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Research Article

The Effect of Periodontal Treatment on HbA1c Levels in Diabetic Patients - A Systematic Review

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Abstract

Background: With regard to the clinical relationship between periodontal diseases and the metabolic control of diabetic patients; we must understand that periodontal treatment is an additional modality of the pharmacotherapy and lifestyle change that the diabetic patients go through. To assess the clinical significance of periodontal therapy on the metabolic control of glucose levels, the glycated hemoglobin (HbA1c) levels are used to compare the periodontal therapy's effect to the effect of additional pharmacological drugs.

Methods: A review of the literature was carried out in a review of the most important points of other systematic reviews using the preferring reporting items for systematic reviews and meta-analysis (PRISMA). For recent studies, five search engines were utilized up to the year 2019. The inclusion criteria were patients with type 1 or type 2 diabetes mellitus diagnosed with periodontal disease, regardless of classification, periodontal treatment with or without using any medical interventions and studies with changes in glycated hemoglobin (HbA1c).

Results: A total of 10 studies were identified for inclusion in this review. The search of PubMed databases provided a total of 58 articles. Web of Science provided a total of 259 articles. Trip Medical Database provided a total of 72. Cochrane library search provided 70 articles. Centre for Reviews and Dissemination Database provided 16. Of these 475 articles, 79 were duplicates, making a total of 379 articles. 359 articles were excluded after reading the title and abstracts, as these papers did not meet the inclusion criteria. The full texts of the remaining 20 articles were reviewed and only 10 articles agreed with all-inclusive eligibility criteria for this study.

Conclusion: Patients suffering from periodontal diseases are also prone to complications from diabetes mellitus as it has been shown that not only that diabetes mellitus is a risk factor for periodontal diseases, but that periodontal diseases, in turn, could affect the control of blood glucose levels. There is a markedly significant effect of periodontal treatment on the improvement of HbA1c percentages in diabetic patients, though the effect size is very small.

Keywords: *Non-Surgical Periodontal Treatment; Diabetic Patient; Periodontal Disease; Gingivitis; Blood Glucose Level; HbA1c; A Systematic Review*

Introduction

Diabetes mellitus is a disease that affects large organs of the body in the absence of control levels in natural borders [1]. And when there's a lack of salivary secretions the individual may suffer from tooth decay and gingivitis, and the diabetes mellitus may have an effect on the progression of the gingival disease, especially having some looseness of the front teeth, indicating the impact on the tissues supporting the teeth. Many studies have shown that gingivitis is more common in people with type 1 diabetes mellitus compared with

non-diabetic patients with the same level of bacterial plaque on teeth. People with type 2 diabetes mellitus also had more serious gingivitis than people without it [2]. A recent clinical study has shown that older patients with type 1 diabetes have more serious forms of periodontal disease compared to a control group consisting of healthy individuals, although the bacterial plaque layer was found to be similar in quality and quantity in both groups [3]. And a two-year study found that people with type 2 diabetes mellitus also suffer from chronic periodontal disease and that the risk of developing diabetes mellitus in the patients suffering from a chronic periodontal disease is six times greater than those who do not have any periodontal condition [4]. Periodontal disease may affect the balance of metabolic control of glucose levels in the blood [5,6].

With regard to the clinical relationship between periodontal diseases and the metabolic control of diabetic patients; we must understand that periodontal treatment is an additional modality of the pharmacotherapy and lifestyle change that the diabetic patients go through [7]. About 50% of all type 2 diabetic patients are using anti-diabetic drugs and Metformin to achieve metabolic control of their glucose levels. With Metformin drug often being prescribed as the first option in the treatment of type 2 diabetes mellitus [8].

To assess the clinical significance of periodontal therapy on the metabolic control of glucose levels, the glycated hemoglobin (HbA1c) levels are used to compare the periodontal therapy's effect to the effect of additional pharmacological drugs. Thus, if periodontal scaling and root surface debridement can improve metabolic control by 0.4 to 0.5% in regard to the HbA1c levels, then its effect can be compared to the effect of additional pharmacotherapy and therefore may find its place in the treatment of diabetes mellitus [9]. Future studies should include patients with different ways of treating diabetes to see if the periodontal treatment works equally well for all diabetic patients regardless of the drugs used or if better results maybe are achieved when combined to other treatment modalities in regard to glucose reduction interventions [5].

