Magnesium hydroxide as a Possible Implant Coating for Enhanced Osseointegration
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Introduction
Magnesium hydroxide [Mg(OH)\textsubscript{2}] is the major corrosion product in biodegradable magnesium implants and is thus suspected as a key player in the enhanced peri-implant bone formation [1]. The general administration of magnesium ions has shown a positive influence on bone remodeling and bone growth [2,3]. Furthermore, Mg(OH)\textsubscript{2} is exposed to an chloride containing environment as in the body, it reacts to more soluble MgCl\textsubscript{2} [4]. This property suggests the use of Mg(OH)\textsubscript{2} as a coating material on bone implants. However, in our study we investigated whether cylinders of isostatically compressed pure Mg(OH)\textsubscript{2} powder could lead to an improved or even accelerated bone formation rate in the local bone environment of rabbit femur condyles.

Materials and Methods
The Mg(OH)\textsubscript{2} cylinders were implanted as into the cancellous part of the medial femur condyles into both femora of 42 adult rabbits using a press-fit method, while the drill hole in control animals was left empty. The rabbits were assigned to three time groups (2, 4 and 6 weeks). The harvested specimens were fixed and embedded into Technovit\textsubscript{9}100New. Three serial uncalcified sections at a 100 μm distance were stained (toluidine blue, von Kossa and TRAP). A 500 μm wide tissue region around the drill hole was analysed by histomorphometry. The parameters of interest were: bone volume per total volume (BV/TV), osteoid surface (OS), osteoclast surface (OcS) and mineral apposition rate (MAR).

Results
The BV/TV increased from 2 weeks to 4 weeks, reaching a significant maximum of 83.9% from where it slightly decreased to 74.5% till week 6 (Fig. 1a). The OcS was significantly reduced during the first four weeks, while an increase in OS was observed at the same time (Fig. 1b,c). Both maxima of BV/TV and OS were noticed at 4 weeks after surgery. Decreasing BV/TV and OS values accompanied by increased OcS announced the start of bone remodelling and lamellar bone formation. At 6 weeks, the OcS adjacent to the Mg(OH)\textsubscript{2} cylinder was in the same range than on the control side (Fig. 1c). The MAR was similar for both groups (2.5 μm/d) at 2 weeks, but decreased on the control side to 1.5 μm/d at 4 weeks, while the MAR remained at 2.3 μm/d in Mg(OH)\textsubscript{2} group at the same time. At 6 weeks, the MAR of the Mg(OH)\textsubscript{2} group matched the control group (1.4 μm/d).

Discussion and Conclusions
This study demonstrates the positive influence of Mg(OH)\textsubscript{2} on the peri-implant bone formation in the vicinity of a compressed Mg(OH)\textsubscript{2} powder implant by an temporarily uncoupled bone remodeling process. So far, our data supports the application of Mg(OH)\textsubscript{2} as a possible coating to enhance osseointegration around bone implants.

References

Disclosures
The authors have nothing to disclose.