International Journal of Dentistry Scientific
Volume 2, Issue 1, Page 77-100, December 2024
ISSN: 3031-7142

EFFECT OF PERIODONTAL TREATMENT ON GLYCEMIC CONTROL IN TYPE-1 DIABETES MELLITUS WITH PERIODONTITIS (SYSTEMATIC REVIEW)

Chaerunnisa Nabilah Sobrina[1], Mellani Cindera Negara[2*], Yuniza[3],

[1]Student of Dentistry Study Program, Faculty of Medicine, Universitas Sriwijaya
[2]Department of Periodontic, Faculty of Medicine, Universitas Sriwijaya
[3]Department of Internal Medicine, Faculty of Medicine, Universitas Sriwijaya
Corresponding author: mellanicinderanegara@fk.unsri.ac.id

Article info: Received: 30-10-2024; Revised: 30-11-2024; Accepted: 15-12-2024; Publish: 30-12-2024

ABSTRACT

Many studies have shown that periodontal therapy, such as scaling and root planning, can improve glycemic control for 3 to 4 months. Moreover, studies have shown that treating patients with type 2 diabetes with antimicrobial agents in addition to scaling and root planning (SRP) improves both periodontal parameters and glycemic control. Aiming to determine the impact on glycemic control, this systematic review focuses on periodontal treatment in the form of SRP, whether or not supplemented with antimicrobials, in type 1 DM patients and periodontitis. Conducted as a systematic literature review with a qualitative approach, this research utilizes journal databases such as PubMed, Google Scholar, DOAJ, and SciElo. Once the journals are obtained, they will be selected and subjected to bias analysis and data extraction. Analysis of five journals qualitatively revealed that SRP, whether or not antimicrobials were added, has no discernible effect on type 1DM patients' glucose control, although it significantly improved periodontal parameters. The inclusion of antimicrobials was found to be more effective for enhancing periodontal parameters in type 1 DM patients, but it did not significantly impact glycemic control post-periodontal treatment**.**

Keywords: Type-1 Diabetes, Glycemic Control, Periodontal Treatment, Periodontitis, Adjunctive Therapy

INTRODUCTION

Periodontal disease is a disease process that involves the relationship between the periodontium, which refers to the periodontal ligament, gingiva, cementum, and alveolar bone, among other tissues that surround and support teeth.[1,2] Gram-negative

anaerobic bacteria that adhere to teeth to form bacterial plaque, such as *Prevotella intermedia, Porphyromonas gingivalis, Actinobacillus actinomycetecomitans, Campylobacter rectus, Bacteroides forsythias, Fusobacterium nucleatum, and spirochetes*, are the usual causes of periodontal disease.[3]

Gingivitis is the first manifestation of periodontal disease, if not properly treated it can progress to periodontitis. Gingivitis is characterized by the reversible inflammation of the periodontal tissues, while periodontitis is characterized by damage to the tooth's supporting structures, which can cause permanent and fast tissue destruction as well as the loss of teeth.[2,3]

Based on research conducted by Agus et al (2020) in Bandung, the study population suffering from gingivitis and periodontitis were 55.25% and 44.75%, respectively. This implies that periodontal problems are oral problems that are very common in the Indonesian population.[1] In addition to affecting oral health, periodontal disease is often attributed to systemic problems, such as diabetes mellitus (DM). As of 2008, Indonesia had a diabetes mellitus prevalence of 57%, ranking it among the top 10 countries globally with the largest number of diabetic patients. In the 2030 period, it is estimated that the quantity of DM patients in Indonesia is anticipated to surpass 20 million (10% of the total population).[4] Due to the elevated occurrence of DM, the prevalence and seriousness of periodontitis may escalate as well.

Diabetes exists in two primary forms: type 1 and type 2. Type 1 diabetes is brought on by the immune system destroying beta cells in the pancreas. Type-1 diabetic diabetes affects 5% of the population. In contrast, 85–90% of people with diabetes have type-2 diabetes, which causes reduced insulin secretion due to decreased sensitivity of the liver, muscles, and fat to insulin.5.6% of people with Type 1 diabetes also have a prevalence of periodontitis.

Although the prevalence of periodontitis is higher in people with type 2 diabetes (88.24%), type 1 diabetes is still associated with an increased risk of the condition. Numerous studies have shown that type 1 diabetes and periodontitis are correlated.Not only is periodontitis more common in people with type 1 diabetes

than in the general population, but it is also far more severe in these individuals.[7] Poor glycemic control with high levels of HbA1C >9% has a very high prevalence of severe periodontitis in contrast to non-diabetic individuals, furthermore, severe periodontitis among diabetic patients can escalate the risk of complications such as cardiovascular, cerebrovascular, or peripheral vascular disease.[8]

Garcia et al (2012) evaluate the relationship between periodontitis, diabetes, and glycemic control. The results showed that among individuals with periodontitis, those with DM exhibited an average glycohemoglobin (HbA1c) level of 7.4% compared to individuals with healthy periodontitis. These results are also consistent utilizing a thorough analysis by Graziani et al (2018), in which periodontitis attributed to elevated HbA1c in the diabetic population. In addition, greater periodontal attachment loss is linked with a prolonged duration of DM.[9,10] Multiple studies have been conducted on the correlation between periodontal care and Glycemic control in patients with type 1 and type 2 diabetes who have periodontitis.

Periodontal treatments such as SRP, antimicrobial therapy, and surgical treatment aim to repair periodontal tissue damage, prevent further disease progression, minimize disease symptoms, and support patients in maintaining healthy periodontal tissues.[11] HbA1c or glycosylated hemoglobin is an indication of metabolic control. The mean level of HbA1c in type-1 DM individuals with periodontitis is 8.84%.[12] Empirical evidence from various studies suggests the benefit of treating periodontitis with improved glycemic control.