Periodontal disease in people with diabetes is a serious disease [10], because it may increase the resistance to insulin, which may cause a deterioration in the level of control of the concentration of glucose in the blood [6]. It is known that bacterial or viral infection increases the resistance of cells to insulin [11], making it difficult to maintain a normal blood glucose level [5]. Therefore, repeated periodontal treatments help reduce insulin resistance [12]. Thus creating a synergistic effect between diabetes mellitus and periodontal diseases, as it has been stated that controlling blood glucose levels more effectively in diabetic patients reduces the severity of the periodontal disease [13].

Many studies indicated great importance of treating periodontal disease in diabetic patients [14], clarifying the idea that periodontal treatment is an additional treatment for diabetic patients to improve their overall health and metabolic control. It is essential not to focus only on assessing clinical trials but also in evaluating various reviews that have addressed the idea in a comprehensive and clear manner as well [15]. Further efforts are needed to provide an overview and compare the incidence of periodontal disease in diabetic patients and the effects of its resolution in metabolic control in a single sheet of paper [16].

Aims of the Study

An overview of the effects of periodontal treatment on diabetes mellitus outcomes and the evidence on which these effects are based on is clearly and explicitly supported by results. And to assess the methodological quality of the HbA1c percentage as an evaluation method of treatment.

Methodology

The current systematic review of literature is carried out in a review of the most important points of other systematic reviews using the preferring reporting items for systematic reviews and meta-analysis (PRISMA). For recent studies, five search engines were utilized up to the year 2019.

The inclusion criteria for considering studies for this review

The collected records are consistent with clinical trial information that focuses on patients with diabetes mellitus and periodontal diseases. Five databases were searched using a specific set of search terms in English, depending on the research of databases or dealing with basic terms or basic models that included diabetes, and review the different methodologies and meta-analysis using a set of conditions; a group of reviews was selected manually.

1. Patients with type 1 or type 2 diabetes mellitus diagnosed with periodontal disease, regardless of classification.
2. Periodontal treatment with or without using any medical interventions.
3. Changes in glycated hemoglobin (HbA1c).

The exclusion criteria for considering studies for this review

If the study didn't meet any of the following criteria it was excluded.

1. If there is a special presentation of the indicators of results for the work of comparison and knowledge of the study groups.
2. If there are any errors in the copies between the indicators presented in the review and the history of the disease.
3. If the outcome indicators illustrative of HbA1c improvement comparisons between therapeutic intervention percentage and control groups.
4. If the study had been able to provide the results of heterogeneity analysis.

Searching method for identifying the studies using the search engines in the designated databases

Five databases were searched (From 1966 to March 2019):

1. MEDLINE (PubMed).
2. Web of Science.
3. Cochrane Database of Systematic Reviews.
4. Trip Medical Database.
5. Centre for Reviews and Dissemination Database.

We have combined the search terms and limited the study to the English language. The specific search strategies differed based on using the designated databases, key terms or basic terms and systematic review including meta-analysis, using identical search criteria and conditions. The terms used were periodontal disease, periodontitis or gingivitis, diabetes, diabetes mellitus, diabetic patient, periodontal treatment, periodontal disease, and systematic review. In addition, a manual search of references from the original researches and also the review articles was conducted.

Data extraction

Data were extracted independently. Titles of articles relevant to the review were selected by discussion. Four hundred and seventy-five articles were identified from Five databases. Abstracts and full texts of the articles were reviewed independently. After reviewing the articles and applying the criteria for inclusions and exclusion, ten articles were selected.

Results

A total of 10 studies were identified for inclusion in this review. The search of PubMed databases provided a total of 58 articles. Web of Science provided a total of 259 articles. Trip Medical Database provided a total of 72. Cochrane library search provided 70 articles. Centre for Reviews and Dissemination (CRD) Database provided 16. Of these 475 articles, 96 were duplicates, making the total of 379 articles. 359 articles were excluded after reading the title and abstracts, as these papers did not meet the inclusion criteria. The full texts of the remaining 20 articles were reviewed and only 10 articles agreed with all-inclusive eligibility criteria for this study. The following flow chart illustrates the complete data collection process (Figure 1).

