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Contact

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Author presents

Tuesday, December 8, 2009
11:00 am–12:30 pm
Poster Session 3:
Other Diseases III
Program 1694
Board B73
Exhibit Halls D–H

Cell Therapy of Corneal Diseases with Umbilical Mesenchymal Stem Cells

W.-Y. Kao, H. Liu, J. Zhang, C. Liu
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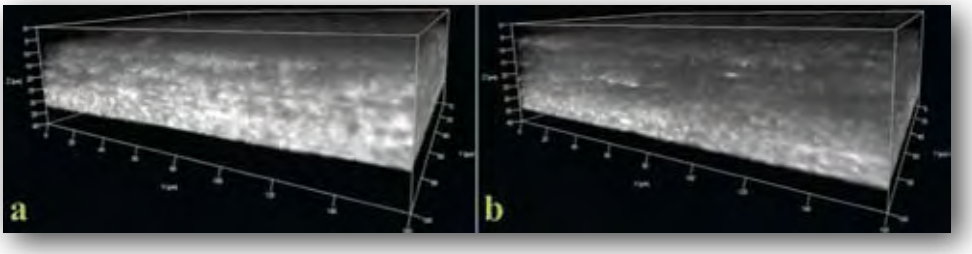
Umbilical stem cells allow mice to see through clear eyes



Confocal images of corneas of lumican knockout mice: Panel "a" is the control eye with no treatment; Panel "b" shows the eye 12 weeks after transplantation of 104 umbilical cord mesenchymal stem cells.

Using human umbilical stem cells as an alternative to corneal transplants clears an experimental hurdle by opening the cloudy eyes of a lab mouse

The miracle age of organ transplantation began not with the heart but with the cornea of the eye in 1905. More than a century later, the 50,000 corneal transplants performed each year in the U.S. seem less of a miracle and more of a standard therapy for severe corneal injury or disease. Yet the supply of human corneas for transplantation is under threat from an unexpected direction—laser eye surgery to reconfigure the refractive surface of the cornea. Whatever it does for eyesight, laser surgery usually leaves the cornea unsuitable for later organ donation.

In the face of this growing shortage comes a successful demonstration of principle for a radically different approach to treating corneal damage—transplanting human umbilical cord mesenchymal stem cells (UMSCs) onto the damaged cornea. Winston Kao and colleagues at the University of Cincinnati College of Medicine transplanted UMSCs into the eyes of special knockout mice genetically engineered to lack the gene for making lumican. Lumican is a protein essential for the formation and maintenance of a transparent cornea. Knockout mice without lumican have thin and cloudy corneas.

Kao reports that transplanting human UMSCs into the mouse eyes significantly improved corneal transparency and increased the thickness of the corneal stroma, the transparent middle layer. The transplanted umbilical stem cells survived in the mouse corneal stroma for more than three months, with minimal signs of graft rejection. In contrast, when Kao transplanted human umbilical hematopoietic stem cells, the stem cells that give rise to all blood cell types, they rapidly vanished from the mouse corneas, victims of graft–host rejection.

Kao says that histological and immunofluorescence staining showed that the transplanted UMSCs could transdifferentiate and assume the appearance of normal corneal keratocytes. The new cells expressed critical keratocyte markers such as keratocan and aldehyde dehydrogenase, as well as the adhesion protein, CD34, all with little or no graft reaction.

Having his proof of principle in hand, Kao believes that UMSC transplants are well worth pursuing as an alternative treatment for severe genetic and corneal diseases. Unlike donated corneas, the supply of human UMSCs is almost unlimited, says Kao. They are easy to isolate from the umbilical cord. Their numbers can be expanded in cell culture and they can be stored and quickly recovered from liquid nitrogen when a patient is in urgent need of a clear, healthy cornea.