As found in the study of Medianos et al (2018) Although there is no evidence of improved glycemic control in type-1 diabetes, but SRP improves glycemic control in type 2 diabetes with a drop in mean HbA1c of 0.29% at 3 to 4 months. In addition, multiple studies have reported the benefits of giving additional antimicrobials alongside scaling and root planning for individuals with type-2 DM, 2.25 mm for an average gain of CAL.[13]

Since there is still a dearth of information on people with type 1 diabetes, the majority of systematic reviews on the impact of periodontal therapy on glycemic control of diabetics have exclusively examined type 2 diabetes patients. Therefore,

the authors are interested in systematically reviewing the repercussions of periodontal treatment on supervision. Evaluating glycemic changes measured by HbA1c post-periodontal treatment in type 1 diabetic individuals through a RCT.

METHOD

This systematic review utilized a Randomized Controlled Trial (RCT) as its study approach. The research time starts from July 2020 until June 2021. The best research design to use when answering questions about the impact of treatment therapy is a randomized controlled trial (RCT), besides this type of study offers reduced potential for systematic bias.[74] Types of studies other than RCTs that assess how periodontal therapy affects changes in mean HbA1c in type-DM individuals 1 will be excluded, this is because to minimize the bias that will occur.

In this systematic literature review, the type of research used is RCT so that the bias analysis will use the Cochrane collaboration tool. After conducting an assessment of bias, results derived from research exhibiting considerable bias, a sensitivity analysis will be conducted, while primary research identified with high bias risk will be eliminated in the analysis while remaining attentive to subsequent conclusions.

Type of Studies

The research methodology adopted for this systematic review involves a RCT. RCT is the most fitting research type for addressing research queries regarding the effect of treatment therapy, besides this type of study offers reduced potential for systematic bias.[14] Types of studies other than RCTs that assess how periodontal therapy affects changes in mean HbA1c in type-DM individuals 1 will be excluded, this is because to minimize the bias that will occur.

Population

The population in this study were individuals with periodontitis aged 10-61 years who were identified in juvenile type-1 diabetes. Type 1 diabetes mellitus

patients with well-controlled, moderate-controlled, or poorly controlled glycemic will be included in this study. The cohort having type 2 diabetes was excluded from this study. Pregnant and lactating women and patients with other systemic disease conditions and complications of diabetes To reduce bias, additional conditions were omitted, including peripheral neuropathy, retinopathy, macrovascular disorders (coronary heart disease and cerebrovascular disease), foot complications (resulting from a combination of neuropathic and vascular issues), and renal failure. Non-surgical periodontal therapy (scaling and root planing) together with extra systemic and local antimicrobial therapy was the intervention used in this study such as antibiotics and other drugs that have the positive impact of optimizing the periodontal condition of the study subjects.

Combination antimicrobial treatments were also included, as was the combination of amoxicillin and metronidazole. This combination has been reported as an adjunct treatment for SRP in chronic periodontitis patients. Surgical periodontal treatments such as flap surgery and gingivectomy were excluded. In addition, drugs that could affect the participants' periodontal status such as phenytoin, calcium channel blockers, cyclosporine, and NSAIDs were also excluded. Phenytoin, cyclosporine, and calcium channel blockers may lead to gingival overgrowth, while NSAIDs can affect the inflammatory process in periodontal tissues. This would be a bias in the study if these drugs were included

Comparison

Patients without periodontal treatment or patients receiving scaling and root planing treatment without additional antimicrobial therapy were used as control groups. This is to compare whether there is a difference between type 1 DM patients who received SRP treatment with additional antimicrobials and patients who received SRP alone on changes in HbA1C values. Earlier studies showed that SRP with adjunctive antimicrobials was more effective in minimizing probing depth and enhancing clinical adhesion in comparison to SRP in patients with DM.

Outcome

The main results measured were changed HbA1C after periodontal treatment. Changes in HbA1c were assessed from the decrease in HbA1c levels from before treatment and after receiving periodontal treatment. An increase in HbA1c values after periodontal treatment will also be reported in this study. Human RBCs usually have a lifespan of 100-120 days, however, the duration of follow-up was'nt constrained by the original study's limitations in this investigation. The secondary outcomes in this study were changes in the periodontal index (probing pocket depth (PPD), gingival index (GI), plaque index (PI), bleeding on probing (BOP), and clinical attachment loss (CAL)) as well as other side effects of periodontal treatment associated with this study. occurs will also be included. Randomized controlled trials addressing serum interleukin and CRP levels were excluded from this study.

PICO Question

1. In patients with type 1 diabetes mellitus and periodontitis, how do scaling and root planning treatments with adjunctive antibiotics compare to control scaling and root planning without adjunctive antibiotics to changes in HbA1c in a randomized controlled trial?
2. If patients with type 1 diabetes mellitus with periodontitis are compared to controls who do not receive periodontal treatment, what impact does scaling and root planing therapy have on changes in HbA1c in a randomized controlled trial without the use of an adjuvant antibiotic?

Data Search Strategy

The journal databases that will be utilized are Google Scholar, PubMed, DOAJ, and SciElo. A list of the keywords and controlled vocabulary utilized can be found in table 1. In order to increase the scope of the data search, the library used is in English and does not restrict the year of release.

