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Animal collagen protein for the production of corneal implants

Background

In collaboration with the biotechnology company LinkoCare, Swedish researchers at Linköping University have developed a corneal implant based on collagen proteins derived from pig skin. Linköping University is known worldwide for innovative education and cross-border research, and its graduates are among the most sought-after and best in the world, according to international rankings. The biotechnology company LinkoCare's vision and strategy is to provide bioengineered medical products with a focus on eye, heart and nerve regeneration applications involving Tissue-Engineered Medical Products, Hybrid Medical Devices and Avanced Therapy Medicinal Products. Currently, the company is developing next-generation bioengineered corneas, as well as refractive devices for vision restoration and correction and tissue-engineered membranes.

Successful pilot study lets blind people see again

Around 12.7 million people worldwide suffer from blindness due to corneal damage or disease. To date, only a corneal transplant from a human donor offers the chance of a cure. Unfortunately, there is an enormous shortage of donations, so that only one in 70 patients receives the necessary corneal transplant. Another problem is that the majority of people who need corneal transplants live in countries where access is difficult and treatment is both limited and costly.

An innovative pilot project is showing initial success: 20 previously mostly blind subjects can see again after receiving an artificial corneal implant! But what is behind this revolutionary implant?

The human cornea consists largely of the protein collagen. In the project, as an alternative to the human cornea, the researchers used collagen molecules that were extracted from pig skin, highly purified and prepared under strict conditions for use in humans. The major advantage is that the pig skin used is a byproduct of the food industry and is easy, cheap and available in large quantities. To create the corneal implant, the scientists stabilized the loose collagen molecules to create a robust and transparent material that can withstand use and implantation in the eye. Another advantage over human corneal donations is that the bioengineered corneas can be stored for up to two years before being implanted in patients, whereas human donations must be used within two weeks.

In connection with the animal implant, the scientists involved in the research project have also developed a new, minimally invasive procedure for treating the eye disease keratoconus, in which the cornea of affected individuals becomes so thin that it can result in complete

blindness. In addition, unlike previous methods, the procedure can be used in smaller hospitals, not just specialty clinics, allowing more patients to be treated. The treatment is performed by the surgeon using a small incision to insert the implant into the existing cornea - there is no need to remove any of the patient's own tissue. The novel surgical procedure eliminates the need for sutures. In addition, the incision into the cornea can be made both with the help of a laser with high precision but also manually with conventional surgical instruments.

The procedure was first tested in pigs and revealed to be simpler and potentially safer to perform than conventional corneal transplantation. Also, in the pilot study with 20 subjects, there were no complications during the surgeries and tissue healing was rapid. Furthermore, the follow-up treatment also proved to be successful: in an eight-week therapy with immunosuppressive eye drops, rejection of the implant could be prevented. This is also a big step forward, because in previous corneal transplantations patients have to take medication for several years to prevent rejection. The subjects in the pilot study did not show any complications either during or after the two-year observation period.

The researchers are confident that the new biomaterial meets all the criteria to be used as a human implant. The ambition to develop an implant that can be mass-produced affordably and that has a high availability and storage time has been fulfilled. The new method is expected to help visually impaired people around the world regain their vision in the future. Before this can happen, however, the implant still has to successfully pass a major clinical trial and the subsequent market approval. At the same time, the goal is also to investigate whether the technology can be used to treat other eye diseases and whether the animal-derived implant can be customized for even greater efficacy.

Want to learn more? We have listed the companies and research institutes involved in the research project for you:

COMPANY / RESEARCH INSTITUTE	LOCATION	WEBSITE
Linköping University (LiU)	Sweden	https://liu.se/en
LinkoCare Life Science AB	Sweden	http://www.linkocare.com/

You prefer a direct contact person who convinces with years of experience and expertise in the field? We have listed some experts for this as well:

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INDUSTRY EXPERT	JOB POSITION	FIELD OF EXPERTISE
Prof. Dr. Neil Lagali	Professor at the Department of Biomedical and Clinical Sciences at LiU	opthalmology
Dr. Pavel Stodulka	Board member at LinkoCare Life Science AB / Director of Gemini Eye Clinics	opthalmology