Tailoring of resorbable scaffolds in head and neck surgery

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Introduction
Form stability and a good integration into the surrounding tissue are on demand for replacement materials in clinical practice. The application of non resorbable scaffold materials like porous polyethylene in different thickness should be compared with surface modified polyglycolic acid (PGA) network. In the present study, polyglycolic acid meshes were coated by blends of chitosan, collagen and hydroxylapatite to enhance their suitability as tissue engineering scaffolds.

Materials and Methods
PGA scaffolds were covered with collagen, chitosan and/or hydroxylapatite.

- LPGA
- II PGA+ Collagen
- III PGA+ Collagen/Chitosan (50%/50%)
- IV PGA+Collagen/Chitosan/Hydroxylapatite (28%/28%/44%)

PGA meshes were coated with collagen dispersion 1% (w/w) or a mixture of 0.5% collagen and 0.5% chitosan in aqueous acetic acid solution 1% (V/V). For the preparation of the hydroxyapatite-collagen composite 125 mg equine collagen type I was dispersed in 60 mM phosphoric acid and simultaneously dropped with 99,6 mM calcium chloride solution into the reaction vessel for 1.5 hours at 40°C and pH 8.3. After further 13 hours the precipitate was centrifugated, washed air dried under reduced pressure. By combination of the collagen-chitosan dispersion with the hydroxyapatite collagen composite a complex of biomimetric material was obtained.

In a further experiment the composition of the latter was varied. Unmodified PGA meshes served as control. The biocompatibility of the samples was analyzed. Material specimen of 8 mm in diameter were prepared and seeded with chondrocytes or osteoblasts.

Primary chondrocytes and osteoblasts were isolated by digestion of cartilage or sprouted from bone usually discarded after surgical intervention. The cells were propagated up to three passages in monolayer and afterwards seeded onto the material surface, 50 000 cells per disc 8 mm in diameter.

After four days in vitro incubation the vitality of the cells at the material surface was estimated with the help of the WST-1 assay.

Results

- The measured OD (optical density) values were related to unmodified PGA meshes, set as 100% viability.

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Conclusions
PGA-based materials are suited as scaffold in tissue engineering of cells. The biocompatibility of biomaterials can be analyzed simple and quickly by the use of WST-1 assay. The viability of the cells can be estimated by direct cell material contact. Depending from the cell type different material properties are needed. Biomaterial for tissue engineering must be tailored specific for the engineered tissue and the desired function. Further experiments seems to be necessary to improve the material for bone tissue engineering.

Acknowledgments
Thanks to Sabine Kozitsch for excellent technical assistance

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