Biased Assessment Plan

In this systematic literature review, the type of research used is RCT so that the bias analysis will use the Cochrane collaboration tool. After conducting an assessment of bias, results derived from research exhibiting considerable bias, a sensitivity analysis will be conducted, while primary research identified with high bias risk will be eliminated in the analysis while remaining attentive to subsequent conclusions.

Data Extraction Plan

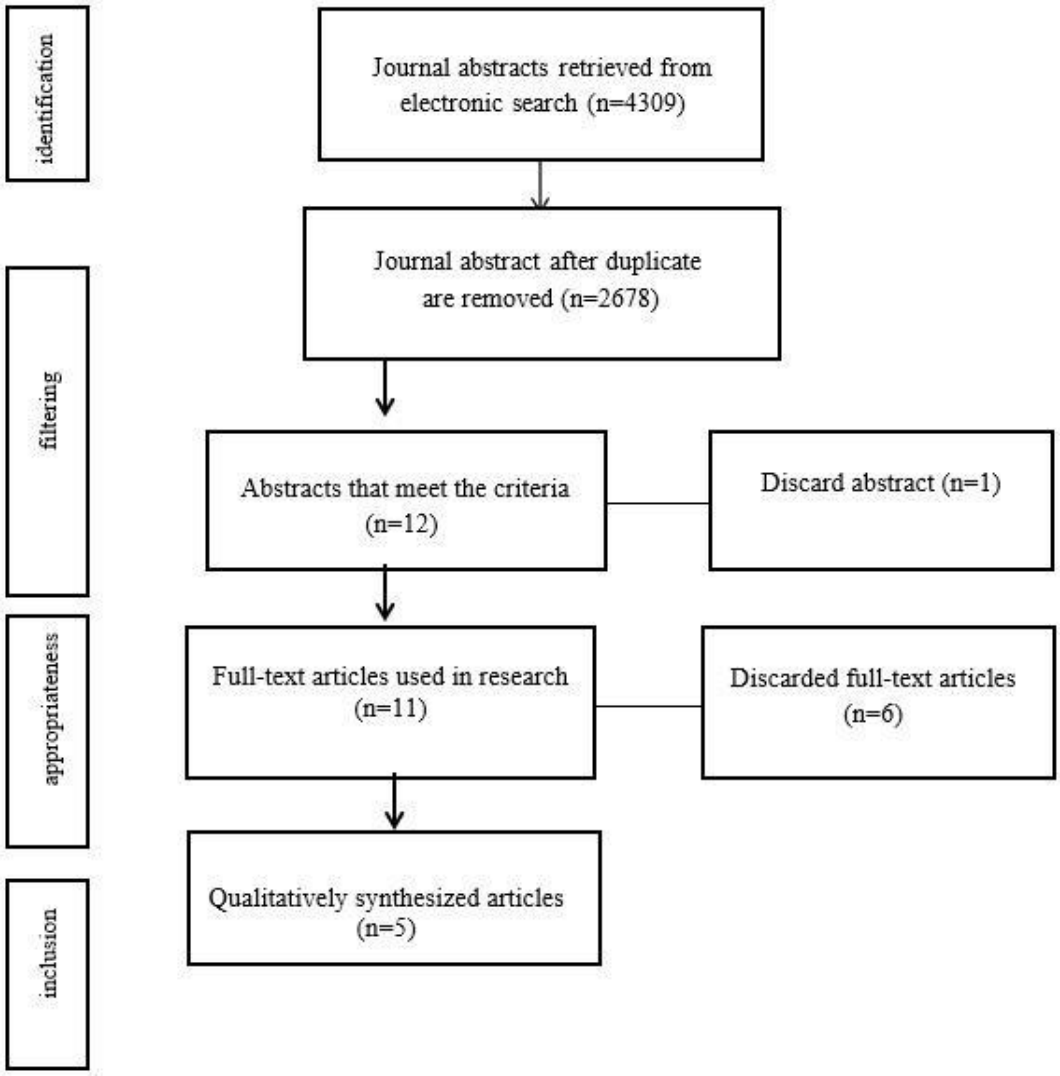
Data extraction plan using the form as attached in table 2.

Data Synthesis Plan

The acquired data will be qualitatively synthesized.

RESULT

The purpose of this systematic review was to investigate how periodontal therapy affected changes in HbA1c levels in people with type 1 diabetes patients with periodontitis adhering to the PRISMA guidelines within four journal databases, namely Google Scholar, PubMed, DOAJ and SciElo. The flow chart below displays the approach used for literature search.



By searching two journal databases, PubMed (n=439) and Google Scholar (n=3870), a total of 4309 journals were found. In the meantime, the researcher found nothing in the SciElo and DOAJ databases. By combining Keyword-Boolean Operators from the Intervention, Population, Comparison, and Outcome (PICO) inclusion criteria namely, (Type 1 Diabetes) AND (Non-surgical periodontal care OR Scaling and root planing OR Adjunctive therapy) AND (Blood sugar control OR Hemoglobin A1c OR HbA1c OR Blood glucose levels OR Glycemia) NOT (Type 2 Diabetes) journals were found through a database search. Then, the journals

containing duplication were reduced, so that 2687 journals were obtained. The journals are then selected according to the inclusion and exclusion criteria that have been determined. After the selection, the abstracts that met the criteria were 12 journals. For 1 journal, it was inaccessible, so the researchers discarded the journal and obtained 11 journals which would be selected full-text based on the exclusion amd inclusion criteria of T-PICOS.

