

Dental Plaque Accumulation and Periodontal Treatment Needs of Smokers

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ABSTRACT

Organic deposits such as food residue, pellicle, dental plaque, and calculus can easily stick to the surface of smokers' teeth due to the tar content that sticks to the teeth, causing the tooth surface to become rough. This study aims to describe periodontal conditions through plaque accumulation and the need for periodontal treatment in smokers. Cross-sectional study at the Dental and Oral Hospital, University of North Sumatra, with a sample of 60 smokers. Plaque accumulation examination uses the Loe and Silness index and periodontal status needs use the Community Periodontal Index of Treatment Needs (CPITN) index. The results of the periodontal status of smokers showed that 36.7% of smokers had a periodontal status score of 0 (healthy periodontium), 33.3% had a periodontal status score of 2 (supragingival calculus), 28.3% had a score of 1 (spontaneous bleeding) and 1.7 % had periodontal status with a score of 3 (pockets 4-5 mm). The results showed that 36.7% did not need treatment (TN 0), 35% of smokers needed better dental care at home/improved oral hygiene and tartar cleaning (TN II), and 28.3% of smokers only needed adequate dental care. better (TN I). The conclusion of this study is that the periodontal treatment needs of smokers at RSGM USU are based on the number of cigarettes and duration of smoking, which is most often found in periodontal status and treatment with scores of 0 and 2.

Keywords: Plaque Accumulation; Periodontal Status; Smokers ;Treatment Needs

ABSTRAK

Deposit organik seperti sisa makanan, pelikel, plak gigi, dan kalkulus dapat mudah melekat pada permukaan gigi perokok akibat dari kandungan tar yang menempel pada gigi menyebabkan permukaan gigi menjadi kasar. Penelitian ini bertujuan untuk mendeskripsikan kondisi periodontal melalui akumulasi plak dan kebutuhan perawatan periodontal pada perokok. Studi potong lintang di Rumah Sakit Gigi dan Mulut Universitas Sumatera Utara, dengan sampel 60 perokok. Pemeriksaan akumulasi plak menggunakan indeks Loe and Silness dan kebutuhan status periodontal menggunakan indeks *Community Periodontal Index of Treatment Needs* (CPITN). Hasil status periodontal perokok menunjukkan 36,7% perokok mempunyai status periodontal dengan skor 0 (periodonsium sehat), 33,3% mempunyai skor status periodontal 2 (kalkulus supragingiva), 28,3% mempunyai skor 1 (perdarahan spontan) dan 1,7% berstatus periodontal dengan skor 3 (poket 4-5 mm). Hasil penelitian menunjukkan 36,7% tidak memerlukan pengobatan (TN 0), 35% perokok memerlukan perawatan gigi yang lebih baik di rumah/ peningkatan kebersihan mulut dan pembersihan karang gigi (TN II), dan 28,3% perokok hanya memerlukan perawatan gigi yang lebih baik (TN I). Kesimpulan penelitian ini, bahwa kebutuhan perawatan periodontal perokok di RSGM USU berdasarkan jumlah batang rokok dan lama merokok, yang paling banyak ditemukan pada status dan perawatan periodontal dengan skor 0 dan 2.

Kata Kunci: Akumulasi Plak; Status Periodontal; Perokok; Kebutuhan Perawatan



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1. Introduction

Health problems in Indonesia are on the rise, particularly in the dental and oral aspects due to the poor knowledge among the population. One of the indicators of dental and oral health is the level of oral hygiene, which is reflected in the presence or absence of organic deposits such as food debris, pellicle, material alba, dental plaque, and calculus.[1] Dental plaque is distinct as a sticky colorless layer consisting of microorganisms including *Streptococcus mutans* embedded in an organic matrix. This biofilm adheres firmly to the teeth, gingiva, and other hard surfaces in the oral cavity. A community of microorganisms found on the surface of the teeth is called biofilms, enclosed in a framework of extracellular polymeric substances.[2]

