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Design, synthesis and characterization of resorbable screw for a reduced degradation rate in bone fracture fixation systems

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Bio-absorbable screws have not yet proven to be without inherent problems. It is widely reported that such screws, even of the same composition, have high variability in degradation rates. A comparison study of different compositions of absorbable interference screws showed that poly (L-lactide) (PLLA) had not fully decomposed 20 months following implantation, poly (D,L-lactide-co-glycolide) (PDLLA-co-PGA) was completely decomposed at 12 months, and poly (D, L-lactide) (PDLLA) showed no degradation at 6 wks post-implantation but no traces were found at 10 months. It is necessary to design resorbable screws with a reduced degradation time, just the necessary time for bone healing. The objective of this work is to characterize a commercial resorbable screw, design and manufacture a new screw with the purpose of decrease the degradation rate in maxillofacial bone. For chemical characterization of the screws the DSC, TGA, FTIR and SEM were used. The design of the new screws was performed by Solid-works and ANSYS software. The manufacturing process was performed by injection molding, and the resultant screws were tested with a degradation method in Phosphate Buffer Solution and deformation test were applied, the chemical formulations for the screws were PLGA, PLGA/Gelatin with different concentration. Following with a alginate and hydroxy-apatite coating by electro-spray method and UV treatment. In chemical characterization of commercial screws were identified the following results: FTIR spectrum was similar to PLGA copolymer, maintaining the main chemical groups. The glass transition showed of the screws is at 153.58oC and the temperature when the polymer start degrading is at 280oC. In the other hand, the design method leads to a screw with similar design in comparison to the body of the original. The tip of the screw is drill shaped and above the same tip, it has a hole for the purpose of a faster osseo-integration and less time of degradation. Its head is Allen type for resistance during installation. Another screw design has more resistance for deformation when installed in the patient, both from its body, and its Allen type head. Rounded, dome shaped head, giving less contact with the adjacent tissue; it also receives an Allen key shape for resistance during installation. Conic shaped body, which reduce the amount of material given for the fabrication of the screw. Mechanical properties and degradation rate are still in evaluation. The expectation of this project is to obtain resorbable screws with a reduced degradation rate to be used in bone fracture fixation systems.

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Observers agreement in perception of non-cavitated approximal dental caries by CCD digital radiography at different exposure parameters

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Ionizing radiations used in dental practice can cause biologic damage due to somatic or genetic effects on the living system and reducing the dose delivered to the patient should always be a concern for the practitioner. Therefore, implementation of dose indicators and dose monitoring is mandatory for dental radiography. Moreover, proper selection of exposure parameters to avoid re-exposure to patients due to poor image quality should always be taken in consideration. The use of digital systems in dentistry yielded the way for dose reduction and provided flexibility and ease of use permitting the production of adequate images optimized for each diagnostic task. Radiographic detection of early proximal caries is one of the most difficult tasks in dental radiographic diagnosis; it is very technique-sensitive and needs adequate exposure parameters such as identifying and survey parameters that allow the detection of artificial lesions or the semi-quantitative assessment of subjective image impression, as a surrogate for image quality and relate these parameters to a reference of dose. Then, accuracy of CCD systems in early detection of proximal caries in regard to the required radiation dose is determined.

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