CORRESPONDENCE

Effects of irrigation solutions on corneal endothelial function

EDITOR,—Reading Yagoubi *et al*'s article¹ was like experiencing 'Back to the Future'. Seventeen years ago we demonstrated that an infusion fluid containing bicarbonate, calcium with glucose will do well without glutathione.²⁻⁴ The presence of glucose eliminated the need for glutathione in these solutions. We also compared the components present in the so-called BSS Plus with TC Earle and TC199 and found no difference in their effect on corneal swelling.⁴

Unfortunately, the ophthalmic community did not take notice of this work and we have been paying dearly all these years for those glutathione additives! Yagoubi *et al*'s paper does not give credit to our research nor to our endothelial cell staining technique⁵ used by them. However, the conclusion drawn from their study that 'the two solutions that contained bicarbonate, glucose, and glutathione — namely, BSS Plus and TC199 with Earle's salts, did not cause corneal swelling' is only partially correct. This statement might imply incorrectly that glutathione is an important component of these infusion fluids, even in the presence of glucose. However, the amount of glutathione in TC199 Earle and TC199 Hank is extremely negligible (2 μ M) to account for its efficacy; nor does more than 1000-fold increase in glutathione (3 mM) in the BSS Plus add to its effect.

It is time to separate apples from oranges and not fall for a commercial hype. As shown previously,²⁻⁴ an infusion fluid containing bicarbonate, calcium with glucose will do well without glutathione additive.

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Reply

EDITOR,—The purpose of our paper was to compare the effects of a range of intraocular irrigation solutions on corneal endothelial function. The intention was not necessarily to determine precisely which components of the solutions were important for maintaining corneal thickness; rather we aimed to highlight some of the deficiencies of solutions such as BSS, Hartmann's, and 0.9% sodium chloride. We observed that the two solutions that contained glucose, bicarbonate ions, and

glutathione (that is, TC199 and BSS Plus) were the only ones that did not cause corneal swelling. Those three components have all been associated with maintenance of endothelial function, and hence the control of stromal hydration, since the work of Dikstein and Maurice,¹ Hodson and Miller,² and others.

By reference to some of his earlier experiments, Peyman questioned the implied necessity for irrigation solutions to contain glutathione. From our experiments, however, we were not in a position to comment on whether glutathione was an essential component, merely that it was present, albeit at very low concentration in TC199, in the solutions that maintained corneal thickness. The question of glutathione, therefore, awaits further investigation, taking into account the observations of Peyman as well as those of Dikstein and Maurice, and others.

We did not intentionally overlook Peyman's work in this area. Our experiments differed in one important respect from previous work on irrigation solutions. We did not rely on corneal thickness changes during exposure to the various solutions as the sole means of assessing the efficacy of the irrigation solutions: corneas were also subjected to a standardised period of perfusion after exposure to the irrigation solutions during which both the barrier properties and the pump function of the endothelium could be assessed.

As far as the staining method was concerned, we cited the reference by Taylor and Hunt³ which described in detail the actual method we used. Taylor and Hunt do refer to the work of Spence and Peyman,⁴ but they introduced an important modification to the technique by pointing out that adjustment of the pH of the alizarin red S solution to 4.2 optimised the efficiency of the dye-lake reaction. Taylor and Hunt also suggested brief fixation in glutaraldehyde to stabilise the stained endothelial mosaic.

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Traditional healers in primary eye care

EDITOR,—We were pleased to see the editorial by Foster and Johnson¹ accompanying our article on corneal disease and traditional eye medicine use in Malawi.² We feel strongly that cooperation with traditional healers may lead to benefits in the area of primary eye care, and so established an interactive training programme with the healers in Chikwawa. The development of initial activities at the local level has led to a firm basis of learning and trust between healers and biomedical personnel. Healers in need of cataract or trichiasis surgery are being targeted for surgical

correction under the assumption that this will lead to a greater acceptance of surgery by their patients. The most distinct difference between our programme and the impressive work of Chana in Zimbabwe is the structure of the collaboration: in Chikwawa, the ophthalmic medical assistant is the primary health professional involved in the collaborative relationship. He has conducted a number of training sessions for groups of healers. Healers refer patients to him at the local district hospital (to which a cataract surgeon travels) rather than a distant central hospital. We have not distributed Western medicines to healers. The problems inherent in sustaining distribution of products such as tetracycline 1% ointment and the danger of healers mixing herbs with the ointment to increase its 'potency' have concerned us.

