The effectiveness of mangosteen rind extract as additional therapy on chronic periodontitis (Clinical trials)

Ina Hendiani*, Dede Hadidjah*, Agus Susanto*, Indra Mustika Setia Pribadi*

***Department of Periodontic Faculty of Dentistry Universitas Padjadjaran**

ABSTRACT

Introduction: Periodontitis is an inflammatory disease that attacks the periodontal tissue comprises the gingiva, periodontal ligament, cementum and alveolar bone caused mainly by plaque bacteriophage or other specific dominant type of bacteria. The purpose of this study was to determine the therapeutic effect of clinical application of mangosteen peel extract gel as adjunctive therapy scaling and root planing in patients with chronic periodontitis. This research was expected to developed new treatment in the field of dentistry, particularly in periodontics, which can be used as supporting material for the treatment of chronic periodontitis. **Methods:** Quasi-experimental research, split mouth, with as many as 14 chronic periodontitis patients. Mangosteen rind was prepared to be formed into extract gel, dried at room temperature, then the dried samples were macerated by using ethanol, then evaporated and decanted for 3 days until obtained condensed extract. The samples were patients with chronic periodontitis in at least 2 teeth with pockets ≥ 5 mm. Clinical parameters of pocket depth, gingival bleeding, and clinical epithelial attachment level were measured at baseline and 1 month after treatment. Analysis of data using the t-test. **Results:** The comparison of average gap ratio of pockets depth, gingival index, gingival bleeding and epithelium attachment levels, before and after treatment showed significant differences, such as in the test and control sides. **Conclusion:** The mangosteen rind gel as adjunctive therapy for scaling and root planing is able to reduce pockets depth, gingival index, and gingival bleeding, and improve clinical epithelial attachment.

Keywords: Mangosteen rind extract, Gel, Chronic periodontitis

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INTRODUCTION

Periodontitis is the most common periodontal tissues disease as form of gingivitis continuation. Tooth supporting tissue in patients with chronic periodontitis will inflamed, which marked by clinical attachment loss and alveolar bone resorption.[1] Periodontitis treatment is done through mechanical, chemical or combination of both therapies. Mechanical treatment such as scaling, root planing and curettage, with the main objective is eliminating the etiologic factors of periodontitis.[2,3] Mechanical therapy doesn't always give good results, indicated by remaining

Correspondence author: Ina Hendiani, Department of Periodontic Faculty of Dentistry Universitas Padjadjaran
Jl. Sekeloa Selatan No. 1 Bandung, West Java-Indonesia, Phone/Fax: +6222-2504985. email: inahendiani@yahoo.co.id

signs of inflammation or periodontal pocket. If this situation occurs then the combination of chemical therapies, such as antimicrobial agents that applied in periodontal pockets can be used as helpful adjunctive therapy.[1]

Plaque, calculus and necrotic tissue can be removed by mechanical treatments such as scaling and root planing.[1.3] Scaling and root planing therapy often does not give a good therapeutic results thus requiring an adjunctive therapy such as the use of antimicrobial agents. The administration of local antimicrobial which directly applied to the pocket has the advantage that it can directly hit the target and not causes toxicity over body's circulation.[1,3,4]

Antimicrobial agents widely available now are not only chemical based but also herbal based, amongst them are mangosteen rind. Mangosteen rind contains xhantone which is an antioxidant, antitumor, antiallergic, anti-inflammatory, anti-bacterial, and anti-virus.[5,6] According to research conducted by Torrungruang[7], one of component xhantone component that had anti-bacterial activity in the oral cavity was alpha-mangostin. This study is also corroborated by Poeloengan[8] which stated that the extract of mangosteen rind was effective on inhibited the growth of gram-positive bacteria and gram negative bacteria in vitro. Nguyen *et al*.[9] Research in also found that alpha-mangostin also able to inhibited the growth of bacteria in the oral cavity.[7,8,9]

Mangosteen (*Garciana Mangostana Linnaeus*) is a fruit plants that grows in tropical rainforest country such as Southeast Asia. Mangosteen is an exotic fruit because it's appealing color and high nutrition.[10.11] So many research about nutritional content of mangosteen has been done.

Previous research stated that not only the pulp and rind of mangosteen fruits were medically beneficial but also the seeds, which had high carbohydrate and oil content although not as much as the pulp. The main content of mangosteen rind is xanthone, the phenol pigment of yellow color, which the color reaction and the chromatography motion similar to flavonoids.[12] The water of mangosteen rind stew is used as a medicine for ulcers, hemorrhoids, and lesions.[13]

Preparation forms of mangosteen rind can be found as juices, powders, capsules, extracts, or water stew. The preparation type of mangosteen rind determined by body's capability to absorb herbal ingredients.[14]

Based on the anti-bacterial and anti-inflammatory activity of mangosteen rind extract, this study will examined the effectiveness of mangosteen rind in gel preparation form on improving periodontal condition in chronic periodontitis patients. Gel preparation form was chosen because its easy to applied properties and patient's comfortability.

