Administering antibiotics through the cornea

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Credit: Asociación RUVID

The anatomic and physiologic structure of the eyes constitutes an important barrier when administering medicine. The amount of medicine that passes through the cornea via creams or drops is very limited, and it is necessary to develop alternative methods of ocular administration. Researchers at the Pharmacy Department of the CEU Cardenal Herrera University have developed a new bioadhesive ocular insert that is placed inside the eyelid and releases a larger amount of medicine through the cornea in a controlled way. They have published their results in *Drug Delivery and Translational Research*.

The researchers at the CEU UCH have developed this new insert for the ocular administration of the antibiotic moxifloxacin, which is fights bacterial infections of the eyes, including corneal queratitis and bacterial endophthalmitis.

The authors write, "When we apply cream or drops in the eyes, eyeball defense mechanisms such as tears are triggered, which dilutes the applied medicine. Sometimes, less than 5 percent of the medicine administered in this way manages to penetrate the eye in an effective way. Therefore, pharmaceutical research aims to develop ocular inserts, very thin cylinders or discs made of bioadhesive polymeric materials, which adapt to the shape of the eye and release the medicine through the cornea in a controlled manner."

Researchers at the CEU UCH have developed and analysed the efficiency of different types of inserts with bioadhesive polymers with different physicochemical characteristics to discover which could obtain an optimal degree of permeability to administer moxifloxacin. The result is a very thin, practically transparent insert that is easily adhered to the ocular mucosa, providing larger concentrations of moxifloxacin through the cornea than other administration vehicles on the market.

The researchers write, "The ocular release of moxifloxacin with this insert would make for an improved treatment of some ocular illnesses such as bacterial endophthalmitis, an infection of the eyeball which can appear after suffering a wound or as a complication following intraocular surgery. It can also be used for treating corneal queratitis, an infection of the cornea which causes inflammation and can leave a leucoma or scar as a result. In both types of infection, vision can become severely compromised without the appropriate treatment."

Permeability of the corneal tissue

In order to establish the physicochemical properties of the most efficient bioadhesive polymers to be used as ocular inserts, the CEU UCH team performed moxifloxacin diffusion ex vivo experiments through rabbit corneas preserved at different temperatures. The histological differences were studied to determine whether the use of frozen corneas was possible. According to the researchers, "the ocular diffusion studies we have undertaken reveal significant differences of diffusion through fresh and frozen corneas, which are very useful for the development of future

research to test new ocular inserts."

The development of an ocular insert to administer moxifloxacin opens new treatment possibilities for ocular infections.

More information: María Sebastián-Morelló et al. Ex vivo rabbit cornea diffusion studies with a soluble insert of moxifloxacin, *Drug Delivery and Translational Research* (2017). DOI: 10.1007/s13346-017-0443-y

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