Based on the Type of studies (T), there is 1 journal that is not a Randomized Controlled Trial (RCT) so that the remaining 10 journals are RCT research types. Then the researchers selected based on the population (P) obtained 4 journals that combined DM type-1 and type-2 in the research population so that the researchers discarded the journals and the remaining 6 journals. Based on intervention (I), outcome (O), and setting (S), the six journals met the specified inclusion and exclusion criteria. However, based on the comparison criteria (C) there was 1 journal that made non-DM patients and received delayed treatment in the control group so that the remaining journals to be synthesized qualitatively amounted to 5 journals.

Characteristics of Research Journals

Taking into account the publication years, there is one journal each from 1995, 2005, and 2008, with two journals from 2004.[15,16,17,18,19] The type of research obtained is a randomized controlled trial. Aldridge's (1995) study had the greatest number of research participants 64 patients with type-1 diabetes and periodontitis, in contrast, Lima's study (2004) had the fewest participants just 11 patients who were diagnosed with periodontitis and type-1 diabetes. The distribution of research participants between males and females in the three journals is equal.[16-19] The ratio of male to female subjects is not stated in one of the journals.[15] One journal has a higher ratio of female research subjects than males.[19] Research conducted in different countries, and there are no journals that make Indonesia a place of research. A clearer understanding of the research journals' general attributes can be obtained from Table 1.

Table 1. General Characteristics of Research Journals

Journal code	Number of subjects	Subjects Age	Research Place
Aldridge 1995	64	16-60 years old	Unit of Metabolic Medicine (UMDS) at London, UK
Llambes 2005	60 (50% man, 50% women)	19-61 years old	Universitas Dr. Peset Hospital at Valencia, Spanyol
Llambes 2008	60 (50% man, 50% woman)	19-61 years old	Universitas Dr. Peset Hospital at Valencia, Spanyol
Skaleric 2004	20 (50% man, 50% woman	26-58 years old	Diabetic Clinic of Universitas Ljubljana, Slovania
Lima 2004	11 (18% man, 82% woman)	35-55 years old	Brazil, USA

2 categories emerge from the literature bias analysis conducted in this systematic review, namely low bias and unclear bias. Based on an assessment of bias using the Cochrane Collaboration Tool, four kinds of literature are considered to have a low risk of bias[15,16,17,19], and one literature is considered to have an unclear risk of bias.[18] The literature is described as having good quality if it is assessed as low risk, in this systematic review as many as four of the five literature have low bias.

Data Extraction Result

Table 2. Data Extraction Results

Journal code	Number of subjects (patients)	Periodontitis Severity	Intervention and Comparison	Value of HbA1c (%) before (a) and post-treatment (b)		Periodontal parameter values before (a) and post-treatment (b)										Follow up
						PD (mm)		BOP (%)		PI (%)		CAL (mm)		GI (%)		
				a	b	a	b	a	b	a	b	a	b	a	b	
Aldridge 1995[15]	1st study: I: 16 C:15 2nd study: I: 12 C: 10	1st study: Gingivitis and *early* periodontitis 2nd study: Severe Periodontitis	I: SRP +OHI C: without periodontal treatment	1st study: 9.4±2 C:10.1±2 2nd study: I: 9.8±3 C: 9.7±2	1st study: I: 9.1±2 C:10.1±2 2nd study: 10.4±2 C: 9.5±2	1st study: I: 4.1±6 C:8.6±11 2nd study: I:3.7±0.7 C:3.6±0.6	1st study I: 3.1±3 C:7.5±12 2nd study I:2.9±0.4 C:3.5±0.6	1st study I:89.9±12 C:84.3±14 2nd study: I:90.4±45 C:79.1±29	1st study: I:94.8±10 C: 87.9±14 2nd study I: 19.2±13 C: 59.3±36							2 month
Llambes 2005[16]	I: 30 C: 30	Moderate to severe periodontitis	I: SRP+ doxycycline 100mg/day for 15 days C: SRP	HbA1c <7 I: 13 subjects C: 9 subjects HbA1c: 7-7.9 I: 5 subjects C: 10 subjects HbA1c: ≥8 I: 12 subjects C: 11 subjects	Not reported	I:3.43±0.64 C:3.35±0.66	I:2.69±0.32 C:2.70±0.41	I:65±17 C:66±17	I: 27±17 C:36±20	I:64±19 C:59±20	I: 21±17 C:21±13	I:2.94±1.31 C:2.65±1.25	I:2.49±0.86 C:2.23±1.19			3 month

Llambes 2008[17]	I: 30 C: 30	Moderate to severe periodontitis	I: SRP+ doxycycline 100mg/day for 15 days C: SRP	I:7.64± 1.81 C:7.51± 1.36	I:7.71± 1.7 C:7.45± 1.29	I: 3.43 C:3.35	Not reported	I: 65 C: 66	Not reported	I: 64 C: 59	Not reported	I: 2.94 C: 2.65	Not reported			3 month
Skaleric 2004[18]	I: 10 C: 10	Chronic periodontitis (severity not reported)	I: SRP+ 4 mg minocycline microsphere (Arestin) C:SRP	I:9.11± 0.93 C:9.49± 1.29	12 week I:8.48± 1.4 C:8.91± 1.24 24 week I:8.50± 0.6 C:8.53± 0.75	I:5.94±0. 67 C:6.10±0. 51	12 week I:3.51± 0.69 C:4.23± 0.94 24 week I:2.67± 0.42 C:3.92± 1.08			I:1.89± 0.45 C:2.10± 0.57	12 week I:1.00± 0.34 C:0.89± 0.41 24 week I:0.91± 0.38 C:0.87± 0.41	I:6.89± 1.36 C:7.70± 1.26	12 week I:4.55± 1.44 C:6.04± 1.32 24 week I: 3.80±1. 30 C:5.78± 1.38	I:2.09± 0.48 C:2.24± 0.40	12 week I:0.69± 0.37 C:0.84± 0.22 24 week I: 0.69±0. 37 C:0.84± 0.22	24 weeks
Lima 2004[19]	I: 11 C: 11	Severe periodontitis	I: SRP+doxycycline hyclate gel 10% C: SRP	Not reported	Not reported	I: 6.0±0.3 C: 5.8±0.3	6 week I:2.5±0. 2 C:3.3±0 .4 6 month I:2.1±0. 2 C:3.6±0 .4					I:7.2±0. 4 C:6.6±0 .5		6 week I:4.5±0. 2 C:5.1±0 .5 6 month I:4.1±0. 5 C:5.4±0 .6		12 month