Over the past 2 years about 240 healers have participated in this pilot project and an evaluation is under way. We are attempting to measure the role healers can play in encouraging cataract patients to accept surgery as well as detect changes in detrimental practices. Early results are encouraging. From September 1990 to March 1992 (pre-intervention) an average of 5.3 cataract blind patients per month presented at Chikwawa District Hospital. From October 1993 to October 1994 (post-intervention) this figure increased by 80% to 9.6 patients per month.

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Argon laser treatment of trichiasis in Hong Kong

EDITOR,—A total of 107 lids with trichiasis were treated with argon laser photocoagulation (one session only). We excluded those with gross entropion and more than 10 abnormal lashes per eyelid. The laser variables were: 100 μ m, 0.2 seconds, and 1.0-1.2 W.

Initially, we started without anaesthesia; however, if the patient could not tolerate this, we applied a topical anaesthetic (oxybuprocaine). If it did not work, we change to infiltration anaesthesia (2% lignocaine with adrenaline 1:100 000). The reason for giving different types of anaesthesia according to an individual's need was to try to clarify the dispute on this issue.¹⁻³ The distribution of anaesthesia used was: infiltration 62 (57.9%); nil 39 (36.4%); topical 6 (5.6%). Thus, if a patient could not tolerate the treatment without anaesthesia, a topical anaesthetic would not be beneficial in most of the cases.

Among the different causes of trichiasis, trachoma carries a significantly low success rate (27.7%) ($p < 0.05$, χ^2 test) because it causes scarring and disturbs the lid anatomy so that aiming during treatment is more difficult; blepharitis has a success rate of 47.8%; and idiopathic trichiasis is most successfully treated with a 69.4% success rate.

The success rate of those cases with less than three lashes per lid was 75.6% while the overall success rate was 62.6%. This is in accord with other authors' finding.²⁻⁴ Sharif³ explained this by the number of laser burns per lash. Our finding shows the association between lower recurrence rate and higher number of burns per lash: with no recurrence there were 16.7 burns per lash and with recurrence there were 14.7 burns per lash. However, this association cannot be proved statistically. Another possible explanation is that in those lids with high number of aberrant hairs the disease leading to trichiasis is still active and the hairs regrow after treatment.

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Electroretinogram as indicator of prognosis of central retinal vein occlusion

EDITOR,—Matsui and colleagues¹ report on ERG b/a wave ratio changes in central vein obstruction and conclude that retinal ischaemia in ischaemic central retinal vein occlusion (CRVO) can be reversible. This result is surprising, as the natural history of ischaemic CRVO has been clearly documented² correlating the degree of retinal ischaemia with the development of neovascularisation – a process that may only be reversed by panretinal photocoagulation (PRP). Their findings are based on investigations including fluorescein angiography (FA) and electroretinogram (ERG), both of which appear to require further analysis.

Firstly, with respect to the FAs in the good prognostic groups which supposedly illustrate resolution of retinal ischaemia. In case 3, the initial FA at 1 month was masked by retinal haemorrhages and the degree of ischaemia cannot be determined owing to the absence of peripheral photographs. Therefore, the FA at 5.5 months, said to show significant improvement, merely shows the predictable changes expected in a well perfused CRVO. Despite inaccuracies in statements regarding the timing of treatment and photography in case 1 (Fig 4), we feel there is no evidence of improvement of ischaemia in (according to the caption) the recovery FA at 5.5 months; this clearly demonstrates marked capillary drop out and macular ischaemia. It also demonstrates PRP which was supposedly not performed until 11 months.

Secondly, two different ERG techniques were used with only one set of normal values and no affirmation that each individual patient was always examined using identical techniques.

Thirdly, the ERGs in Figure 2 show a speculative b-wave identification on an ERG with no replication, and result in a markedly longer a-b interval than when initially seen. If the b-wave were taken at the first visible peak, a very different amplitude value would be

obtained. What were the criteria for b-wave identification?

Finally, following PRP, if case 1 stabilised, how do the authors explain such marked trial to trial variations in a- and b-wave amplitude (Table 1)? What is the expected intersession variability for their laboratory (normally about 10%)?

We therefore suggest that Matsui *et al* reconsider their results, or repeat the study with greater scientific stringency, and reassess the validity of their original conclusion.

