Complementary Therapies in Medicine (2008) **16**, 262—267

available at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevierhealth.com/journals/ctim

Topical application of *Garcinia mangostana* L. pericarp gel as an adjunct to periodontal treatment☆

Supanee Rassameemasmaung[a,*], Anongporn Sirikulsathean[a], Cholticha Amornchat[b], Pawinee Maungmingsook[c], Pleumchitt Rojanapanthu[d], Wandee Gritsanaphan[e]

[a] *Department of Oral Medicine, Faculty of Dentistry, Mahidol University, Ratchathewi, Bangkok 10400, Thailand*
[b] *Department of Microbiology, Faculty of Dentistry, Mahidol University, Bangkok, Thailand*
[c] *Nakornpathom Hospital, Nakornpathom, Thailand*
[d] *Department of Pharmacy, Faculty of Pharmacy, Mahidol University, Bangkok, Thailand*
[e] *Department of Pharmacognosy, Faculty of Pharmacy, Mahidol University, Bangkok, Thailand*
Available online 25 April 2008

KEYWORDS
Garcinia mangostana L.;
Local drug delivery;
Periodontal treatment

Summary
Objective: To evaluate the effects of gel containing *Garcinia mangostana* L. pericarp extract (GM gel) applied topically as an adjunct to periodontal treatment.
Design: Subjects who had periodontal pockets on their single-rooted teeth were randomized into the test or control group. Subjects in the test group received periodontal treatment consisting of scaling, root planing and subgingival application of GM gel while those in the control group received scaling and root planing without GM gel application.
Setting: Mahidol University, Faculty of Dentistry, Thailand.
Main outcome measures: Clinical parameters included probing pocket depth (PPD), clinical attachment level (CAL), bleeding on probing (BOP), Gingival Index (GI) and Plaque Index (PI). Microbiological parameter included subgingival microbial composition as examined by phase contrast microscopy.
Results: Clinical improvement compared to baseline was found in both groups ($P < 0.05$). The test group exhibited significantly higher reduction in mean PPD, GI and BOP than the control group at the 3rd month after treatment ($P < 0.05$). Subgingival microbial composition changed from diseased state to that compatible with health after treatment in both groups. However, significant differences between groups were found only in the mean percentage of cocci at the 1st and 3rd month after treatment ($P < 0.05$).
Conclusions: GM gel could enhance the clinical effects of periodontal treatment.

Introduction

Periodontitis is the common oral disease affecting many people around the world. It is defined as an inflammation and progressive destruction of the tooth-supporting structures (periodontium). This disease results from interaction

☆ This work was financially supported by Mahidol University Research Grant.
* Corresponding author. Tel.: +66 22036500; fax: +66 23548510.
E-mail address: dtsrs@mahidol.ac.th (S. Rassameemasmaung).

0965-2299/$ — see front matter © 2008 Elsevier Ltd. All rights reserved.
doi:10.1016/j.ctim.2007.12.004

between specific host defense mechanisms and dental plaque biofilms that colonize on the tooth surfaces at or below the gingival margin. The progression of periodontitis can be arrested by mechanical debridement consisting of scaling, root planing and proper oral hygiene control.[1] These treatment modalities aim to remove dental plaque and plaque-retentive factors. However, pathogenic bacteria may not be eliminated in the deep periodontal pockets due to poor access for mechanical debridement, root anatomical complexity[2,3] and the ability of the bacteria to invade and reside in the periodontal tissues[4] or dentinal tubules.[5]

The recognition of bacterial plaque as the main etiologic factor has led to increasingly antimicrobial agent intervention. Antimicrobial agents may gain access into the periodontal pockets through both systemic and local route of delivery. Systemic antimicrobial agents can be used to treat multiple sites simultaneously and may target invasive organisms and affect reservoirs of bacteria in the oral cavity.[6] However, systemic antimicrobial agents may lead to potential side effects such as development of resistant bacteria[7] and gastrointestinal intolerance.[8] These drawbacks would be markedly reduced if antimicrobial agents applied locally could be used.