The objective of this study was to determine therapeutic effects of the mangosteen rind extracts gel as an adjunctive therapy on scaling and root planing in chronic periodontitis patients. This research was expected to developed new treatment in the field of dentistry, particularly in periodontics, which can be used as supporting material for the treatment of chronic periodontitis.

METHODS

The methods used in this study was quasi-experimental with split mouth for the method before and after treatment. The study population was chronic periodontitis patients who came for treatment to Periodontal Clinic RSGM (Dental Hospital) Universitas Padjadjaran Bandung, during the period of September to December 2014.

As much as 14 chronic periodontitis patients were purposively selected. The inclusion criteria of this research was: chronic periodontitis patients in 30-65 years of age; at least 2 sides with minimum 2 teeth involved in each side; periodontal pockets depth ≥ 5 mm; not under antibiotics treatment for at least 3 months; whilst the exclusion criteria was: a history of systemic disease; smoking habit.

Equipments and materials used in this study were Osung® UNC periodontal probe 15; ultrasonic scaler; manual scaler; hoe, files, sickle and chisel; Osung® Gracey curette; mirror mouth; sonde; tweezer; Nierbekken; Cotton and cotton pellet roll; mouthwash; syringe; masks and gloves; dental mirror; stationary kit; check form; Informed consent form; mangosteen rind gel extracts; alcohol 70%; and povidone iodine.

Gel extracts of mangosteen rind was packaged in a syringe and applied into the pockets until overflowed into the surface of the gingival margin. Chronic periodontitis is periodontal disease characterized by the damage

of periodontal ligament and alveolar bone, followed by the formation of pockets, recession, or both. Gingival bleeding is bleeding that occurs when the probing process was done. Gingival bleeding index was measured by using Bleeding on Probing (BOP) modification index according to Ainamo and Bay. The measurement criteria was that the measurement performed at 6 surfaces (disto buccal, midbuccal, mesio buccal, disto lingual/palatal, mid lingual/palatal, mesio lingual/palatal), then marked whether bleeding occurred or not: (1) mark if there was bleeding after probing. (0) mark if there was not bleeding after probing (Fig. 1 and Fig 2).

Gingival inflammation is an inflammatory that occurred in gingival tissue that was marked by gingival discoloration measured by Sillness and Loe index, with criteria as follows: 0 = no inflammation/normal gingiva; 1 = mild inflammation, slight discoloration and edema, no bleeding on probing; 2 = moderate inflammation, edema, redness, hypertrophy, bleeding on probing; 3 = severe inflammation, redness and hypertrophy characterized by spontaneous bleeding.

The depth of pocket is the distance from the edge of the gingiva up to the bottom of periodontal pockets and was measured by using William probe. Measurements were taken at 6 surfaces (disto buccal, mid buccal, mesio buccal, disto lingual/palatal, mid lingual/palatal, mesio lingual/palatal), on each tooth. Epithelial attachment level is the distance from the boundary between the cementum and enamel *(*cementoenamel *junction* - CEJ) up to the bottom of the pocket, and was measured by using UNC periodontal probe.

Preparation of mangosteen rind extract was done in Laboratory of Research Service Department of Chemistry University of Padjadjaran. The preparation process was done by preparing 3 kg of mangosteen, which had rind characteristics solid black color, shiny, and had no crust. Then the fruits was washed clean, the pulp was taken out and cut into small pieces. These pieces was then dried under no sunlight, and pounded after, to produce 500 g of fine material (powder).

The study samples were patients that has already signed informed consent. The teeth of patients were divided into 2 sides with at least two tooth included on each side. One side as the test area were given scaling treatment, root planing, and application of mangosteen rind extract topical gel, whilst the contra lateral side was made into control area that was given only scaling treatment and root planing alone.

The application of mangosteen rind extract topical in the test area was done by applying the gel to the bottom of the pocket until it overflows up to the gingival margin, then let stand for a while and afterwards the excess gel

Figure 1. Probing with no bleeding

Figure 2. Probing with bleeding.

Figure 3. Mangosteen rind extracts topical gel was applied with syringe into periodontal pockets

was cleaned with cotton (Fig. 3). Patients were instructed not to eat, drink or gargle for 1 hour after treatment. Patients were also instructed to keep their daily oral hygiene. The measurement of clinical parameters (plaque index, gingival bleeding, pocket depth, epithelium attachment level, and gingival inflammation) were recorded at the beginning of the visit (baseline) and one month post - treatment. When control was done 1 week after treatment at test area was applied the mangosteen rind extract topical gel.

