ORIGINAL ARTICLE

Effectiveness Propolic Irrigation After Scaling and Root Planing on Chronic Periodontitical Patients

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ABSTRACT

Introduction: Periodontitis is a chronic inflammatory disease involving plaque bacteria which initiates local periodontal inflammation. This process causes periodontal pockets, reduced tissue adhesion, and resorption of alveolar bone. In patients with chronic periodontitis, scaling and root planing cannot be separated. Propolis has anti-inflammatory, immunomodulatory, antioxidant and antibacterial properties. This study was conducted with the objective of assessing the effectiveness of propolic 10% irrigation and 20% propolic irrigation after scaling and root planning in influencing pocket depth measured by Periodontal Probing Depth (PPD), Clinical Relative Attachment Level (RAL), and Interleukin (IL)-1β expression during periodontal tissue healing in patients with chronic periodontitis. **Methods:** The study population consisted of 12 dental elements obtained from patients with chronic periodontitis. Patients were measured for PPD and RAL and gingival sulcus fluid was taken to see IL-1β expression before scaling and root planning. After the scaling and root planing action, 10% and 20% propolic irrigation were performed. On the 21st day, PPD and RAL were measured again and gingival sulcus fluid was taken to see IL-1β expression. The research data were analysed using the Shapiro-Wilk and continued with Independent Sample-T tests with significance as $p<0.05$. **Results:** The results of Independent Sample T tests showed a significant difference between the group with scaling and root planning plus 10% propolic irrigation compared to the 20%propolis group ($p<0.05$). **Conclusion:** The results from this study indicated that scaling and root planning plus 10% propolic irrigation showed a better ability to influence PPD, RAL, and IL-1β expression the periodontal tissue healing in chronic periodontitis patients than scaling and root planning plus irrigation propolic 20%.

Keywords: Scaling and root planing, Propolic, Interleukin-1β

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INTRODUCTION

Periodontitis is a chronic inflammatory disease in adults (9). The pathogenesis of periodontitis involves bacterial plaque which initiates local periodontal inflammation characterized by swelling, infiltration of leukocyte cells, and release of inflammatory mediators. This inflammation process causes periodontal pockets, reduced tissue adhesion, and resorption of alveolar bone which can lead to tooth loosening (19). The inflammatory state in periodontitis involves the role of proinflammatory cytokines, such as interleukin 1 beta (IL-1β), which is found in gingival tissue and gingival crevicular fluid in patients with periodontitis (11).

Periodontal treatment is an action taken to eliminate existing diseases and prevent their return with appropriate treatment (20). In patients with chronic periodontitis, scaling and root planing cannot be separated. The scaling action needs to be followed by root planing with the aim that the root surface will become smooth so that it inhibits plaque accumulation and calculus adhesions. Scaling and root planing are fundamental therapies for the treatment of periodontal disease (12). The actions of scaling, root planing, curettage, and maintaining good oral hygiene will improve the state of inflammation and prevent further deepening of any pockets. In certain patients these efforts can eliminate all existing diseases (20). Although highly recommended, this treatment has limitations, such as among others, it cannot reach the pocket area with a depth of more than 3 mm and cannot reach the bifurcation area which is a cavity in the tooth root. Nonetheless, scaling and root planning

are still the main treatments, because they can reduce inflammation in the gingival grooves (14). According to research by Petersilka et al. (16), after the subgingival scaling action, up to 30% of calculus remains in the total root surface area.

Examination of periodontal tissue conditions can be conducted by several methods, including measuring pocket depth by Periodontal Probing Depth (PPD), Clinical Relative Attachment Level (RAL), and Bleeding on Probing (21). Research by Hyun Oh et al. (10) demonstrated that gingival crevicular fluid volume and IL-1β level after scaling and root planning showed the severity of periodontal disease and were better variables than periodontal pocket depth and bleeding on probing as markers of gingival inflammation.

Propolic has anti-inflammatory, immunomodulatory (1), antioxidant, and antibacterial properties. In a study conducted by Suryono (18), propolic 10% reduced polymorphonuclear numbers, while increasing fibroblasts and new blood vessels. The research of Ozan et al. (15) found 10% propolic is the best medium in the storage of periodontal cells after teeth are avulsed compared to milk, 20% propolic, and Hank's balanced salt solution (HBSS). Propolic 20% is effective in reducing pocket depth so that it can be considered as an additional irrigation agent for scaling and root planing in patients with chronic periodontitis (13). The healing process of the periodontal tissue over days 2-7 involves restoration and epithelialization of the gingival sulcus and on the 21st day is accompanied by the completion of the regeneration of the periodontium collagen fibres so that measurements of pocket depth, clinical attachment loss, and bleeding on probing can be considered on that day (17).