For the local antimicrobial agent to be useful, it must be successfully delivered to the base of the periodontal pockets at an efficacious concentration and retain in the pockets for an adequate length of time.[9] To achieve these, the sustain-released delivery drugs such as minocycline ointment[10] or metronidazole gel[11] had been used. It was found that mechanical debridement plus local delivery of these agents produced more favorable outcomes, for example, the reduction of periodontal pocket depth and the number of inflamed gingival sites, than those without local drug delivery.[10,11]

The use of herbal medicine as an alternative approach has gained much interest nowadays. *Garcinia mangostana* L., known as the mangosteen tree, contains various compounds such as chrysanthemin, garcinone A, B and C, sesquiterpenoids, gartanin, fructose, sucrose, tannins, xanthones and their derivatives in its pericarp.[12] Mangostin could inhibit penicillin-resistant strain of *Staphylococcus aureus* with an MIC of 3.125 μg/ml.[13] γ-Mangostin also inhibited growth of *Helicobacter pyroli* with the MIC of 1.56 μg/ml.[14] The antimicrobial screening test performed at our laboratory demonstrated that the 80% ethanolic extract from the pericarp of mangosteen inhibited growth of *Porphyromonas gingivalis* W50, the main periodontopathic bacteria, at the MIC of 3.91 mg/ml. Other than the antimicrobial activity, mangostin, 1-isomangostin and mangostin triacetate exhibited an anti-inflammatory activity.[15] γ-Mangostin also showed a potent inhibitory activity against prostaglandin E_2 released.[16]

Due to its antimicrobial and anti-inflammatory activity, we hypothesized that topical application of gel containing *G. mangostana* L. pericarp extract (GM gel) could inhibit bacterial growth and facilitate wound healing after periodontal treatment. Thus, this study aimed to evaluate the clinical and microbiological effects of the gel when used as an adjunct to periodontal treatment.

Methods

Subject selection

Before experiment, the study protocol was approved by the Committee on Human Rights Related to Human Experimentation, Mahidol University, Thailand. This study was performed at the Faculty of Dentistry, Mahidol University. Subjects, aged between 35 and 60 years, were the outpatients of the Department of Oral Medicine, Faculty of Dentistry, Mahidol University. They were systemically healthy and were diagnosed as chronic periodontitis. They had at least two sites with probing pocket depth (PPD) of 5—6 mm and other two sites with PPD of 7—9 mm on their single-rooted teeth. The selected teeth had no endodontic complication. The selected sites must have a radiographic evidence of alveolar bone loss and had bleeding upon probing or suppuration. Subjects were excluded from the study if they were pregnant, lactated, smoker, used antibiotic within the previous 3 months, and received periodontitis treatment within the previous 6 months. Subjects who met the above criteria were explained about the objectives and the details of the study. Those who were willing to participate were asked to sign the informed consent forms before entering the study.

After screening, subjects were randomized into the test or control group. Subjects in the test group received mechanical debridement consisting of scaling, root planing and subgingival application of GM gel while those in the control group received mechanical debridement without GM gel application.

GM gel

The crude extract from the pericarp of mangosteen was formulated as a local delivery drug (*G. mangostana* gel or GM gel) by the Department of Pharmaceutical Technology, Faculty of Pharmacy, Mahidol University, Thailand. The concentration of GM gel was adjusted according to the antimicrobial screening test performed at our laboratory. The gel was tested for short term toxicity by the National Laboratory Animal Center, Mahidol University. It was suggested that the gel could be safely used according to the research regimen. GM gel was kept at 4 °C throughout the study period.

Clinical parameters

Probing pocket depth (PPD) and clinical attachment level (CAL) were measured from the selected sites (Fig. 1) using a standard periodontal probe (PCPUNC 15, Hu Friedy™, IL, USA) and recorded to the nearest millimeter. Bleeding on probing (BOP) was recorded as the presence or absence of bleeding upon probing.[17] Gingival Index (GI)[18] was measured as follows: 0 = normal gingiva; 1 = mild inflammation, slight change in color; 2 = moderate inflammation, redness, edema and glazing; 3 = severe inflammation, marked redness and edema, ulcerations. Plaque Index (PI)[19] was then measured using the following criteria: 0 = no plaque in the gingival area; 1 = a film of plaque adhering to the free gingival margin and adjacent area of the tooth. The plaque may be rec-