	9 month I:2.0±0.2 C:3.8±0.4	9 month I:4.0±0.4 C:5.6±0.6
	12 month I:2.0±0.2 C:3.9±0.4	12 month I:4.0±0.4 C:5.7±0.5

Description:I=intervention; C=comparison; SRP=scaling root plan; OHI=oral hygiene instructions; PD=probing depth; BOP=bleeding on probing; CAL=clinical attachment loss; PI=plaque index; GI=gingival index;a=before treatment;b=after treatment

Table 2 reveal the value of HbA1c and the values of periodontal parameters before and after being given periodontal treatment. Changes in HbA1c values were the main outcome assessed in this systematic review. Three journals report changes in HbA1c values. Aldridge (1995) conducted two studies on his research. After 2 months, there were no differences between the groups in the first research, which demonstrated the Hawthorne effect in a control group.[20]

The Hawthorne effect is a non-specific effect caused by research subjects knowing that they are being studied or being watched so that research subjects modify their behavior, this effect can lead to results being biased in the study. In the first research, the test group's mean change in HbA1c following two months of periodontal treatment was -0.3%. The HbA1c levels in the control group remained unchanged both before and after receiving periodontal therapy. Owing to the Hawthorne effect in the initial investigation, Aldridge (1995) created a follow-up study. In this study, the test group's mean change in HbA1c following two months of periodontal treatment was 0.6%, while the control group's change was -0.2%.

However, this result is not statistically significant. Llambes (2008) revealed variations in HbA1c readings between the control group (without the addition of doxycycline) and the test group (30 patients given 100 mg of doxycycline once daily for 15 days). Following three months of treatment, the test group's mean HbA1c changed by 0.07%, whereas the control group's changed by -0.06%. These differences were not statistically significant.

Skaleric (2004) demonstrated that while Hb1Ac was decreased in both groups, there was little difference between the test and control groups. After 12 weeks of treatment, Table 10 demonstrates that the test group's mean HbA1c changed by -0.63% whereas the control group's changed by -0.58%. The test group's HbA1c score increased once again at week 24.

The secondary outcome in this systematic review was a change in periodontal indicators pre- and post-periodontal treatment through SRP, with or without adjunctive antimicrobial therapy. Changes in periodontal parameters were reported in four literatures which demonstrated a noteworthy rise in periodontal parameters among type-1 DM subjects after undergoing periodontal treatment.[20,21,22,23]

According to Llambes (2005), periodontal metrics significantly improved in both the test and control groups three months after periodontal therapy ($p<0.001$). Significant reductions were seen in PI, PPD, BOP, and CAL. Table 3 demonstrates that the inclusion of doxycycline resulted in a significant improvement in changes in periodontal markers in the SRP group. In contrast, the SRP group received 100 mg/day for 15 days without the addition of doxycycline.

According to the Lima (2004) study, the test group showed statistically significant variations only at the 12-month evaluation ($p<0.05$), with a greater reduction in PD and CAL increase noted across various time points compared to the control group. According to Table 3, there has been a greater average improvement in PD and CAL values at 12 months.

Specifically, PD values have improved by 1.9 mm and CAL values by 1.7 mm. These findings imply that subgingival delivery of an extra antimicrobial—10% doxycycline hyclade gel—produces additional positive clinical outcomes for the treatment of periodontal disease in people with type 1 diabetes. Skaleric (2004) comparable findings, showing that the test group (SRP) with the addition of 4 mg minocycline microspheres (Arestin) had a statistically significant improvement in periodontal measures compared to the control group ($p<0.001$).

According to Skaleric (2004), at 12 and 24 weeks, there were statistically significant variations in PD and CAL between the two groups. In the test group, the mean change in PD was 3.27 mm, whereas in the control group, it was 2.17 mm. The test group's mean CAL gain was 3.09mm, while the control group's was 1.92 mm.[71]

Table 2 also shows in the second study by Aldridge (1995) that all periodontal parameters experienced a significant improvement in the group that was given periodontal treatment rather than to the group that was not given treatment ($p<0.01$). The change in mean PD values after receiving periodontal treatment in the test group was 71.2% and 19.8% in the control group.

Discussion

This systematic review, one of the five pieces of the literature shows that periodontal treatment in the form of SRP is given to patients with type 1 DM has

the benefit of improving periodontal parameters when compared to no periodontal treatment. Although there was no significant improvement in glycemic control.[20] Many studies have reported the benefit of adding antimicrobials as adjunctive therapy to SRP, both systemic and local administration has been reported to reduce bacteria in the periodontium.

Four of the five kinds of literature provided added antimicrobials to the test group. and without the addition of antimicrobials in the control group. Research Llambes (2005) and Llambes (2008) provide interventions in the form of SRP with the addition of systemic antimicrobials such as 100 mg of doxycycline once daily for 15 days**.**[16.17] The Skaleric (2004) and Lima (2004) studies provide interventions local addition of antimicrobials.

