less than grade II LOCS) in some patients in this group.
- There was a slight astigmatic shift in the nuclear cataract and PSC groups. We suggest that this is likely to be caused by slight cortical cataract (less than grade II LOCS) in some patients in these groups.

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