Engineered cornea more resistant to chemical injury

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(Medical Xpress) -- A new study from the University of Reading has established that a prosthetic cornea made from human cells is the best model for testing how irritants and toxins cause eye injuries.

The engineered cornea so closely resembles a natural cornea that it is a more reliable method of assessing damage caused by chemicals to the surface of the eye. One of these, sodium lauryl sulphate, is very common in shampoos, hair conditioners and toothpaste and was used in the study.

Existing models do not consider the important influence that mechanical properties, such as stiffness, play in directing normal cell growth. The leading model uses a material many times stiffer than the natural cornea,

and another popular test uses one that is less stiff. The Reading model uses a surface that mimics the stiffness of a human cornea.

Corneal tissue engineering has improved dramatically over recent years as demand has grown. More than 48,000 cornea transplants have been recorded on the UK Transplant Registry since the Corneal Transplant Service began in 1983, and this is set to rise a with an ageing population. Currently corneal transplantation requires a continuous supply of health donor corneas.

An effective engineered replacement is essential if current levels of corneal transplantation are to be maintained.

The scientific advancements recently made at Reading in corneal biology and biomaterials can now, for the first time, be combined to create an accurate model of the cornea applicable to both toxicity testing and transplantation.

Dr Che Connon, from Reading School of Pharmacy, uses compressed collagen gels to engineer the prosthetic cornea which result in a much smoother and stiffer surface on which to grow cells than normal collagen. This technique represents the ultimate in biocompatibility as it results in a biomaterial comprised wholly of human proteins.

"Most irritants cause a temporary stinging, such as when shampoo gets into your eye," said Dr Connon. "However, we need to make sure that transplants using engineered material are as robust as possible - people who have already experienced loss of vision through damage to their own cornea need the confidence to know that their transplant is up to the job.

"This latest study proves that our prosthetic cornea was more resistant to chemical irritation. Compressed collagen cells which more accurately

mimic the corneal surface provide the most protection against toxic assault."

Previously Dr Connon and Professor Ian Hamley in the Department of Chemistry engineered a tissue suitable for cornea transplantation using human stem cells. The research team developed a prosthetic cornea comprised solely from human cells and proteins, their growth and development having been directed by a synthetic polymer template which mimics the cornea's natural architecture

The paper, ‘Influence of substrate on corneal epithelial cell viability within ocular surface models', by Yun Feng, James Foster, Shengli Mi, Bo Chen, and Che John Connon, is published in *Experimental Eye Research*.

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Provided by University of Reading