RESULTS

Data analysis was done by using the t-test to measured changes in gingival bleeding, pocket depth, and the epithelial attachment levels before and after treatment on each side, then compared between test and control area, with confidence level of 95%.

Research was conducted towards chronic periodontitis patients who came for treatment to Periodontal Clinic Dental Hospital Faculty of Dentistry University of Padjadjaran Bandung, during the period of September to December 2014. All clinical parameters value such as pocket depth, epithelium attachment level, bleeding on probing, plaque index, and gingival index was measured before and after application of mangosteen rind extracts topical gel. Afterwards, the average difference between the test and the control area was compared to analyze the effectiveness of the use of Mangosteen rind extracts gel on

Table. 1. Characteristics of patients

Characteristics	Amount (n)	%
Gender		
• Male	7	50
• Female	7	50
Age (years)		
• 30-39	6	42.9
• 40-49	5	35.7
• 50-59	2	14.2
• 60-69	1	7.1
Surface		
Mesial	55 (31 test area, 24 side area)	54
Distal	47 (24 test area, 23 side area)	46
Number of teeth		
Test area	46	56
Control area	36	44

Table 2. The average (mean) value of pocket depth (PPD), gingival inflammation (GI), gingival bleeding (BOP), and the level of epithelium attachment level (CAL) before and after treatment at the test control area

Variables		Surface	Before (H_0)	After (H_{31})	Difference	p-value
PPD:						
	Mesial	Test area	5.61	3.55	2.06	0.000*
		Control area	5.42	4.33	1.08	0.001*
	Distal	Test area	5.46	3.71	1.75	0.000*
		Control area	5.43	4.24	1.20	0.000*
IG:						
	Mesial	Test area	1.90	1.03	0.90	0.000*
		Control area	2.04	1.58	0.46	0.001*
	Distal	Test area	1.92	1.08	0.83	0.000*
		Control area	2.04	1.57	0.48	0.002*
BOP:						
	Mesial	Test area	1	0.48	0.52	0.000*
		Control area	1	0.83	0.17	0.046 NS
	Distal	Test area	1	0.33	0.67	0.000*
		Control area	1	0.87	0.13	0.083 NS
CAL:						
	Mesial	Test area	6.32	4.48	1.84	0.000*
		Control area	6.46	5.79	0.67	0.67 NS
	Distal	Test area	6.38	4.79	1.58	0.001 *
		Control area	6.04	5.77	0.27	0.518 NS

Table 3. Average (mean) difference of Pocket Depth (PPD), Gingival Inflammation (GI), Gingival Bleeding (BOP), and Epithelium Attachment Level (CAL) before and after treatment between the test area and the control area

Variables	Surfaces	Test area	Control area	Difference	p-value
PPD:					
	Mesial	2.06	1.08	0.98	0.004*
	Distal	1.75	0.20	0.55	0.059
IG:					
	Mesial	0.90	0.46	0.44	0.003*
	Distal	0.83	0.48	0.35	0.034*
BOP:					
	Mesial	0.52	0.17	0.35	0.008*
	Distal	0.67	0.13	0.54	0.000*
CAL:					
	Mesial	1.84	0.67	1.17	0.009*
	Distal	1.58	0.27	1.31	0.005*

Note: PPD= Probing Pocket Depth; IG= Index Gingiva; BOP= Bleeding on Probing; CAL = Clinical Attachment Loss*= significant p < 0.05; NS= not significant based on Wilcoxon Signed Rank Test, significant (p < 0.05) based on Mann-Whitney test

the treatment of chronic periodontitis. Table 1 showed the charectiristics of patients.

Table 1 showed that the male patients were 7 persons, and female patients were 7 person. Most age of patients was 30-39 (42.9%). Mesial surfaces of the tooth were 55 surfaces (54%), distal surfaces were 47 (46%), the number of teeth on the test area were 40 teeth (56%) and on the control area were 36 teeth (44%).

Table 2 showed that pocket depth, gingival conditions (gingival inflammation) were decreased significantly on the mesial and distal surfaces on both test and control area. Gingival bleeding also decreased significantly on the mesial and distal surfaces of both test and control area, except on the distal surface of the control area, the difference value was not significant. The epithelial attachment loss level decreased significantly on the mesial and distal surfaces before and after scaling and root planing treatment and applied mangosteen rind extract topical on the test area, whilst on the control area, the difference value of epithelial attachment level before and after treatment on the mesial and distal surfaces was not significant.