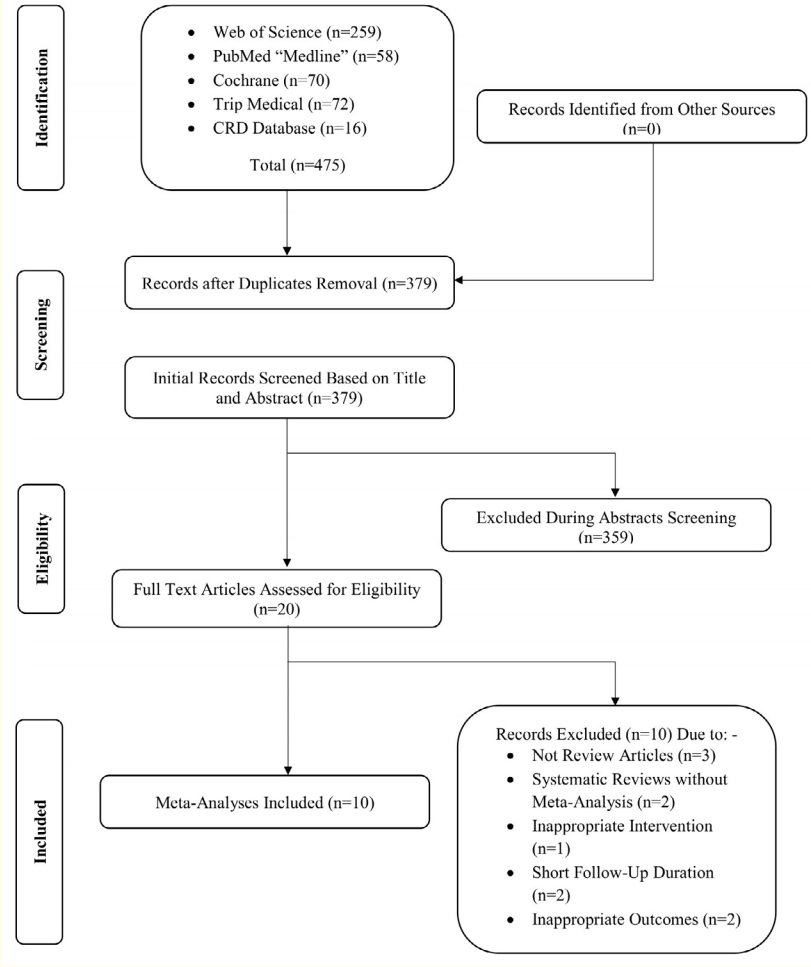

Figure 1: *Flow diagram of the articles' selection process by PRISMA.*

The study by Engebretson S and T Kocher performed a comparative meta-analysis, and after reviewing, testing and judging, the index was presented as a hemoglobin-compliant guide that can be measured clearly after follow-up and control [4].

Although in some other cases, it was highlighted that the HbA1c can be used as significant factor indicator in improving the patient's condition between the study groups as in the Simpson TC., *et al.* meta-analysis [14]. It was noted that recovery was recalculated in HbA1c in both groups and random effects model, and it revealed a 95% confidence interval (ratio through a calculated range of significant difference counts between the two groups) [17].

Hasuike A., *et al.* [18] made a systematic review and assessment of periodontal treatment on diabetic patients health, the review included 9 studies and reported that periodontal therapy for diabetic patients is one of the most important and effective things that can help diabetic patients maintain their comfort and safety.

Three Systematic review studies were included through a combination of randomized trials and some controlled clinical trials [5,16,18]. And there were several Systematic reviews in which a set of analyses were conducted focusing on sample size, follow-up period, or some risk of bias, and the use of antibiotics [15].

A general overview of the comparative analysis of the included reviewed is summarized in table 1. And the interpretation of the reviewed articles is summarized in table 2. The follow-up periods after the treatment in the various reviews varied from 3 months to 9 months to other various periods. The review of the articles including the type of study, treatment modality, follow-up period and assessments is summarized in table 3.

Author Year	Quan., et al. 2015	Sun Q.Y et al. 2014	Wang X., et al. 2014	Corbella S., et al. 2013	Engebretson S., et al. 2013	Liew A.K., et al. 2013	Sgolastra F., et al. 2013	Simpson T.C., et al. 2010	Teeuw W.J., et al. 2010	Hasuik A., et al. 2017
Are outcome indexes presented as comparisons of HbA1c percentage improvements between the intervention and the control groups	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes
Is there any obvious transcription error between index presented in meta-analysis and original trials?	No	N/A	No	N/A	No	N/A	No	No	No	No
Is random effects model used for combining dates in the meta-analysis?	Yes	N/A	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes
Are results of heterogeneity analysis presented?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 1: *Results of comparability assessment of included reviews.*