Smoking is one of the major factors influencing plaque formation in teeth.[3] The inhaled smoke contains toxic chemicals that affect the teeth and other soft tissues in the oral cavity.[4,5] These chemicals can reduce the protective function of saliva to prevent dental caries. Saliva in smokers neutralizes the acidic pH of the oral cavity, which is lower than non-smokers, thereby increasing the risk of dental caries. In addition, prolonged smoking potentially leads to a reduction in the flow rate of saliva.[6] The occurrence of plaque is associated with the quantity and quality of saliva, which plays a crucial role in cleaning teeth surface from pathogenic conditions.[7] Cigarette tar, when present, can precipitate on surfaces of the teeth, creating a rough appearance and providing an ideal surface for plaque and microorganisms to attach. Smoking habits also harm periodontal health, causing infection and inflammation of the gingiva.[8] The primary etiology of periodontal disease is dental plaque,[9] which plays an important role in the health of oral tissues.[10] Smoking has a significant relationship with periodontal disease,[11] ranked as the most common problem in the oral cavity after caries. The prevalence is higher in adults and is one of the leading causes of teeth loss in developing countries.[12] Furthermore, the percentage of smokers in the population aged ≥ 15 years in North Sumatera Province was 31.10%, 27.46%, and 27.28 % in 2018, 2019, and 2020, respectively.[13]

Several indexes can be used to measure dental plaque including the Loe and Silness index as well as *Plaque Control Record* (PCR). These indices are essential for assessing plaque formation on teeth surface.[14] When left untreated, periodontal disease can cause teeth mobility, eventually resulting in total loss.[15,16] To address this, it is crucial to assess periodontal tissue and determine its treatment needs by measuring the *Community Periodontal Index of Treatment Needs* (CPITN).[17] The aim of CPITN is to estimate the prevalence of periodontal status, measure the level of treatment needs, and determine the appropriate type of treatment.[18]

According to Tahir et al., smokers have a higher plaque index (1.63 ± 0.28) than non-smokers (1.34 ± 0.47).[19] Al-Bayaty et al., also reported that plaque index in smokers was 51.35 ± 11.27 ,[20] and in Suhanda et al., the highest CPITN score (3) was found in smokers, describing a pathological pocket of 4-5.5 mm.[21] These results showed that smokers need special attention due to the direct adverse effect of the habit on oral health. Therefore, this study aimed to examine the relationship between plaque accumulation and periodontal treatment needs of smokers.

2. Methods and Materials

This study used a cross-sectional study design and was conducted at the Dental and Oral Hospital Universitas Sumatera Utara, with a sample size of 60 smokers. Ethical approval was received from the Health Research Ethics Committee (KEPK) of the University. All subjects agreed and were willing to sign the informed consent after the explanation. The inclusion criteria were light, moderate, and heavy smokers who agreed to participate, and the exclusion criteria were smokers who had been scaling in the last six months. Before conducting the survey, an inter-examiner test was carried out to calibrate Plaque Loe and Silness indexes as well as the *Partial Community Periodontal Index and Treatment Needs* (PCPITN) index. Demographic data and information regarding brushing of teeth were obtained through interviews and questionnaires. Oral hygiene was assessed by conducting a plaque examination using the Loe and Silness plaque index, while CPITN was used to determine oral health care needs for each individual to restore the health of periodontal tissues. The Loe and Silness plaque index which required the evaluation of six teeth: 16, 12, 24, 34, 42, and 46, was carried out on four surfaces namely distovestibular, vestibular, mesiovestibular, and palatal/lingual. A score was given for each surface, and then the average was calculated by adding plaque score on the four surfaces in one teeth and dividing by four. The result was categorized into a score of 0-1 (good), 1.1-2 (moderate), and 2.1-3 (severe).[14] On the other hand, CPITN score was assessed based on the state of bleeding, sulcus depth, and calculus. The examination was carried out once by one examiner with the

help of an assistant to record data. Analysis of the six sextants was scored according to the table below and data were analyzed through statistical tests using the Spearman correlation test for bivariate analysis, with a significance level of 5%.