This study was conducted with the objective of assessing the effectiveness of propolic 10% irrigation and 20% propolic irrigation after scaling and root planning in influencing pocket depth measured by PPD, clinical RAL, and IL-1β expression during periodontal tissue healing in patients with chronic periodontitis.

MATERIALS AND METHODS

This clinical quasi-experimental research was conducted at the Integrated Research Laboratory, Faculty of Dentistry, Prof. Soedomo Hospital and Yogyakarta Health and Calibration Laboratory Centre for 4 months (October-January 2020). All of the study procedures were conducted in accordance with the ethical standards of research and approved by the Ethics Committee of the Faculty of Dentistry, Universitas Gadjah Mada (00535 / KKEP / FKG-UGM / EC / 2020).

1. Preparation of propolic

Propolis was diluted with distilled water gradually to obtain a concentration of 10% and 20% applied as subgingival irrigation as much as 4 ml (13) (Figure 1). The propolic used in this study is Brazilian® Propolic produced in Minas Gerais and distributed by Nusa Mega.

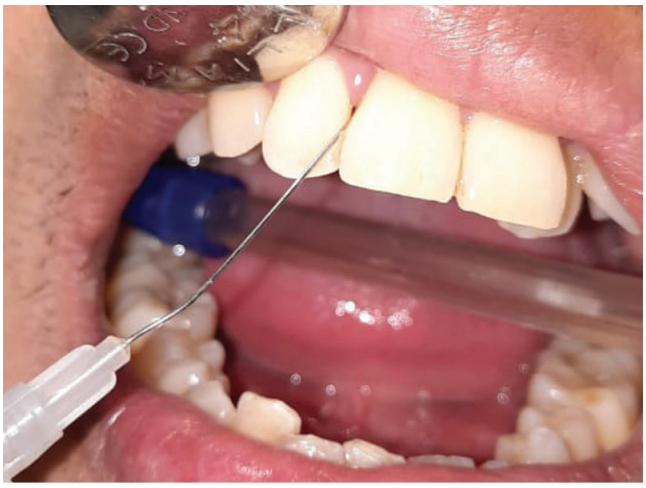

Figure 1 : Propolis irrigation on the subgingival upper anterior teeth using a syringe.

2. Preparation of the patient

The research sample was obtained from the teeth of patients with chronic periodontitis from the Periodontitis Specialist Clinic of the Prof. Soedomo Dental Hospital, Faculty of Dentistry, Universitas Gadjah Mada with the following inclusion criteria: the patient's age is 25-57 years with the conditions that are free of COVID-19, who is not reactive to the rapid examination of antibody tests, good systemic health and experiencing chronic periodontitis. The teeth examined had at least one pocket per quadrant with a probing depth of 4-6 mm. Exclusion criteria were patients not undergoing periodontal treatment and who received antibiotic therapy within 3 months before the start of the study and smoking.

3. Relative Attachment Level (RAL) Measurement.

Prior to the RAL measurement, an acrylic stent was made which was useful for fixing the position during the RAL measurement. Measurement of RAL was done with a UNC 15 probe from the specified acrylic sten boundary to the base of the periodontal pocket at the six points of the teeth that were measured, namely mesiofacial, midfacial, distofacial, mesiolingual/palatal, midlingual/palatal, and distolingual/palatal (Figure2).

4. How to measure the expression of IL-1 β.

First, the work area was isolated with a cotton roll by removing the supragingival plaque beforehand, then inserting a paper point size 15 into the cervical part of the tooth, 1-2 mm subgingival until there is light resistance and holding it in that position for 30 seconds (Figure 3). Paper points with blood contamination of the patient should not be employed. The paper points

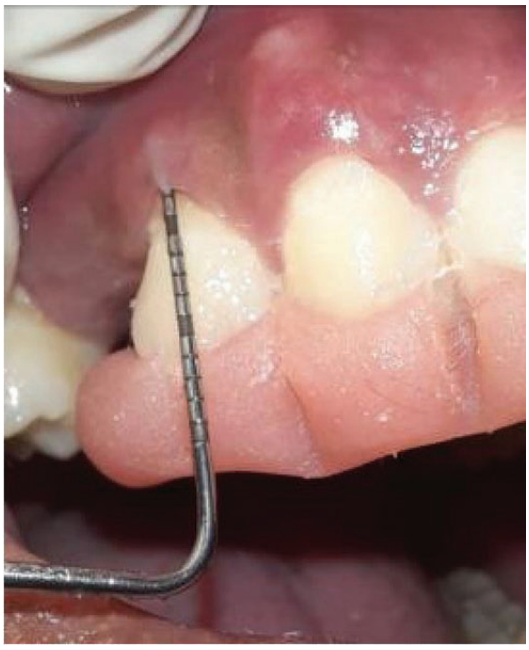

Figure 2 : Relative Attachment Level (RAL) measurement using acrylic stent.