Scaleric (2004) provides a scaling intervention and root planning with the addition of an antimicrobial in the form of 4 mg of minocycline microspheres (Arestin) which was given locally in a pocket 5 mm and Lima (2004) who gave an antimicrobial in the form of 10% doxycycline hyclate gel which was administered subgingival to assist in the treatment of SRP.[18,19] The findings from all four journals indicated a notable enhancement in periodontal parameters within the group with additional antimicrobials compared to the SRP group by itself. This harmonizes with the research of Mubarak et.al who also reported that SRP with additional antimicrobials improved periodontal parameters significantly compared to SRP treatment alone in diabetic patients.[24] The outcomes of prior studies with the subject of type-1 diabetes were shown by Miller et.al with the addition of the antimicrobial doxycycline on scaling and root planning was more beneficial than the control group.

According to Iwamoto, Grossi, and Shabeer, doxycycline has good anti-collagenase, anti-inflammatory, bone resorption inhibitory effects and has an HbA1c-lowering effect in DM patients. Although in this systematic review there were no reports of a significant decrease in HbA1c. Shabeer's (2014) study further stated that 10% dosiclin cyclase gel has a broad spectrum, is bacteriostatic, has low systemic toxicity, can maintain maximum concentrations in the pocket, and is clinically and microbiologically beneficial when used as an adjunct to SRP in healing. pockets with a depth of 6 to 7 mm.[25]

Likewise, minocycline microspheres are reported to be effective improve

clinical improvement and reduce the need for surgery when used as adjunctive therapy to SRP.

Glycated hemoglobin (HbA1c) has a lifespan that follows the age of erythrocytes which is about 100–120 days so that the average blood glucose level throughout the previous two to three months is reflected in the HbA1c.[17] Skaleric (2004) had a varied follow-up, ie at 6, 12, 18, 24 weeks. In this study, the decrease in mean HbA1c was most evident at week 12 (3 months).[18] In the three-month follow-up period of the Llambes (2005) and Llambes (2008) investigations, there was no discernible change in the participants' HbA1c readings. Llambes (2008), while in Llambes (2004), changes in HbA1c values were not reported.[16,17]

The outcomes of this systematic review are similar to those of Medianos et al. (2018) who reported follow-up was carried out at 3 months following periodontal care but there was no evidence of a notable improvement in glucose regulation reported in individuals with type-1 DM. Meanwhile, Aldridge's study (1995) which followed up patients 2 months after treatment also had similar results, that is, people with type 1 diabetes did not significantly improve their glycemic control. at 6 weeks, 6, 9, 12 months, but this research did not report HbA1c values.

Four of the five kinds of literature have predominantly of patients with inadequately managed diabetes. Aldridge (1995) had type 1 DM individuals with HbA1c levels of 8%. The high HbA1c levels indicated that the study participants had uncontrolled diabetes and were at risk for complications. In addition, periodontitis studied in most of the literature is severe periodontitis,[15,19] moderate to severe periodontitis[16,17], and one literature does not mention the severity of periodontitis studied.[18]

The severity of this periodontitis may be related to diabetes control in study participants because diabetic individuals with poor glycemic control developed periodontal destruction wider range than patients with good glycemic control.[3] The gingiva experienced oxidative stress due to inadequate glycemic management and increased development of advanced glycation end products, which exacerbated periodontal tissue destruction.[26] Similar to the Seppala research (1994), which shown that those with uncontrolled type-1 diabetes experienced considerably higher rates of bone loss and attachment loss than those with well-controlled type-1 DM.[27]

Hartanti (2018) citing the research results of Christgau (1998) claims that if a patient has poor glycemic control (high Hb1Ac levels), periodontal therapy will not affect their glycemic control.[26,28] In this systematic review, high Hb1Ac levels were found. (≥8%) in almost all research results. Furthermore, Christgau's (1998) DM patients with adequate glycemic control can react to periodontal therapy similarly to people without diabetes, according to a study. poor healing.

Moreover, supplementary factors like smoking or poor plaque control may affect the response to periodontal treatment in diabetic individuals.[3] In this systematic review, there are three literatures that report smoking habits in research subjects.[16-18] Llambes (2005) and Llambes (2008) reported that there were 38 study subjects who did not smoke and 22 subjects who had a smoking habit with 11 of them smoking <15 cigarettes/day and 11 of them being heavy smokers who smoked 15 cigarettes/day. [16-17] Skaleric (2004) revealed that there were three participants in the control group and seven smokers in the test group.[18]

The findings of this systematic review indicated that in people with type 1 diabetes who had periodontitis, periodontal treatment in the form of SRP, with or without additional antimicrobials, did not significantly affect glycemic control. Additionally, the secondary finding of this systematic review was that periodontal treatment in conjunction with antimicrobials produced additional positive clinical outcomes on enhancing periodontal parameters in type-1 DM patients, but there was no benefit in improving glycemic control.

These results also align with a previous study performed by Smith et.al that showed after periodontal treatment there was an improvement in periodontal status but no enhancement in glucose regulation in people with type 1 diabetes.[29] It was hypothesized that poor glycemic control and smoking habits would occur. This explains why, in this systematic study, periodontal therapy had no discernible impact in enhancing glycemic control.

The findings of this systematic analysis validate the hypothesis proposed by Newman et al. in their book, according to which periodontal therapy has a less significant impact on glycemic control in patients with type-1 diabetes than in those with type-2 diabetes. In patients with type 2 diabetes and type 2 with periodontitis, periodontal therapy significantly improved glycemic control;

however, this effect did not extend to individuals with type 1 diabetes, despite both groups seeing improved periodontal health.

