Conclusion: A strongly positive net apposition with strongest gain at implant´s surface was observed.

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P036

Tissue engineered scaffolds for mimetic autografts

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Introduction: Despite its regenerative capacity, bone healing can be compromised, leading to delayed fracture regeneration and nonunion. Due to the scarcity of bone tissue that can be used as autograft, novel tissue engineering strategies arise as a promising solution by using biocompatible materials.

Methods: Our objective is the development of engineered autografts capable of efficiently treat fracture nonunion. For this purpose, we designed polycaprolactone (PCL) autografts surrounded by a porous membrane mimicking periosteum. To assess their regenerative capacity, these scaffolds were tested in critical size femur defect for ten weeks carrying out μCT and histological analysis. Additionally, we are focusing on the generation of PCL biocomposites, such as poly ethyl-acrylate (PEA) covered PCL membranes which can enhance morphogen functionalization, reducing the effective BMP dose.

Results: At the mCT level, structural mimetic PCL scaffolds, showed no significant difference in bone healing (Empty group, 11.47±4.93 mm^3; MA, 14.95±3.09 mm^3, p=0.1711). Histological analysis demonstrates that MEW PCL mimicking periosteum enhances bone growth, but insufficient for successful healing. However, once functionalized with PEA and BMP-2, these implants showed highly improved regeneration (CTL group, 11,47±4,93 mm^3; BMP-2 group, 49,24±13,20 mm^3, p = 0.0001). Figure 1. These implants were loaded with BMP-2 solutions previously studied in vitro to estimate morphogen dose, which resulted in 55.64±14.83 ng (n=6).

Conclusions and discussion: In conclusion, PEA functionalized mimetic autografts show an important increase in bone healing, enhancing BMP-2 effects, which provide representative regeneration with a 100 folds lower dose than typically described in literature.

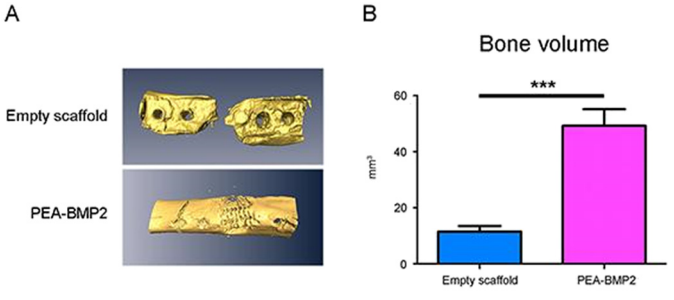

Figure1. A) 3D bone reconstruction from μCT analysis data of empty critical size femur defect and treated with PEA-BMP2 coated PCL scaffold using 10ug/ml morphogen solution. B) BMP2 treatment along with PEA coated PCL scaffolds significantly increases bone volume formed in these critical size defects (p = 0.0001,***).

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P037

Mechanical impact of X-ray- and gamma-irradiation on the mechanical parameters of cortical human bone

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For very high dosages of dozens of kGy, X-ray- and gamma-irradiation is known to cause a mechanical degradation of the mineralized bone tissue. Both in clinical and research applications, bone can be subject to many different sources of irradiation. However, data about the influence of irradiation on the mechanical properties of bone at dosages of clinical applications are lacking. Hence, we investigated the influence of irradiation in clinical relevant dosages on the mechanical parameters of bone with respect to material parameters and crack characterization.

Beam-shaped bone samples were irradiated at dosages of mGy, Gy and kGy and subsequently tested via three-point-bending. Additionally, to quantify the cracking behavior, tomographic fractometry was carried out to quantify the fracture surface.

Our results of the mechanical investigation point to a severe decrease of the mechanical performance at high dosages of 31.2 kGy quantifying the work to maximum stress (control: 39.98 ± 9.22 Nmm vs. 31.2 kGy: 12.75 ± 1.76 Nmm, $p < 0.05$) whereas no changes in mechanical parameters were detected for 30 Gy, 0.008 Gy and 6.4 mGy (44.15 ± 9.53 Nmm, 35.27 ± 7.17 Nmm and 41.01 ± 7.94 Nmm $p > 0.05$). These results are supported and in agreement with the fracture surface texture with a more tortious crack surface in the control group (control: 1.51 ± 0.15, 1.310 ± 0.086, $p < 0.005$).

Our findings suggest that synchrotron imaging (utilizing dosages of several kGy) does severely alter the mechanical properties of the bone material. Effects of synchrotron irradiation need to be considered in the bone quality framework. Clinically relevant radiation dosages of 30 Gy and less do not alter the mechanical behavior of bone primarily.

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P038

Osteogenic potential of periodontal cells is dependent on Notch signaling

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Periodontal ligament stem cells (PDLSC) represent a perspective resource for regenerative medicine. Notch is an important signaling participating in embryonic patterning and in particular in osteogenesis. The role of Notch in osteogenesis is not defined. In this work, we sought to find out how Notch signaling affects osteogenic potential of periodontal ligament stem cells (PDLSC).

We activated Notch in PDLSC by addition of various amounts of lentiviruses bearing activated intracellular domain of the Notch1 receptor, NICD. Using real-time PCR, we analysed the dependence of changes in the expression levels of osteogenic markers (*RUNX2, COL1A1, OGN, POSTN*). Activation of Notch was confirmed by expression of Notch target gene *HEY1*. To quantify the intensity of mineralization of