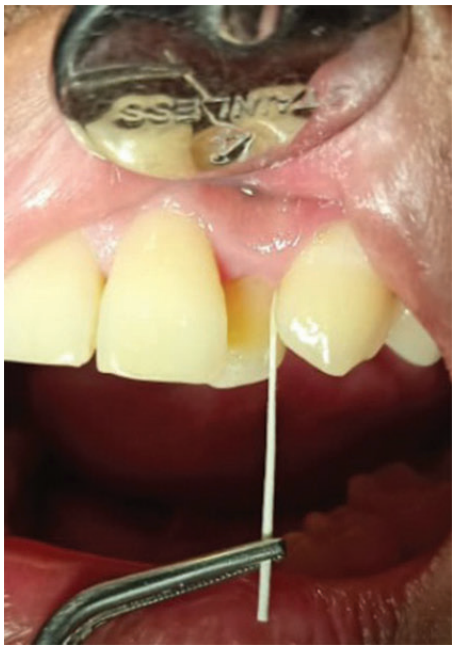

Figure 3 : Gingival crevicular fluid (GCF) collection using a paper point.

were then put into an Eppendorf tube filled with 0.3 ml of saline phosphate buffer solution. The gingival crevicular fluid was released from the paper points by centrifugation for 15 minutes at a rate of 3000 rpm and the gingival crevicular fluid samples were stored at -200C until they were analysed.

The research data were analysed using the Shapiro-Wilk tests and continued with Independent Sample-T tests with significance set as $p<0.05$.

RESULTS

This study consisted of 12 dental elements obtained from patients with chronic periodontitis who came to our clinic at the Prof. Soedomo Dental Hospital. The samples in this study were divided into two groups, which were the 10% propolic irrigation group after scaling and root planning and the 20% propolic irrigation group after scaling and root planning. The results obtained are statistical data from measurements of PPD, RAL, and concentration of IL-1β. The mean and standard deviation (SD) values of PPD, RAL, and IL-1β in the 10% propolic group and 20% propolic group are presented in the following Table I. Descriptive data on PPD in all groups indicated the highest PPD group was in the 10% propolic group on day 0 (4.50), while the lowest PPD in in the 10% propolic group was on day 21 (1.83). Reductions in all groups between baseline and day 21 are shown in Table II. Statistical analyses for reduction of PPD, RAL, and concentration of IL-1β are shown in the following table III, which shows the greatest number of reductions in group A and the lowest significant result in concentration IL-1β.

DISCUSSION

Descriptive data of PPD reduction in all post-scaling and root planing groups showed that the highest PPD reduction group was in the 10% propolic group (1.83), while the lowest PPD reduction was in the 20% propolic group (0.67). Periodontal pockets with a depth of 5 mm or less including moderate stage periodontitis are an indication for non-surgical antimicrobial therapy treatment (7). The recommendation to minimize treatment visits during the COVID-19 pandemic should be maintained to stop the spread of COVID-19. Accordingly, the selection of research subjects was limited and not as easy as in the conditions before the COVID-19 pandemic.

Tissue damage due to lipopolysaccharides (LPS) of Porphyromonas gingivalis bacteria in periodontitis causes periodontal pockets. The main treatment for periodontitis is scaling and root planing which aims to remove plaque and calculus containing the biofilm Porphyromonas gingivalis bacteria. However, scaling and root planing have limitations because they cannot reach pockets of more than 3 mm so that additional material is needed, which is propolis irrigation. Research conducted by Devitaningtyas et al. (5) on 10% propolic incorporated into the hydroxyapatite carbonate material had the highest inhibitory power against the growth of the bacterium Porphyromonas gingivalis. In the study conducted by Mali (13), 20% propolic can also inhibit Porphyromonas gingivalis bacteria.

The mechanism of propolic in causing bacterial cell

Table I : Mean value and standar deviation on PPD, RAL, and concentration IL-1β

	Baseline		Day 21	
	Group A	**Group B**	**Group A**	**Group B**
PPD (mm)	4.50±1.05	4.17±1.17	1.83±0.75	3.17±0.75
RAL (mm)	9.50±1.64	9.00±1.41	6.33±0.52	7.83±0.75
Interleukin -1β(pg/L)	1787.19±33.35	1430.49±37.07	1760.99±22.97	1534.59±39.37

PPD : Periodontal Pocket Depth;
RAL : Relative Attachment Level
IL-1β : Interleukin 1 Beta
Group A : 10% propolis irrigation after scaling and root planning
Group B : 20% propolis irrigation after scaling and root planning