Table 1. Criteria for Periodontal Treatment Needs

Dental Score	Status Periodontal	Score TN	Treatment Needs
4	Pathological pocket \geq 6 mm. If one of the teeth in the sextant is given a score of 4, then there is no need to check the pocket depth, calculus, and gingival bleeding on the other teeth in the sextant.	III	Requires more complicated treatments (deep scaling, root planing, periodontal surgery, increased oral hygiene).
3	Pathological pocket 3.5-5.5 mm.	II	Requires improvement of dental care at home/improvement of oral hygiene and scaling.
2	Presence of supragingival calculus or subgingival calculus.		
1	Bleeding on probing.	I	Requires improvement of dental care at home/improvement of oral hygiene and scaling.
0	There were no pockets or gingival bleeding at the time of examination using a WHO prob/healthy periodontal tissue.	0	Requires no maintenance.
X	If there is only one functional teeth/no extraction indication or no teeth in the sextant.		

3. Results

The number of samples in this study was 60 smokers with an age range of 18-26 years, where the number of male subjects (98.3%) was more than females (1.7%). The majority were light smokers (98.1%) compared to moderate (1.7%) as shown in Table 2.

Table 2. Subject Distribution

Variables (n=60)	Frequency (n)	Percentage (%)
Gender		
a. Male	59	98,3
b. Female	1	1,7
Age		
a. 18-21 years	44	73,3
b. 22-40 years	16	26,7
Smoker category		
a. Light smoker	59	98,3
b. Moderate smoker	1	1,7

According to the Loe and Silness plaque index, plaque accumulation was mostly in the good category (91.7%), with only (8.3%) moderate. The majority of subjects were at periodontal status of 0 or healthy (36.7%), and treatment needs of level 0 (36.7%) (Table 3). Table 4 shows a significant relationship between plaque index and periodontal status ($p=0.036$) as well as plaque accumulation and periodontal treatment needs ($p=0.022$).

Table 3. Conditions of Oral Hygiene

Variables (n=60)	Frequency (n)	Percentage (%)
Plaque Index		
a. Good	55	91,7
b. Moderate	5	8,3
Periodontal Status		
a. 0 (Healthy)	22	36,7
b. 1 (Gingival bleeding)	17	28,3
c. 2 (Supragingival calculus)	20	33,3
d. 3 (Periodontal pockets of 4-5 mm)	1	1,7

Periodontal Treatment Needs		
a. 0 (No treatment needs)	22	36,7
b. I (Oral hygiene improvement)	17	28,3
c. II (Oral hygiene improvement, scaling)	21	35

Table 4. Relationship Between Plaque Accumulation and Periodontal Status as well as Periodontal Treatment Needs of Smokers

Variables (n=60)	Plaque Accumulation	
	Coefficient correlation	p-value
Periodontal Status	0.272	0.036*
Periodontal Treatment Needs	0.295	0.022*

Spearman Correlation Test; *significant p<0.05

4. Discussions

Smoking has a significant impact on the oral health of individuals, particularly in the development of plaque on teeth. Cigarette, which is tobacco products, are typically burned, smoked, or inhaled. When smoking, cigarette smoke, which contains many harmful chemicals rapidly enters the oral cavity, affecting the teeth and soft tissue, potentially leading to damage over time.

In the context of periodontal disease, the primary etiology is dental plaque, accumulating and resulting in gingivitis. Over an extended period, plaque can cause the loss of periodontal attachment primarily due to the production of collagenase enzymes, which degrade collagen in the tissue. Furthermore, it also causes demineralization and teeth decay by microbes, resulting in caries. The dominant age of the subjects found in this study was 18-21 years (73.3%), and the gender was mostly male (98.3%). According to Basic Health Research (RISKESDAS) in 2013, the prevalence of smoking was 16 times higher in male (65.8%) than in female (4.2%). Based on data from the Household Health Survey (SKRT), smoking habit in male aged 14 years and above was 45.8%, and in female was 2.9%. This disparity was attributed to factors that promote the behavior among individuals, such as social stigma. For example, in Indonesia, smoking among male is considered socially normal, while the habit is deemed culturally and socially unacceptable for females. In addition, smoking among male is also a symbol of manhood.

