Abstract

Introduction

Periodontitis is a chronic inflammatory disease that affects the integrity of the supporting tissues of the tooth, including the gingiva, periodontal ligament and alveolar bone, which are generally known as the periodontium. The local delivery of antibiotics offers the potential for reaching and maintaining the therapeutic concentration at the site of the infection; since in this method drug is directly applied to the site, the concentration of the drug can be significantly higher than the systemic ones. Several degradable and non-degradable devices were developed for the delivery of antimicrobial agents into the periodontal pocket. In recent years, functional biomaterial research has been directed towards the development of improved scaffolds and novel drug delivery systems. The aim of this study was to develop a local delivery device, Sodium Alginate/CMCNa/ Adipic acid dihydrazide (NaAlg/CMCNa/ADH) scaffold, which allows the sustained release of tetracycline to effectively control local infection in periodontitis.

Methods

In the present work, NaAlg/CMCNa/ADH scaffold was synthesized by freeze-drying 2.5% polymer solution. Adipic acid dihydrazide (ADH) was added as crosslinker and N-(3-Dimethylaminopropyl)-N′-ethylcarbodiimide hydrochloride (EDC) and and 1-Hydroxybenzotriazole hydrate (HOBt) were added as Carboxyl group activator. Then dialysis was performed for 3 days against distilled water. In order to drying, the gel was poured into plates and lyophilized at -45 ° C for 24 hours. Then Samples were immersed in tetracycline solution vials for 48 hours in dark condition. The scaffolds were then dried by freeze-drying method for 24 hours. Finally, the scaffolds were evaluated by SEM, FTIR, ^{1}H NMR, Swelling test, and TG/DTA. The amount of tetracycline released from the scaffolds was analyzed by UV spectrophotometry in PBS solution. Triplicate experiments were performed for each sample and expressed as means± standard deviation.

Results

The synthesized scaffolds had porous structure according to SEM images and in the scaffolds containing tetracycline the porous macrostructure was intact. In the FTIR spectra of NaAlg/CMCNa/ADH scaffold, the shoulder was seen at 1645 cm^{-1} Which indicates the formation of amide bond. The average water uptake of scaffolds was 93.216% ± 4.419. Scaffolds loaded by tetracycline showed sustained release pattern and were able to release 70% of drug up to 96 hours.

Conclusion

The NaAlg/CMCNa/ADH scaffolds could be beneficial in the management of periodontal infections and were suitable as a slow-release device for tetracycline.

Keywords

Periodontitis, Scaffold, Sodium Alginate, Tetracycline, CMCNa, Local drug delivery