No.	Author Year	Interpretation of results
1	Sun QY., *et al*. 2014	Outcome indexes presented as comparisons of HbA1c percentages improvement between the intervention and the control groups.
2	Corbella S., *et al*. 2013	Heterogeneity was analyzed. Outcome indexes presented as comparisons of HbA1c percentage improvement between the intervention and the control group.
3	Liew AK., *et al*. 2013	Included studies were assessed using a standardized form described by the Cochrane group. Results of assessment, however, were not revealed.
4	Engebretson S., *et al*. 2013	Nine of thirteen randomized clinical trials were categorized into Low risk of bias groups, whereas the remaining four were at a Moderate risk of bias.
5	Wang X., *et al*. 2014	Outcome indexes presented as comparisons of HbA1c percentage improvement between the intervention and the control groups. There aren't any obvious transcription errors between indexes presented in the meta-analysis and original trials.
6	Quan Li., *et al*. 2015	Their analysis suggested that sub-group analysis of small randomized clinical trials (n < 8 0) showed a greater effect, and smaller heterogeneity than did largely sample size trials.
7	Simpson TC., *et al*. 2010	Results of the study varied in terms of quality and were inadequate in different studies. Thus, it was concluded that the results were not sufficient.
8	Sgolastra F., *et al*. 2013	Results of the study varied in terms of quality and were inadequate in many ways. Only three were considered to be at high risk.
9	Teeuw WJ., *et al*. 2010	Two of five studies were categorized into "doubtful quality", and others were "good quality".
10	Hasuike A., *et al*. 2017	Results of the study based on 5 of the 9 reviewed studies pointed towards an improvement of HbA1c between the intervention and control groups.

Table 2: *Interpretation of results.*

No.	Author Year	Definition of Participants	Periodontal Treatment	Follow-up	Studies Design	Assessment of RoB* Across Studies	Assessment of RoB* Within the Study
1	Sun QY., *et al*. 2014	Diabetics with periodontal disease	With or without adjunctive Antimicrobial therapy	3 Months	Controlled Clinical Trials	Quality of the included studies were done using standardized form	Heterogeneity was analyzed
2	Corbella S *et al*. 2013	Diabetics with periodontal disease	Non-surgical treatment only or with the use of local drugs and systemic antibiotics	3 Months	Randomized Controlled Trials	9 of 13 studies were customized into low-risk group and 4 into moderate risk	The publication was not assessed, but heterogeneity was analyzed
3	Liew AK *et al*. 2013	Youth at the age of 16 diabetics with periodontal disease	Non-surgical treatment only or with the use of local drugs and systemic antibiotics	3 Months	Randomized Controlled Trials	The studies varied in terms of quality and were inadequate in many ways	It was analyzed using Begg's test. Heterogeneity was analyzed
4	Engebretson S., *et al*. 2013	Youth at the age of 18 with type 1 or 2 diabetics who have periodontal disease	Surgical and nonsurgical therapy	3 Months	Randomized Controlled Trials	The studies varied in terms of quality and were inadequate, the results were not retrieved	It was analyzed using funnel plots. Heterogeneity was analyzed.

5	Wang X., *et al*. 2014	Youth at the age of 18 with type 1 or 2 diabetics who have periodontal disease	Non-surgical treatment only or with the use of local drugs and systemic antibiotics	3 Months	Randomized Controlled Trials	The studies varied in terms of quality and were inadequate in different studies	The publication was not assessed, but heterogeneity was analyzed using funnel plots
6	Quan Li., *et al*. 2015	Type 2 diabetics with periodontal disease	Nonsurgical treatment or only using antibiotics	3 Months	Randomized Controlled Trials	The studies varied in terms of quality and were inadequate in different studies, the results were not ideal	It was analyzed using Begg's test. Heterogeneity was analyzed
7	Simpson TC., *et al*. 2010	Over 16 years of age with type 1 and 2 diabetics with periodontal disease	Any periodontal treatment on diabetic patient care was assessed	9 Months	Randomized Controlled Trials	The studies varied in terms of quality and were inadequate in different studies, the results were not sufficient	The publication was not assessed due to the lack of studies
8	Sgolastra F., *et al*. 2013	Over 18 age with type 1 and 2 diabetics with periodontal disease	Nonsurgical periodontal treatment	3 Months	Randomized Controlled Trials	The studies varied in terms of quality and were inadequate in many ways, only 3 were at high risk	Publication bias was assessed by using funnel plots, asymmetry ties heterogeneity was analyzed
9	Teeuw WJ *et al*. 2010	Diabetics with periodontal disease	Any kind of periodontal treatment	3 Months	Randomized Controlled Trials and Controlled Clinical Trials	2 of 5 studies were categorized into "doubtful quality" and others were "good quality"	The publication was not assessed, but heterogeneity was analyzed
10	Hasuike A., *et al*. 2017	Systematic review and assessment of systematic reviews examining the effect of periodontal treatment on diabetic patients	Any kind of periodontal treatment	Various Months	Randomized Controlled Trials	Testing using the telephone analysis was done in 9 studies	Heterogeneity was analyzed, and periodontal treatment on the improvement of HbA1c was explained

Table 3: *General characteristics of included reviews.*

** Risk of bias.*

Discussion

Systematic reviews offer comprehensive evidence to see the effect of gingivitis on diabetes when it comes to the magnitude of the effect and the accuracy of the evidence. We can conclude that there is an indication of the effect of the inability to treat gums on improvement [5]. HbA1c can be used to evaluate the effect of periodontal treatment in diabetic patients, but the effect size is very small. In addition to this small impact size, the supporting evidence can't be considered as high quality. These facts must be well known to health care workers and patients [14].

