Correspondence

Surgical corneal clouding

SIR, We were very interested to read the recent paper 'Morphological changes in the human corneal epithelium associated with surgical corneal clouding' by Hague, Dilly, and Thompson,¹ where they discuss the mechanisms of corneal clouding during cataract surgery which they attributed to epithelial changes.

We have recently looked at this problem of transient corneal clouding² and carried out a prospective study of 60 patients undergoing extracapsular cataract surgery. Our results suggest that the basic problem lies in the endothelium (as Hague *et al.* postulated), and we feel that any epithelial changes are likely to be secondary to this.

The corneal clouding we observed had the following features: it occurred rapidly after the start of the irrigation/aspiration phase of the surgery, often within seconds, and then resolved after 1-2 minutes when irrigation was stopped or when the anterior chamber contents were replaced by balanced salt solution or sodium hyaluronate (Healonid). High power examination of the cornea with the operating microscope in the presence of clouding revealed an optically clear epithelium but a degree of haziness at the level of the endothelium: in particular there appeared to be changes at the junctions between the endothelial cells.

We measured a series of parameters during surgery. These included the temperature of the infusion fluid, the duration of the infusion, the infusion flow rate, and the pH, osmolality, and chemical composition of the infusion fluids. Hartmann's solution was used as the infusion fluid during surgery on 40 eyes, and balanced salt solution (supplied by Alcon Laboratories (UK) Ltd) was used during surgery on 20 eyes. Our results revealed there was no association between the incidence of corneal clouding and the temperature of the infusion fluid, the duration of the infusion, or the flow rate of the infusion. However 90% of cases using balanced salt solution had no corneal haze compared with only 20% of cases using Hartmann's solution.

Further analysis of our results suggested that the large difference in osmolality between the two infusion fluids may be significant: the osmolality of aqueous is 300 mosmol/l, that of balanced salt solution 304 mosmol/l, and that of Hartmann's solution only 256 mosmol/l.

We postulated that the endothelial changes we observed may be due to a rapid change such as crystallisation or vacuolation occurring at the intercellular junctions. We concluded that the appearance of surgical corneal clouding was due to transient changes at the level of the endothelium, and these changes could be largely eliminated by using balanced salt solution as the infusion fluid.

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References

- 1 Hague S, Dilly N, Thompson GM. Morphological changes in

the human corneal epithelium associated with surgical corneal clouding. *Br J Ophthalmol* 1987; 71: 729-33.

- 2 McDonnell PJ, Spalton DJ. The maintenance of corneal clarity during extracapsular cataract surgery. *Eur J Implant Refract Surg* in press.

SIR, P J McDonnell and D J Spalton's work, reported in their letter shows that the importance of the endothelium in surgical corneal clarity has been identified by our two differing approaches. Dilly *et al.*¹ have shown that during osmotic insult to corneal endothelial cells there is considerable disruption of the junctions between the endothelial cells before there is any evidence of corneal stromal oedema. McDonnell and Spalton's results are in accord with these observations. Crystallisation we believe is a most unlikely event in the living intercellular space, especially in the presence of increased fluid flow between the cells. Dilly *et al.*'s observations are of increased vacuolisation between the cells. Similar changes have been shown between the epithelial cells of other compromised corneas, especially in neuroparalytic keratitis (Dilly and Mackie, unpublished observations).

Clouding is likely to be the result of a variety of factors; the time of onset and duration of clouding varies enormously between different patients. We would agree that there is a particular form of clouding which occurs almost immediately after the start of irrigation and clears quickly after infusion ceases. The speed of onset of this condition could certainly be explained by opacification at the level of the endothelium. We had attributed this change to a direct effect by pressure or mechanical forces of the infusion, but a change induced by chemical or osmolar insult seems equally feasible. We suggest that the endothelial changes are the first stage on the process leading to epithelial disruption.

In more prolonged clouding and clouding of later onset the epithelium certainly plays a part. The histological changes we identified are large enough to cause diffraction of light and hence result in opacity. Otherwise an explanation is also required for the clinical observation that removing the epithelium improves the view of intraocular structures. The use of balanced salt solution for infusion is a logical approach to this problem. McDonnell and Spalton's results seem encouraging. However, we have used balanced salt solution for infusion during surgery and still experienced problems with clouding of the cornea. We suspect that, although their suggestion may offer some improvement, it is not the complete answer to what is probably a heterogeneous problem.

We thank Drs McDonnell and Spalton for their interesting letter.

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Reference

- 1 Dilly PN, Cavanagh HD, Jester JV, Lemp MA. In vivo tandem scanning reflected light microscopy. II: Morphological demonstration of ouabain inhibition of rabbit corneal endothelial pump. *Invest Ophthalmol Vis Sci* 1987; 28: (suppl, 3): 326.