

Optimizing topical antibiotic delivery in dogs: Tear film pharmacokinetics of moxifloxacin following pre-treatment with hyaluronic acid

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Abstract

Purpose

To evaluate the impact of pre-treatment with mucoadhesive polymers on tear film concentrations of topically administered moxifloxacin in dogs.

Methods

Eight healthy dogs were enrolled in a randomized paired-eye crossover study consisting of two sessions (7-day washout). Eyes received topical 0.5% moxifloxacin alone (control) or following pre-treatment with a mucoadhesive polymer applied 30 seconds earlier: either 0.2% hyaluronic acid (HA; Hylogel®) or 0.75% cross-linked hyaluronic acid (XHA; Oculenis®). Tear samples were collected using microcapillary tubes at baseline and predefined intervals up to 480 minutes, and moxifloxacin concentrations were quantified by UV-Vis spectrophotometry (293 nm).

Results

Total moxifloxacin exposure (AUC_{0-480}) increased following pre-treatment with either HA formulation. The XHA produced a statistically significant 2.0-fold increase in mean AUC_{0-480} over control (47,929 vs. 24,417 $\mu\text{g}\cdot\text{min}/\text{mL}$; $P = 0.005$). The HA group achieved a 1.8-fold increase in mean AUC_{0-480} (37,104 vs. 20,693 $\mu\text{g}\cdot\text{min}/\text{mL}$), but this did not reach statistical significance ($P = 0.154$). In the XHA trial, a significant treatment effect ($P = 0.012$) and interaction ($P = 0.002$) were observed for concentration, which remained significantly higher than control for 15 minutes ($P \leq 0.018$). In the HA trial, a significant treatment effect was noted for concentration ($P = 0.020$), with levels remaining significantly higher than control for 10 minutes ($P \leq 0.024$). No ocular irritation was observed.

Conclusion

Prior administration of mucoadhesive polymers increases moxifloxacin bioavailability on the canine ocular surface, with this effect being more pronounced for cross-linked HA ("reservoir effect") compared to linear HA formulations. These findings may help optimize topical antibiotic delivery strategies in dogs with bacterial keratitis.

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Introduction