This study showed that 91.7% of smokers were in the good plaque accumulation, while 8.3% were in the moderate category, with a mean plaque score of 0.51 ± 0.31 based on the Loe and Silness index (Table 2). Similar results were reported by Rahmita et al., where the mean plaque index score of 42 smokers was 0.47 ± 0.34 . [22] Khemiss et al., also examined 148 smokers and the mean plaque index score was 1.46 ± 0.76 . [23] However, Al-Bayaty et al., obtained different results where plaque index was reportedly 51.35 ± 11.27 . [20] This was presumably because 98.3% of subjects were light smokers, hence, the adhesion of tar and nicotine content to the teeth was still small.

Approximately 36.7%, 33.3%, 28.3%, and 1.7% of smokers had periodontal status with a score of 0 (healthy periodontium), 2 (supragingival calculus), 1 (spontaneous bleeding), and 3 (4-5 mm pocket), respectively, as shown in Table 2. Periodontal status plays a crucial role in determining the level of treatment needs among smokers. Based on the results, 36.7% of smokers did not require treatment (TN 0), 35% required improved dental care at home/increased oral hygiene and scaling (TN II), while 28.3% only needed improved dental care (TN I). The highest percentage was recorded in TN 0 because most of subjects were light smokers. The effect of smoking on periodontal tissue can vary depending on the frequency of exposure to tobacco in the oral cavity. [24]

Smokers often have higher pocket depth due to loss of alveolar bone, and the longer the exposure of the oral cavity to tobacco, the greater the formation of pathological pockets measuring 4-5.5 mm. The majority of subjects in this study were light smokers leading to a healthy periodontal status. Therefore, the prevalent treatment services needed were 0, I, and II. There were no respondents with pathological pockets ≥ 6 mm making root planing treatment unnecessary.

This study found a significant relationship between plaque accumulation and periodontal status ($p=0.036$) with a positive correlation coefficient value ($r=0.272$) on periodontal status, which means that the more plaque there is, the worse the condition of periodontal status (Table 2).

The majority of plaque accumulation was in the good category. This underscores the importance of maintaining good oral hygiene, as higher plaque accumulation can make periodontium tissues more susceptible to irritation from plaque bacteria. A significant relationship was also found between plaque accumulation and the level of periodontal treatment needs ($p=0.022$) with the positive correlation coefficient value ($r=0.295$) on the need for periodontal treatment shows that the more plaque increases, the greater the need for periodontal treatment. In general, subjects did not require treatment due to the healthy periodontium (Table 2). The result was in line with Suhandia et al.,[21] stating that the duration of smoking influenced the treatment needs of smokers. Individuals who had been smoking for 1-10 years needed TN II (14.61%) and TN III (1.12%), while smokers >10 years required TN II (44.94%) and TN III (39.33%). Similarly, Gautam found that the effect of smoking on periodontal tissue could vary depending on the frequency of exposure to tobacco in the oral cavity. Smokers often have higher pocket depth due to loss of alveolar bone. The higher the frequency of smoking, the greater the effect on the oral cavity, in this context, the formation of pathological pockets measuring 4-5.5mm.[25] In heavy smokers, attachment loss tends to increase compared to light smokers. This could be attributed to the various chemicals contained in cigarette, resulting in periodontal disease.[26]

5. Conclusions

In conclusion, this study found that subjects had plaque accumulation and good periodontal status because the majority were light smokers, thereby eliminating the need for periodontal treatment. A significant relationship was found between plaque accumulation and periodontal status, as well as treatment needs. The most common periodontal status and treatment needs observed among smokers were scores of 0 and 2.

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7. Conflicts of Interest

The authors declare that there are no conflicts of interest to disclose concerning this study.

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