

Fabrication, characterization and drug release profile of doxycycline film for treatment of periodontitis

Mehrsima Ghavami-Lahiji^{1,2}, ***Farhad Shafiei***^{1,2}, ***Farhood Najafi***³, ***Mohammad Erfan***⁴

1. Department of Dental Biomaterials, School of Dentistry, Tehran University of Medical Sciences, Tehran, Iran
2. Research Center for Science and Technology in Medicine, Tehran University of Medical Sciences, Tehran, Iran
3. Department of Resin and Additives, Institute for Color Science and Technology, Tehran, Iran.
4. Department of Pharmaceutics, School of Pharmacy, Shahid Beheshti University of Medical Sciences, Tehran, Iran

Introduction: Nowadays, many people worldwide suffer from periodontal diseases. The effectiveness of mechanical debridement of dental plaque and repeated systemic administration of antibiotics are limited because of lack of access to bacteria in the periodontal pocket. Local drug delivery systems are capable of improving patient satisfaction as well as therapeutic efficacy by controlling the required rate of drug release over time. The objective of this study was to evaluate controlled localized delivery of doxycycline hydrochloride (DOX) for local treatment of periodontitis.

Materials & Methods: Polycaprolactone (PCL) films containing DOX were prepared by solvent casting technique. In this technique, PCL and DOX were dissolved in dichloromethane/ tetrahydrofuran solvent mixture. The system employed Pluronic F-127 as surfactant and dibutyl phthalate as plasticizer. Alginate-chitosan was incorporated as a mucoadhesive polymer. The final mixture was then poured into a petri dish. After evaporation of the solvent, the films were cut into the desired size. Three formulations with different drug weight percent (0.5, 1 and 2%) were prepared. The films were characterized by differential scanning calorimetry (DSC) and X-ray diffraction (XRD). Drug release properties were investigated using UV-Visible spectroscopy during two weeks. Data were analyzed using repeated measure ANOVA.

Results: DSC and XRD showed that doxycycline existed predominantly in amorphous form in all formulations. All the periodontal films revealed high burst release in first 24h which significantly decreased thereafter ($p < 0.05$). Initial drug release followed by a gradual release during the rest time. Higher drug release was obtained from films containing 2% DOX. Drug concentration ranged from ($82.03 \pm 10.5 \mu\text{g/ml}$), at first 24h to ($6.28 \pm 0.9 \mu\text{g/ml}$) at 14th day in 2wt%.

Conclusion: This study demonstrates the potential for application of DOX-loaded periodontal films as a promising controlled release system without side effects. This device, can be designed to fit around teeth at certain time.

Keywords: periodontal diseases, drug release, doxycycline