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The effects of contact lens care solutions on the corneal epithelium - a comparative investigation using confocal microscopy

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Certain combinations of silicone hydrogel contact lenses and care regimens have previously been found to produce significant asymptomatic annular corneal staining in contact lens wearers (Jones *et al* 2002). This project focused on investigating the etiology behind this staining. From the data obtained, contact lens companies will be assisted in the design of lens care products to prevent/reduce such corneal staining if indeed it is deemed clinically necessary to do so.

High resolution confocal microscopy was employed to observe the response (and its permanence) of corneal epithelial cells and sub-basal corneal nerve fibers to two popularly marketed contact lens care solutions. The project investigated the effect of OptiFree® Express® MPDS no rub cleaning solution and Bausch & Lomb ReNu MultiPlus® no rub cleaning solution on the cornea of PureVision™ contact lens wearers. The corneal epithelium and sub-basal nerve fibers were observed at 500 times magnification (with a theoretical lateral resolution of 1 µm) using the ConfoScan3 confocal microscope (Nidek Technologies, Italy).

Twenty asymptomatic silicone hydrogel contact lens wearers were recruited. These contact lens wearers were on average 26 years old and had been wearing soft contact lenses for approximately 8 years. Previous silicone hydrogel lens use had occurred over the past 20 months on average. Ten non contact lens-wearing control subjects were also recruited. These non contact lens wearing controls averaged 25 years in age. Data from the 10 control subjects, as well as data from the 20 contact lens wearers were analyzed using Statistica7.

The basal epithelial cell density of non contact lens wearers was significantly greater than that of contact lens wearers ($p < 0.05$). Neural width of non contact lens wearers was significantly larger than that of contact lens wearers ($p < 0.05$). Contact lens wearers tended to show greater pre confocal staining compared to non contact lens wearers, when examined on the slit lamp biomicroscope.

Superficial epithelial cells were easier to resolve on confocal microscopy when either of the two care solutions was used (Figures 1 and 2). Individual sloughed off cells were visible on confocal microscopy when staining was observed on slit lamp biomicroscopy (Figures 3 and 4). Staining and sloughing off was greater for ReNu MultiPlus® compared to OptiFree® Express® MPDS, ($p < 0.05$). Fluorescence extending to the basal epithelium was at times observed for ReNu MultiPlus® but not OptiFree® Express® MPDS (Figure 5).

Basal epithelial cell density declined significantly ($p < 0.05$) for ReNu MultiPlus®, perhaps indicative

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of oedema. There was no significant change in basal epithelial density with OptiFree® Express® MPDS ($p>0.05$). ReNu MultiPlus® showed a decline in neural density compared to the OptiFree® Express® MPDS care regimen. However, this decline was not significant ($p>0.05$). Subbasal nerve fibre width declined significantly on the ReNu MultiPlus® care regimen ($p<0.05$). There was no decline in neural width on the OptiFree® Express® MPDS care regimen.

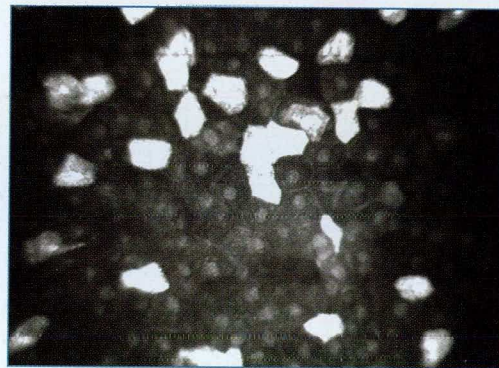
In conclusion, it was seen that contact lens care solutions affected the corneal epithelium of silicone hydrogel contact lens wearers. The observed corneal staining was caused by contact lens and care solution interactions.

Reference

1. Jones L, MacDougall N, Sorbara LG. Asymptomatic corneal staining associated with the use of balaafilcon silicone-hydrogel contact lenses disinfected with a polyaminopropyl biguanide-preserved care regimen. *Optom Vis Sci* 2002; 79(12) 753-761.



Figures 1 & 2 - Superficial epithelium. Figure 1 was taken at baseline for participant 31 and figure 2 was taken for the same participant after one week of contact lens and OptiFree® Express® MPDS solution use.



Figures 3 & 4 - Superficial epithelium. Figure 3 was taken at baseline for participant 27 and figure 4 was taken for the same participant after two weeks of contact lens and ReNu MultiPlus® solution use. Participant 27 showed significant annular staining on slit lamp examination.



Figure 5 - Basal epithelium. Figure 5 was taken on participant 19 after 4 weeks of contact lens and ReNu MultiPlus® solution use. Participant 19 showed minimal annular staining on slit lamp examination.