Delivery of atropine from etafilcon A contact lens to control myopia

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Background: Myopia (short-sightedness) is growing in prevalence around the world. People with myopia have elongated axial length of eye, and if this grows too much it can lead to blindness. Atropine drops have been used to control the eye growth and reduce the amount of myopia. However, due to the low bioavailability of atropine in eye drops, use of atropine loaded contact lenses may offer an improved delivery system.

Objectives: The present study was conducted to produce a stable nano-micelle formulation of atropine and to determine whether the formulation could be adequately loaded into and released from contact lenses and be stable upon sterilization.

Methods: A surfactant was mixed with phosphate buffer saline (PBS) (pH = 6.5) and atropine base was added to make a nano-micelle formulation. The nano-formulation was kept at room temperature (23^0C) and the stability of the encased atropine was checked at different time periods using high performance liquid chromatography (HPLC). The nano-formulation was autoclaved (121 ºC; 15 mins) and the amount of atropine was then analysed by HPLC. The polydispersity index (PDI) and the particle size of the nano-formulation was measured by dynamic light scattering. The nano-formulation was incorporated into Etafilcon A contact lenses by soaking. The amount taken up and then released during stirring for 24 h was assessed by HPLC. Any effect on material properties of the contact lenses was assessed by measuring their percentage of transmittance (% T) and equilibrium water content (EWC) using UV-Visible spectrophotometry and electrical balance.

Results: There was no degradation of atropine in the nano-micelle formulation even after 67 days incubation. Autoclaving resulted in slight degradation of the atropine in the nano-micelle formulation; 24.35±0.15 µg before autoclaving, 19.36±1.71 µg after autoclaving (n=3), but significant amount of atropine was still present in the formulation. The PDI and the particle size of the surfactant was 0.53 and 342 nm, respectively. 5.42±0.20 µg (n=3) atropine was taken into an etafilcon A contact lens, and most of this (5.38±0.01 µg; n=3) was released from an etafilcon A lens within 4h. The EWC and % T of the nanoformulation loaded etafilcon A contact lens was 54.52±0.83 % and 98.38±0.12 % (n=3) at 479 nm.

Conclusion: Atropine in a nano-micelle formulation was stable and able to be taken into contact lenses without causing any significant effects on the materials properties of the lenses. Delivery of atropine from nano-micelle loaded contact lens might be a promising option to control the development of myopia.

Keywords: Drug delivery, atropine, nanoformulation, contact lens and myopia.