This discrepancy stems from variations in the glycemic response to periodontal treatment across the groups. Individuals with type-1 and type-2 DM exhibit differences in insulin dynamics: while type-1 diabetes is marked by inadequate insulin levels, type-2 diabetes entails insulin resistance. Consequently, periodontal interventions that mitigate systemic inflammation may enhance insulin sensitivity and consequently ameliorate glycemic management in individuals with type 2 diabetes. Conversely, type 1 DM is not significantly linked to insulin resistance. Hence, the reduction of inflammation post periodontal treatment might not substantially impact insulin sensitivity, therefore reducing the impact of periodontal therapy on patients with type 1 diabetes' ability to control their blood sugar levels.

Furthermore, it should also be noted that diabetic patients experience dysfunction in the immune response. Several analyses have confirmed that diabetic patients have decreased chemotaxis function and phagocytosis by PMN and macrophages. According to Delammaire's study, PMN chemotaxis was observed to be notably decreased in diabetic individuals than in non-diabetic one.[30] Furthermore, according to Balasoiu, the average HbA1c concentration was higher High levels of diabetes were found in diabetic patients with impaired phagocytosis, indicating that patients with poor DM management (high HbA1c) lead to decreased phagocytic function.

One essential stage in the pathophysiology of infection is the adherence of bacteria to mucosal or epithelial cells. Factors that can increase this attachment are poor glycemic levels, regular daily cigarette consumption and carbohydrate composition of receptors that may serve a vital purpose in susceptibility to infection.[31] In this systematic review, there were research subjects with high baseline HbA1c levels, and some subjects were reported to be heavy smokers, this is thought to affect the attachment of microorganisms to become more virulent coupled with the disruption of chemotaxis and phagocytosis by PMN causing microbes, viruses, or germs to be difficult. destroyed in DM patients so that this may be a reason good glycemic control is difficult to achieve in this systematic review study.

Another weakness of this systematic review is that the amount of literature analyzed is small, which is only five journals so that the research population obtained is still small with the total number of participants in this systematic review being 155 patients. Because type 1 diabetes affects only 5% of the diabetes population, this is possible, so research with type 1 DM subjects is still rarely done.

In addition, due to this reason, researchers also experienced limitations in searching the literature. In addition, the advantage of this systematic review is that it has good quality literature with four out of five journals having a low risk of bias.[15,16,17,19] Only one journal has an unclear risk of bias. Skaleric (2004) has an unclear bias due to the lack of explanations available in journals regarding masking/blinding subjects, operators, and raters, lack of explanation of missing subjects at follow-up, and baselinehomogeneity.[18]

CONCLUSION

Based on the literature analysis that has been done,This systematic review shows that:

1. In individuals with type 1 diabetes mellitus who also had periodontitis, periodontal therapy (SRP with or without supplementary antimicrobial) or no periodontal treatment at all did not significantly affect improvements in glycemic control.
2. When it comes to enhancing periodontal parameters in type 1 DM patients with periodontitis, periodontal treatment in the form of SRP combined with extra antimicrobials is more advantageous than periodontal treatment alone.

REFERENCES

1. Susanto A, Dyah N, Amaliyah A, Indra M. Periodontal Health Status and Treatment Needs of The Community in Indonesia: A cross sectional study. *J Int Oral Heal*. 2020;12(2):114-119.
2. Ireland R. *Kamus Kedokteran Gigi*. EGC; 2014.
3. Corlan D. Periodontal Disease and Diabetic Patients - Clinical and

Histopathological Aspects. *Rom J Morphol Embryol*. 2016;57(4):1323-1329.

4. Ministry of Health Republic of Indonesia. Indonesia Health Profile 2018: The Prevalence of Diabetes Mellitus in Indonesia. Published online 2020. www.depkes.go.id
5. Sanz M. Scientific evidence on the links between periodontal diseases and diabetes: Consensus report and guidelines of the joint workshop on periodontal diseases and diabetes by the International Diabetes Federation and the European Federation of Periodontology. 2018;45:138-149.
6. Goldberg M. Type 1 and 2 diabetes mellitus and oral health. *J Biomed Allied Res*. 2019;1(2):1-4.
7. Dicembrini I, Serni L, Monami M, et al. Type 1 diabetes and periodontitis: prevalence and periodontal destruction—a systematic review. *Acta Diabetol*. 2020;57(12):1405-1412. doi:10.1007/s00592-020-01531-7
8. Chapple I. Working Group 2 of Joint EFP/AAP Workshop. Diabetes and Periodontal Disease: Consesus Report of The Joint EFP/AAP Workshop on Periodontitis and Systemic Disease. *J Periodontol*. 2013;84:106-112.
9. Dina G. Periodontitis and Glycemic Control in Diabetes: NHANES 2009 to 2012. *J Periodontol*. 2015;86(4):499-506.
10. Graziani F, Gennai S, Solini A, Petrini M. A systematic review and meta-analysis of epidemiologic observational evidence on the effect of periodontitis on diabetes An update of the EFP-AAP review. *J Clin Periodontol*. 2018;45(2):167-187. doi:10.1111/jcpe.12837
11. Graziani F, Karapetsa D, Alonso B, Herrera D. Nonsurgical and surgical treatment of periodontitis: how many options for one disease? *Periodontol 2000*. 2017;75(1):152-188. doi:10.1111/prd.12201
12. Meenawat A, Punn K, Srivastava V, Meenawat AS, Dolas RS, Govila V. Periodontal disease and type i diabetes mellitus: Associations with glycemic control and complications. *J Indian Soc Periodontol*. 2013;17(5):597-600. doi:10.4103/0972-124X.119286
13. Deo, Vikas, Satish Gupta ML. Evaluation of Subantimicrobial Dose Doxycycline as an Adjunct to Scaling and Root Planing in Chronic

Periodontitis Patients with Diabetes:A Randomized, Placebo-Controlled Clinical Trial. *J Contemp Dent Pract*. 2010;11(3):1-7.

