preliminary investigations and can be used for testing new media, substances, drugs, or preservation conditions and their impact on corneal tissue quality and safety. Furthermore, the quantitative method to assess whole endothelium mortality can be implemented at eye banks for the evaluation of corneas intended for transplantation.

**P13-A113 THE EVEIT BIOREACTOR SYSTEM AS PLATFORM FOR ARTIFICIAL CORNEA PROTOTYPES**

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**Purpose** Corneal donor tissue is in short supply. Only a fraction of the demand is satisfied. The tissues can vary in quality and sometimes have limited use. To address the issue, the generation of artificial corneal grafts is intensively researched.

Various aspects of these prototypes need to be tested, ranging from structural integrity to cellular morphology. Our Ex Vivo Eye Irritation Test (EVEIT) is based on an air-lift organ culture system, where we currently are using rabbit corneas from food industry. We constantly expanded our capabilities in quantifying various parameters concerning metabolism, structural integrity and optical properties. This also opens up the possibility of using the system as a testing platform for prototypical artificial corneal constructs.

**Methods** Various ophthalmological aspects can be investigated using the EVEIT system:

- Self-healing of superficial injuries and morphological characteristics can be observed over several days by live-tissue staining macroscopy.
- Metabolic parameters are recordable via the endothelial nutrient supply mechanism.
- Acute changes in internal pressure can be measured in the artificial anterior chamber with high resolution.
- Corneal barrier functions and pharmacokinetic properties can be quantified using photometric analysis methods.
- Dry-Eye model and established corneal edema models can be employed to test the efficacy of potential therapeutics.
- Advanced 3D design and printing methods allow us to quickly adapt the bioreactor, for example, to incorporate human corneas or to improve the mobility of the system.
- In order to comply with the 3Rs principle, testing of several different chemicals on one cornea is now also possible with the aid of automated multi-application.
- Recent developments of the EVEIT system include the engineering of an artificial eyelid model.

**Results** Our long experience in using and optimizing the EVEIT system led to a unique adaptability to accommodate different testing conditions and requirements. Established disease models such as corneal edema and in dry eye syndrome (in process) are involved in testing new drugs.

**Conclusion** Our established EVEIT system, in addition to its experimental capabilities, could contribute to the development of artificial corneal grafts in the future, as we have shown in previous work. The flexibility of the system allows us to adjust and improve an enormous range of test conditions and parameters.
processed within 2 h after death. Porcine eye bulbs were decontaminated by immersion in 10 mL of 5% povidone-iodine and corneas were dissected under aseptic conditions, leaving approximately 2 mm of the scleral rim. DMEK grafts were prepared by means of mechanical stripping technique using specific surgical instruments for DMEK (Moria, France) on fresh corneas (n=2) and on corneas stored in Eusol-C (AL.CHLMIA Srl, Italy) at 4°C for 7 days (n=4) and for 14 days (n=4). Endothelial cell (EC) density was compared before DMEK-preparation (specular and light microscopy on trypan blue stained tissues) and after DMEK-preparation (fluorescence microscopy on Calcein-AM stained tissues). DMEK graft injection was simulated in anterior chamber of fresh porcine eye bulbs.

Results The porcine DMEK grafts preparation resulted to be more challenging compared to human DMEK grafts. Despite similarity between human and porcine corneas, porcine Descemet membrane (DM) firmly adheres to the underlying stroma. DMEK grafts preparation was not successful at day 0; DMEK preparation was possible by mechanical stripping technique on corneas stored in Eusol-C for 7 and 14 days obtaining naturally rolled endo-out porcine DMEK grafts. An EC mortality increase up to 20% was observed on DMEK graft compared to initial whole corneal tissue. DMEK roll injection was successfully simulated in anterior chamber of the porcine eye bulb.

Conclusion Naturally rolled DMEK endo-out grafts were successfully prepared by mechanical stripping technique on porcine corneal tissues stored in Eusol-C at 4°C (up to 14 days). DMEK Surgery including the tissue injection in anterior chamber could be simulated. Further studies will be performed to improve ex-vivo-porcine DMEK surgery model.

The use of ready-to-use grafts from specialized eye banks might provide a number of benefits, including graft quality control, assured availability at a certain operation time, a decreased likelihood of case cancellation, and a shorter and less sophisticated DMEK surgery, with a resulting lower risk of graft damage. However, it is critical to thoroughly establish the clinical safety of employing these preloaded tissues. Especially since most of the studies were prepared and stored under hypothermic conditions. There are only a few studies on preprepared tissues in organ culture, which are partly controversial.

In this prospective study we included patients who received DMEK surgery at the Knappschaft Eye Clinic Sulzbach. Patients received either a preloaded DMEK (pDMEK), prepared five days before surgery in the eye bank, or a conventional, directly before surgery, surgeon-prepared DMEK (sDMEK).

The preliminary data show a trend towards more frequent need for rebubbling in the pDMEK group and a statistically non-significant lower postoperative endothelial cell count compared to the sDMEK group. However, the development of visual acuity and decrease in corneal thickness is comparable in both groups.

Therefore, we investigated the clinical outcomes of the first organ-cultured preloaded DMEK cases and compared these outcomes with those from our very last cases with surgically loaded tissues from a single centre.

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