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Development and Characterization of Moxifloxacin HCl Loaded Dental Strips For Treatment of Periodontitis

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ABSTRACT

Moxifloxacin HCI is a broad - spectrum antimicrobial agent, active against a number of aerobic, anaerobic, gram positive and gram negative periodontal pathogens. In the present investigation, Chitosan strips (C_1 – C_5) and Hydroxy Propyl Methyl Cellulose K_4M (HPMC K_4M) strips (H_1-H_5) containing Moxifloxacin HCI (10% to the weight of polymer) were prepared by solvent casting method using 1% v/v acetic acid in water. The prepared strips were optimized on physicochemical basis like thickness, average weight, surface pH, percentage moisture loss, folding endurance, content uniformity, *in vitro* drug release studies, microbiological evaluation and stability studies. The average weight and thickness of strips increase as the polymer increases. The moisture loss decreases as the concentration of polymer concentration increases. The chitosan showed 100 times greater folding endurance as compared to HPMC K_4M and showed less drug entrapment as compared to hydrophilic HPMC K_4M strips. The percentage cumulative drug release was greater in strips containing lipophilic polymer as compared to hydrophilic polymers. The formulations C_1 and H_5 are better than others because the extent of release was maintained for 4 and 3 days respectively. Release Kinetics of Moxifloxacin HCl follow the Korsmeyer Peppas model, showed zero order release profile. The formulations C_1 and H_5 showed greater growth inhibition area for *S. aureus* and lesser for *E.coli.*

Keywords: Chitosan, HPMC K_4M, Moxifloxacin HCl, Strips, Periodontitis

INTRODUCTION

Periodontal diseases comprise group of inflammatory conditions of the supporting teeth initiated by the microorganisms colonize on the tooth surface and infect the surroundings. [1,2] In diseased state, supporting collagen of the periodontium is destroyed and the alveolar bone begins to resorb. The epithelium of the gingival migrates along the tooth surface forming periodontal pockets and provides an ideal environment for the growth and proliferation of microbes. [3,4] Systemic and local applications of antimicrobial agents (doxycycline, tetracycline and metronidazole) have been, and are still used in the treatment of chronic adult periodontitis. [5,6] Many polymer-based systems have been studied for various antibiotic deliveries and evaluated *in vitro* or *in vivo* for the treatment of periodontal diseases. In conventional mode of drug administration, many drugs do not reach target areas in the body in sufficient concentration due to premature inactivation and excretion. The systemic drug administration has been useful in treating periodontitis but show several thousand folds of dilution before it reaches the site and exposes the rest of the body to potential side effects. This problem can be overcomed by administering the drug directly to the intended site of action with lesser dose. [7] Sustained drug delivery systems are able to provide very precise control over drug release for a prolonged period of time eliminating the need for frequent dosing and minimizing side effects, thereby increasing patient compliance and comfort. [8] Moxifloxacin HCl is a Group 4 flouoroquinolone with activity against a broad spectrum of gram positive, gram negative and anaerobic bacterial pathogens. [9] The purpose of the study was to develop bioerodible delivery systems for moxifloxacin HCl, dispersed in Chitosan and HPMC K_4M polymers. The systems designed to be placed into a periodontal pocket for the desired length of time. A comparative study of *in vitro* characteristics of two different polymers based systems was also carried out, to establish the most suitable strip for periodontal application.

MATERIALS AND METHOD

Chitosan and poly propylene glycol was obtained from Acros Organics U.S.A., HPMC K_4M was gift sample from Cadila Pharmaceuticals Ltd. Ahmedabad, and Glacial Acetic Acid was purchased from S.D. Fine-Chem. Ltd. Mumbai, Moxifloxacin HCl. was obtained from Maithari Labs Pvt. Ltd. Andhra Pradesh.

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PREPARATION OF DENTAL STRIPS

Method used for the preparation of dental strips was solvent casting technique [10] using 1% glacial acetic acid and distilled water as solvent system. Total ten formulations were prepared(Table-1). Dental strips were prepared by soaking the chitosan in aqueous acetic acid (C_1-C_5) and HPMC K_4M in distilled water (H_1-H_5) with poly propylene glycol as a plasticizer using magnetic stirrer in a closed beaker to get various concentrations of polymers. Moxifloxacin HCl was added in required concentrations to each. After complete mixing, 10 ml solution was poured in a clear petridish over aluminium foil placed on a horizontal plane. An inverted funnel was placed over the petridish, with a cotton plug placed into the stem, for slow evaporation of the solvent. The petridish was maintained at 24°C for 24 hours. After complete evaporation of solvent, cast strips were obtained and then cut into pieces of 0.5 x 0.5 cm and each wrapped in aluminium foils and stored in desiccator at room temperature in dark place for further study.

EVALUATION OF DENTAL STRIPS

The compatibility studies for drug and polymer were conducted by using IR spectroscopy. Various physiochemical properties such as thickness, average weight, and surface pH, percentage moisture loss, folding endurance, content uniformity, *in vitro* drug release studies and microbiological evaluations were performed on prepared strips.

Physicochemical Evaluation

Thickness of the strips was measured using micrometer screw gauge. [11] Each strip of every formulation was measured for variation in thickness at three different points.

Average Weight of strips were assessed on an electronic single pan balance for all the formulations of polymers by individually weighing ten strips of each batches five times and determining their mean weight.

Surface pH was determined by allowing the strips to swell by keeping them each in contact with 5 ml of distilled water (pH6.5±0.05) for an hour in glass tubes. The surface pH was then noted by bringing a combined glass electrode by wrapping the strip around it and allowing to equilibrate for 1 min. [12]