14. Baeza M, Morales A, Cisterna C, Cavalla F, Jara G IY. Effect of Periodontal Treatment in Patients with Periodontitis and Diabetes: Systematic Review and Meta-analysis. *J Appl Oral Sci*. 2020;28.
15. Aldridge JP, Lester V, Watts TLP, Collins A, Viberti G, Wilson RF. Single-blind studies of the effects of improved periodontal health on metabolic control in Type 1 diabetes mellitus. *J Clin Periodontol*. 1995;22(4):271-275. doi:10.1111/j.1600-051X.1995.tb00147.x
16. Llambés F, Silvestre F, Hernández-Mijares A, Guiha R, Caffesse R. Effect of non-surgical periodontal treatment with or without doxycycline on the periodontium of type 1 diabetic patients. *J Clin Periodontol*. 2005;32(8):915-920.
17. Llambés F, Silvestre F-J, Hernández-Mijares A, Guiha R, Caffesse R. The effect of periodontal treatment on metabolic control of type 1 diabetes mellitus. *Clin Oral Investig*. 2008;12(4):337.
18. Skaleric U, Schara R, Medvescek M, Hanlon A, Doherty F LJ. Periodontal treatment by Arestin and its effects on glycemic control in type 1 diabetes patients. *J Int Acad Periodontol*. 2004;6(4).
19. Martorelli de Lima AF, Cury CC, Palioto DB, Duro AM, Silva RC da, Wolff LF. Therapy with adjunctive doxycycline local delivery in patients with type 1 diabetes mellitus and periodontitis. *J Clin Periodontol*. 2004;31(8):648-653.
20. Wahab Z, Novitasari A, W NF. Profil Lipid sebagai Kontrol Glikemik pada Pasien Diabetes Mellitus Tipe II. *J Kedokt Muhammadiyah*. 2015;4(0):1-10. https://jurnal.unimus.ac.id/index.php/kedokteran/article/view/2569/2419
21. Beck RW, Riddlesworth T, Ruedy K, et al. Effect of continuous glucose monitoring on glycemic control in adults with type 1 diabetes using insulin injections the diamond randomized clinical trial. *JAMA - J Am Med Assoc*. 2017;317(4):371-378. doi:10.1001/jama.2016.19975
22. Rossetti P, Pampanelli S, Fanelli C, et al. Intensive Replacement of Basal Insulin in Patients With Type 1 Diabetes Given Rapid-Acting Insulin

Analog at Mealtime. *Diabetes Care*. 2003;26(5)(5):1490-1496.

23. Bohn B, Herbst A, Pfeifer M, et al. Impact of physical activity on glycemic control and prevalence of cardiovascular risk factors in adults with type 1 diabetes: A cross-sectional multicenter study of 18,028 patients. *Diabetes Care*. 2015;38(8):1536-1543. doi:10.2337/dc15-0030
24. Al Mubarak S, Abou Rass M, Alsuwyed A, et al. A new paradigm between mechanical scaling and root planing combined with adjunctive chemotherapy for glycated hemoglobin improvement in diabetics. *Int J Diabetes Mellit*. 2010;2(3):158-164.
25. Ahamed S, Jalaluddin M, Khalid I, Moon N, Shaf TK, Ali FM. The use of controlled release locally delivered 10% doxycycline hyclate gel as an adjunct to scaling and root planing in the treatment of chronic periodontitis: clinical and microbiological results. *J Contemp Dent Pract*. 2013;14(6):1080-1086. doi:10.5005/jp-journals-10024-1455
26. Hartanti. Efek kontrol glikemik terhadap penyakit periodontal penderita diabetes mellitus. *Idj*. 2013;2(2):98.
27. Seppälä B, Ainamo J. A site-by-site follow-up study on the effect of controlled versus poorly controlled insulin-dependent diabetes mellitus. *J Clin Periodontol*. 1994;21(3):161-165. doi:10.1111/j.1600-051x.1994.tb00297.x
28. Christgau M, Palitzsch KD, Schmalz G, Kreiner U, Frenzel S. Healing response to non-surgical periodontal therapy in patients with diabetes mellitus: Clinical, microbiological, and immunologic results. *J Clin Periodontol*. 1998;25(2):112-124. doi:10.1111/j.1600-051X.1998.tb02417.x
29. Smith GT, Greenbaum CJ, Johnson BD, Persson GR. Short-term responses to periodontal therapy in insulin-dependent diabetic patients. *J Periodontol*. 1996;67(8):794-802. doi:10.1902/jop.1996.67.8.794
30. Delamaire M, Maugendre D, Moreno M, Le Goff MC, Allannic H, Genetet B. Impaired leucocyte functions in diabetic patients. *Diabet Med*. 1997;14(1):29-34. doi:10.1002/(SICI)1096-9136(199701)14:1<29::AID-DIA300>3.0.CO;2-V

31. Balasoiu D, van Kessel KC, van Kats-Renaud HJ, Collet TJ, Hoepelman AI. Granulocyte function in women with diabetes and asymptomatic bacteriuria. *Diabetes Care*. 1997;20(3):392-395. doi:10.2337/diacare.20.3.392