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Reply

EDITOR,—We appreciate the comments of Cordeiro and others.

Firstly, they questioned our interpretation of the ischaemic CRVO in case 3, whose FA could not be interpreted because of blood covering the retina. Our interpretation of the ischaemic retina came mainly from the ERG findings of low b/a amplitude ratio with normal a-wave. The blood in front of the retina will not decrease the b/a ratio. It will increase the ratio instead. Non-ischaemic CRVO would not show decreased ERG b/a ratio. However, the level of retinal ischaemia in case 3 would be moderate because the decrease of the b/a ratio is not as marked as that usually seen in complete occlusion of the central retinal artery.

The fundus photograph in case 3 shows extremely dilated retinal veins, extensive retinal haemorrhage, and some capillary dropout in the area not covered by the blood in the FA. Cordeiro *et al* mentioned that the clearing of the haemorrhage and normalisation of the veins, as documented in case 3, was a predictable outcome. I disagree. Predicting the final outcome of CRVO from the initial fundus appearance alone is difficult because one cannot judge the degree of retinal ischaemia if the retina is covered by blood. The ERG plays an important role in such cases.

There was an error in the caption for Figure 4. The FA in the middle of Figure 4 was taken after 11 months just before the PRP instead of 1 month. And the FA in the bottom was taken at 62 months instead of at 5.5 months. The captions of Figures 4 and 2 were mixed for which I apologise. Cordeiro *et al* feel that there is no evidence of improvement of the ischaemia after PRP (bottom Fig 4). The FA taken sometime after PRP was magnified in the posterior pole and shown in the bottom of Figure 4. It is clear that the central non-perfused area is decreased after PRP compared with that before the PRP. The spot in the fovea in the bottom of Figure 4 is a pigmented scar spontaneously developed after the macular oedema subsided.

Secondly, Cordeiro *et al* asked why two different ERG techniques were used with only one set of normal values. This report is a

retrospective study from data collected over many years. At one point we had to change the ERG system in our laboratory because of new recommended standardisation, and for other reasons. However, the majority (6/8 cases) had ERG recorded with the old system with description of the normal age matched values. Only two cases were recorded with the new system. ERG data used in those two cases were those recorded with bright single flash, strong enough to record oscillatory potential. The intensity was comparable with that of the old system. Only ERG b/a ratio was used in those two cases.

Thirdly, Cordeiro *et al* mentioned that the b-wave identification in Figure 2 was speculative. This criticism would be well taken if we had to measure the b-wave from this recording only. We routinely record ERG on EEG recording paper simultaneously with the cathode oscilloscope. In the reading on the EEG paper, whose paper speed is much slower, identification of the b-wave peak is easy. We recorded the amplitude from both these findings.

Finally, Cordeiro *et al* questioned if case 1 was stabilised, why was there a marked a- and b-wave amplitude variation after PRP. It would be wishful thinking that the retinal function would be stabilised after PRP. Obviously it was not. There was a change in the fundus appearance after PRP besides the scar formation on the laser spots, such as haemorrhage or vascular anastomosis during a long observation period after PRP, as described in the test. Vision fluctuated too. Therefore, it is not surprising to see some fluctuation of the ERG findings. In spite of this fluctuation, there was a trend in which the a-wave declined and the b-wave increased. As a result, the b/a amplitude ratio improved. The suggestion was made to repeat the study with greater scientific stringency. Such a study requires a long time if done by one institute. A nationwide study in CRVO has been recently completed in the United States in which multiple medical centres participated. This study included ERG and FA. The results of the study may disclose a similar case. Namely, ischaemia in CRVO may not be permanent and may be reversible in some.

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Effect of trabeculectomy on pulsatile ocular blood flow

EDITOR,—We read with interest the paper by James.¹

An increase of pulsatile ocular blood flow (POBF) was found in the standing position following trabeculectomy. This was attributed to an increase in perfusion pressure which is expected with reduction of intra-ocular pressure (IOP) assuming autoregulation was absent.

In the lying position, however, POBF was unchanged following trabeculectomy despite similar magnitudes of IOP lowering. It was suggested that in this group, because of the extremely high IOP in the lying position pre-operatively, the POBF was somehow maintained at an elevated level by autoregulatory mechanisms which masked any improvements in POBF after surgery. This was also felt to be responsible for the regaining of the usual postural changes following trabeculectomy.