Table II : Reduction on all group between baseline and day21

Parameter	**PPD (mm)**	**RAL (mm)**	**IL-1β (pg/L)**
Group A	2	2	312.27
	2	2	412.30
	3	2	346.99
	3	1	346.26
	1	1	318.93
	1	1	403.42
Group B	3	2	268.06
	2	2	201.12
	1	1	192.96
	0	1	289.34
	2	1	216.60
	1	1	190.45

PPD : Periodontal Pocket Depth
RAL : Relative Attachment Level
IL-1β : Interleukin 1 Beta
Group A : 10% propolis irrigation after scaling and root planning
Group B : 20% propolis irrigation after scaling and root planning

Table 3. Statistical analysis for reduction of PPD, RAL, and concentration of IL-1β

Parameter	**Test**	**Reduction**		
		Group A		**Group B**
PPD	Independent t test	1.83	P = 0.028*	0.67
RAL	Independent t test	3.83	P = 0.028*	2.67
IL-1β	Independent t test	356.69	P = 0.001*	233.06

Significant*
PPD : Periodontal Pocket Depth
RAL : Relative Attachment Level
IL-1β : Interleukin 1 Beta
Group A : 10% propolis irrigation after scaling and root planning
Group B : 20% propolis irrigation after scaling and root planning

lysis can be via flavonoids which cause malfunction of the Na + - K + pump, which results in sodium ions to be trapped in the cell, and subsequent polarity changes in the cell plasma that develop into osmosis of fluid into the cell. This is what causes the cells to swell and eventually burst. These ruptured membranes cause interference with the exchange of substances needed by bacteria to survive, resulting in their death.

The mean table shows that the lowest RAL reduction value is found in the propolic irrigation group of 20%, while the highest RAL reduction is in the 10% propolic irrigation group. This finding shows that the increase in tissue adhesion was better in the propolic group 10%. In the research of Ozan et al. (15), 10% propolic is the best medium for storing periodontal tissue cells after teeth are avulsed compared to milk, 20% propolic, and Hank's balanced salt solution (HBSS) with increased fibroblast cell growth observed within 48 hours.

The tissue regeneration process goes through several stages, which are homeostasis, inflammation, proliferation, and maturation. On day 2-7 day in the tissue healing process, there was restoration and epithelialization of the gingival sulcus and on day 21, it was accompanied by the completion of the regeneration of the periodontium collagen fibres so that pocket depth measurements, clinical attachment loss and bleeding on probing can be considered on that day (17).

The mean IL-1β levels at baseline between the 10% propolic irrigation group and the 20% propolic irrigation group showed a decrease in IL-1β levels. It is because during inflammatory conditions, the IL-1β expansion is increased in the state of periodontitis. However, the reduction in the 10% propolic irrigation group was higher than the 20%. propolic irrigation group. This finding is in line with the research conducted by Hyun Oh et al. (10) that found deep periodontal pockets also show high IL-1β concentrations. In the initial conditions of this inflammation process, inflammatory mediators are released, including pro-inflammatory cytokines IL-1β, IL-6, and tumour necrosis factor-alpha (TNF-α) by the body's immune cells during the tissue healing process. Several studies have reported higher IL-1β levels in periodontitis than in healthy and gingivitis patients (6). Studies on cultured mouse bone marrow cells have shown that IL-1β can increase the formation of osteoclasts and prostaglandins (22). The caffeic acid phenethyl ester (CAPE) content in propolic can inhibit cyclooxygenase (COX-2) in inflammation that occurs in mouse epithelial cells and inhibits nuclear factor kB.

CAPE is one of the active ingredients in propolic and contains active phenols. According to research conducted by Hadiyah et al. (8), results showed that the higher the phenol content in a substance will affect the tissue toxicity, thereby triggering cell death. The inhibition of cell growth by CAPE is associated with an effect on oxidative processes induced by mitogen stimuli. The regulation of cell proliferation in various types of mammalian cell types is mediated by binding of cytokines, growth factors, and hormones that are specific to cell surface receptors which in turn move oxygen radicals and H2O2. Caffeic acid phenethyl ester is known to be able to inhibit a wider range of oxidative processes or is comparable to chemopreventive agents such as Tamoxifen (2).

CONCLUSION

The conclusion from this study was that scaling and root planning plus 10% propolic irrigation showed a better ability to influence Pocket Depth, Clinical Attachment Loss, and IL-1β expression during periodontal tissue healing in patients with chronic periodontitis compared to scaling and root planning plus 20% propolic irrigation. Research using propolic is recommended to develop because it is herbal ingredient which is easily available at a relatively inexpensive price, does not cause resistance, and is relatively safe..

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