

## Histological study of multifunctional bioabsorbable ciprofloxacin-releasing and plain polylactide-polyglycolide 80/20 screws implanted in rabbit cranial bone

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**INTRODUCTION:** Bioabsorbable surgical devices offer advantages over metallic ones. They maintain the fixation and decompose gradually. An implant removal operation is not needed. Several studies have demonstrated the biocompatibility of polyglycolide (PGA) and polylactide (PLA) and their copolymer (PLGA). The use of PLA, PGA and PLGA matrices for controlled release of therapeutic agents has also been extensively studied<sup>1</sup>. Local delivery of antibiotics, using a bioabsorbable carrier, has the advantages of avoiding systemic side effects and it assures achieving high local tissue levels of the antibiotics. In this study the tissue reactions to bioabsorbable self-reinforced (SR) ciprofloxacin-releasing PLGA 80/20 screws and to plain SR-PLGA 80/20 screws in rabbits' cranial bone were evaluated in two experiments.

**METHODS:** In the 1<sup>st</sup> experiment, in each rabbit a plain PLGA screw was implanted on one side and titanium screw on the other side of the sagittal suture (n=21). Three animals were sacrificed after each follow-up period of 2, 4, 8, 16, 24, 54 and 72 weeks. In the 2<sup>nd</sup> experiment, in each rabbit, two ciprofloxacin-releasing PLGA screws were implanted, one screw on either side of the sagittal suture (n=20). Animals were sacrificed after 2, 4, 8, 16 and 24 weeks, four animals per group. Blocks of bone, each containing one screw were retrieved. In the 2<sup>nd</sup> experiment one block was used to assess tissue drug concentration. The other block was used for histological examination. Numbers of macrophages, giant cells, active osteoblasts and fibrous tissue layers were assessed and degradation of the bioabsorbable screws was evaluated.

**RESULTS:** In both experiments after 2 weeks, macrophages were seen near the heads of screws. After 4 and 8 weeks, the screws were surrounded by fibrous tissue capsule that progressively grew in thickness by time. Osteoblastic activity and groups of giant cells were seen. At 16 weeks, compact fragmentation of the screw heads was seen with macrophages seen inside the screw

matrices with Cipro screws. After 24 weeks, a significant change in the morphology of plain PLGA screws had occurred. In both experiments osteoblastic activity and the amount of giant cells had decreased. After one year, with plain PLGA screws: some biomaterial was still present. PLGA screws had been replaced by adipose tissue, fibrous tissue and "foamy macrophages" which had PLGA particles inside them. After 1½ years, the amount of biomaterial decreased remarkably. The particles of biomaterial were inside "foamy macrophages".

**DISCUSSION & CONCLUSIONS:** Plain and ciprofloxacin-PLGA 80/20 screws elicited only a mild-to moderate inflammatory reaction when implanted in rabbit cranial bone. No contraindications as regards their clinical use was found. Ciprofloxacin-PLGA screws released gradually the loaded antibiotic. They could be used clinically as infection prophylaxis and osteofixation in craniomaxillofacial surgery in nonload-bearing or slightly load-bearing applications.

### REFERENCES:

<sup>1</sup> L. Nie, D.P. Nicolau, P.R. Tessier et al (1998) Use of a bioabsorbable polymer for the delivery of ofloxacin during experimental osteomyelitis treatment. *J Orthop Res* **16**:76-79.

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