Ultra-short laser texturing of calcium phosphate ceramics for enhanced antimicrobial activity

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The discovery of alternative materials with enhanced antimicrobial characteristics that will help decrease the use of antibiotics has become a priority in developing innovative solutions for fighting the increasing antibiotic resistance of diverse bacterial strains. In the field of orthopaedics, implant replacement surgery becomes more common, especially as society becomes older. Thus, bioresorbable implanted devices have the significant advantage of gradually degrading and disappearing when inserted in the body. Due to its chemical similarity to natural bone, beta tricalcium phosphate (β-TCP) is a desirable synthetic material for biomedical applications. Consequently, one of the most frequent and dangerous medical problems following the implantation of an implant is bacterial infection. Treatment of infectious or possibly infectious bone disorders continues to be a significant challenge in healthcare. The surface characteristics of the ceramic biomaterial influence the cell-based interactions, protein adherence, and antimicrobial properties, thus affecting the osseointegration process. Therefore, the implant surface topography and chemistry have to be considered, when designing the ideal scaffolds. In this study we will present the combination of laser-induced surface texturing with examination of doped β-tricalcium phosphate ceramic for creation of orthopedic implants, to achieve improved performance of the biological feedback in view of antibacterial behaviour. In this research a systematic study of diverse patterning designs, showing the dependence of surface characteristics in relation to antimicrobial feedback, allows definition of reproducible laser patterning models for achievement of best conditions for microbial biofilm rupture.