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Projects

Emulsion electrospinning of DegraPol® as a way of protein incorporation

Electrospun scaffolds from different polymers can act as carriers of growth factors and thus allow for different applications in the area of tissue engineering and regenerative medicine. For optimal use of these scaffolds and proper healing processes, appropriate release kinetics of the growth factors present on the scaffolds is necessary. Loading the scaffolds with growth factors can be realized by different immobilization techniques resulting either in covalent crosslinking, physical ab/adsorption, binding with the help of heparin or others.

In order to use electrospun DegraPol® meshes as growth factor carriers in tendon rupture repair, we chose emulsion electrospinning. As a model protein, FITC-labelled BSA was emulsion electrospun with DegraPol® (Figure 1).

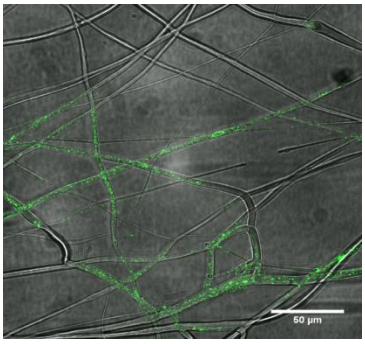

Figure 1 Water- in-oil emulsion electrospun DegraPol with FITC-labelled BSA. The incorporation of the model protein in the electrospun fibers can be clearly seen (green dots).

DegraPol® tube used as peritendinous anti-adhesive

In (flexor) tendon rupture repair, there are still open problems up-to-date: adhesion and rupture in the early healing phase with a reoperation rate of 7 – 15 % leading to increased work disability and costs. On the one hand side, the repaired tendons should have high primary repair strength for early active post-operative motion, and on the other hand side, the repair site should be flat in order to allow the tendon to glide smoothly in the tendon sheath. According to Kuwata *et al.*, optimum primary repair strength requires multi-strand locking loops and cross-stitch epitendinous sutures. However, such repair techniques lead to bulging at the repair site and thus to adhesion during the healing process.

Considering these problems, a polymer device which bags the repaired tendon tightly and has a flat outer surface would probably help to reduce the adhesion caused by a rough and large primary cross-sectional area at the repair site. In addition, such a flattening tube may act as a potential carrier device and be supplemented with bioactive substances or stem cells in order to stimulate the healing process *in situ* (see project above).

We are investigating the anti-adhesiveness of electrospun Degrapol meshes by measuring the contact of healing tendon tissue to the surrounding tissue using a method from Tan *et al*., Effects of Nonsteroidal Anti-Inflammatory Drugs on Flexor Tendon Adhesion, JHS 35A, June 2010. As far as that we were able to show, that a DegraPol tube reduces the extent of adhesion significantly by 12 %. Further improvements are now being considered.

Anesthesia of chicken embryos for in vivo MRI measurements.

For the *in vivo* MRI method to quantify the perfusion capacity of artificial organs placed on the embryonic avian chorioallantoic membrane (CAM) *in ovo*, the movements of the chicken embryo might hazard the MRI measurements. Therefore, a proper anesthesia of the chicken embryo before measurement is absolutely needed. With the intention to anesthetize the chicken embryos for around 60 minutes, we investigate the effect of different anaestesia such as (i) ketasol/ midazolam (with Anexate® as an antagonist for midazolam), (ii) medetomidin and (iii) thiopental with an application volume of 0.3 mL. The movements of the chicken embryos are videotaped and scored.

Johanna Buschmann, 2. 12. 2014