One of the desirable characteristics of a high-quality system that was studied by this review is for it to be good in identifying and evaluating the effect of the treatment. In addition, a high-quality review system can offer great advantages for regular updating and studies [6].

The GRADE approach is one of the most distinctive methods of assessing evidence, especially in the field of systematic reviews [5,17] and the periodic treatment guide on a diabetic patient. This approach has been adopted by many communities and studies in health care. This approach was only used for the Simpson, TC., *et al.* meta-analysis [14] to confirm the quality of evidence among the studies listed.

Sun QY., *et al.* studied diabetic patients with periodontal disease with or without adjunctive antimicrobial therapy. For 3 months, the quality of the included clinical controlled trials quality was done using a standardized form. Heterogeneity was analyzed [5].

Corbella S., *et al.* studied diabetic patients with non-surgical periodontal treatment only with the use of the local drug and systemic antibiotic for 3 months, nine of the thirteen randomized clinical trials were customized into a low-risk group. The publication was not assessed, but heterogeneity was analyzed [13].

Liew AK., *et al.* dealt with youth at the age of 16 years old with non-surgical periodontal treatment only with the use of the local drug and systemic antibiotics, antibiotics were used for 3 months through the randomized clinical trials. The studies varied in terms of quality and were inadequate in many ways. The review ssed Begg's test and heterogeneity was analyzed [6].

Engebretson S., *et al.* dealt with youth at the age of 18 years old with type 1 and 2 diabetic patients who have periodontal diseases. Surgical and nonsurgical treatments with a follow-up of 3 months on randomized clinical trials. The studies varied in terms of quality and were inadequate, the results were not retrieved. Heterogeneity was analyzed using funnel plots [4].

Wang X., *et al.* dealt with youth at the age of 18 years old with type 1 and 2 diabetic patients who underwent periodontal non-surgical treatment with the use of local drug and systemic antibiotics with a follow-up of 3 months on randomized clinical trials. The studies varied in terms of quality and were inadequate in different studies, Publication was not assessed, but heterogeneity was analyzed using funnel plots [8].

Quan Li., *et al.* studied type 2 diabetic patients with periodontal disease who underwent periodontal non-surgical treatment with the use of systemic antibiotics with a follow-up of 3 months on randomized clinical trials. The studies varied in terms of quality and were inadequate in different studies. Results were not ideal throughout Begg's test. Heterogeneity was analyzed [9].

Simpson TC., *et al.* studied type 1 and 2 diabetic patients over 16 years of age with periodontal disease who underwent any periodontal treatment as a part of randomized clinical trials with a follow-up of 9 months. The studies varied in terms of quality and were inadequate in different studies. Results were not sufficient [14].

Sgolastra F., *et al.* studied type 1 and 2 diabetic patients over 18 years of age with periodontal disease who underwent non-surgical periodontal treatment as a part of randomized clinical trials with a follow-up of 3 months. The studies varied in terms of quality and were inadequate in many ways. Only 3 studies were at high-risk, the publication bias was assessed by using funnel plots. Asymmetry test and heterogeneity were analyzed [15].

Teeuw WJ., *et al.* Diabetic patients with periodontal disease who underwent any kind of periodontal treatment as a part of randomized clinical trials and controlled clinical trials with a follow-up of 3 months. Two of five studies were categorized into "doubtful quality" and others were "good quality". Publication bias was not assessed. Heterogeneity was analyzed [16].

Hasuike A., *et al.* made a systematic review and assessment of periodontal treatment on diabetic patients' health, the study reviewed nine studies. It concluded that periodontal therapy for diabetic patients is one of the most important and effective measures that can help diabetic patients maintain their comfort and safety [18].

Conclusion

Patients suffering from periodontal diseases are also prone to complications from diabetes mellitus as it has been shown that not only that diabetes mellitus is a risk factor for periodontal diseases, but that periodontal diseases, in turn, could affect the control of blood glucose levels. There is a markedly significant effect of periodontal treatment on the improvement of HbA1c percentages in diabetic patients, though the effect size is very small.

Declarations of Interest

None.

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