Comparison of the difference in the average pocket depth (PPD), the condition of the gingival (GI), gingival bleeding (BOP), and epithelium attachment level (CAL) before and after treatment between the test area and the control area was shown in Table 3.

Comparison of the average difference of pocket depth (PPD), condition of gingiva (IG), gingival bleeding (BOP), and epithelium attachment level (CAL) before and after treatment between the test area and the control area as served in Table 3 shown significant differences on the mesial and distal surfaces. The results showed that the adjunctive treatment by applied mangosteen rind extract topical gel after scaling and root planning therapy were given better results in the chronic periodontitis treatment seen from decreased in the pocket, plaque, gingival inflammation, gingival bleeding and improvement in epithelium attachment, compared towards mere scaling and root planning therapy.

DISCUSSION

Mangosteen (*Garcinia mangostana Linn*) has a powerful efficacy on all of its part, such as pulp, rind, seeds, and leaves. Utilization of mangosteen rind has been done frequently, one of them is extracting the mangosteen rind for the treatment of various illness. Mangosteen rind that extracted with ethanol has proved efficacious towards specific bacteria. Mangosteen rind extract has antibacterial activity against gram-positive and gram-negative bacteria.[7,15]

The study results showed that there were improvements in all clinical parameters examined both on the test area that was treated by both

scaling and root planing and also adjunctive therapy by applied mangosteen rind extracts topical gel, and on the control area that was treated merely by scaling and root planing. This was because scaling and root planing were only initial treatment stage to eliminate etiological factors such as bacteria or other risk factors of periodontal disease in order to stopped disease progression and restore the periodontal tissues to be healthy again.

The changes of microfloral condition after scaling and root planing accompanied by changes in the measurement of periodontal tissue clinically. Several clinical trials have consistently shown the successful treatment of the initial scaling and root planning therapy on reducing gingival inflammation, pocket depth, and improving clinical attachment in most patients with periodontal disorders. Decreasing value of pocket depth (PPD) on both of the test control area, mostly shown on the mesial surface of test area which was 2.06 mm. From the statistical test, there was significant difference (p = 0,004) on pocket depth value between the test and control area.

The study results showed that the use of mangosteen rind extracts topical gel was more effective on reducing pocket depth (PPD) compared toward a mere scaling and root planing therapy. Likewise with attachment loss (CAL), there was a significant difference (p = 0.005; p = 0.009) between the test and control area, which was found bigger decreasing value difference in the test area rather than the control area.

Generally, the test area was shown significant improvement of all clinical parameters that were measured before and after treatment. These results were obtained because on the test side, besides scaling and root planning therapy, also added with the application of mangosteen rind extracts topical gel which was a prevalent antibacterial and anti-inflammatory. The use of mangosteen rind extracts gel as local antibacterial, that applied inside the periodontal pocket was able to reduce the amount of subgingival microflora, pocket depth, and clinical signs of inflammation. Adjunctive therapy that administered locally generally able to reduce pocket depth and the clinical attachment results were also better than the results from mere scaling and root planning therapy.[7,8]

According to research done by Hill and Moore[16], the administration of local antibacterial could becoming adjunctive therapy that was useful for conventional treatment (scaling and root planning therapy). Antibacterial agents that applied locally in subgingival on periodontitis cases was very beneficial in the treatment of patients who had pocket depth more than 5 mm, or in patient that was not responded towards periodontitis main treatment (scaling and root planing).

The results of this study were also supported by Rassamumasmaung S *et al*. Research, that stated that the application of *Mangostana garcinea* pericarp topical gel was effective to be used as adjunctive therapy of scaling and root planing in periodontitis, as shown by the occurrence of larger reduction in pocket depth, gingival inflammation, and bleeding on probing. However, in epithelium clinical attachment level did not shown significant difference between the test and control area. Clinical Attachment Level as parameter of gingival inflammation reduction through the increases of gingival tissue adaptation and reduction of periodontal probe penetration.[17]

Anti-inflammatory activity of *mangostin* and its derivatives, which had effect on prostaglandin synthesis. When the level of prostaglandin was reduced, there was improvement on periodontal parameters of periodontitis. Mangosteen rind extracts gel able to modulate the host inflammatory response. Tannin on mangosteen is able to reduce PPD and acts as an astringent by contracting and wrinkling the tissues, as well as having the effect of vasoconstrictor that able to reduce exudation and inflammation.

CONCLUSION

Application and irrigation of mangosteen rind extracts gel was able to reduce pocket depth (PPD), gingival inflammation (BOP), and improve clinical epithelium attachment (CAL) in chronic periodontitis. Therefore, mangosteen rind extracts gel can be used as adjunctive therapy on scaling and root planing in chronic periodontitis cases.

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