



Systematic review

# Adjuvant Therapies to Scaling and Root Planing in People with Diabetes: A Systematic Review

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## ABSTRACT

**Introduction:** Type 2 diabetes mellitus (T2DM) and periodontitis are diseases with high morbidity rates and a bidirectional relationship that makes their management more complicated. **Objective:** To determine whether there are additional benefits in the percentage reduction of glycated haemoglobin (HbA1c) and in the reduction of the values of the periodontal clinical parameters in people with T2DM and periodontitis when applying adjuvant therapies as a complement to Scaling and Root Planing (SRP). **Materials and methods:** The databases reviewed were PubMed®, Cochrane Library®, ScienceDirect® and Virtual Health Library. The systematic review focused on randomised clinical trials from 2016 to 2021. The risk of bias was measured using the Risk of Bias tool. **Results:** For this review, 11 relevant studies with 625 participants aged 35 to 63 years were identified.

It was demonstrated that SRP with adjuvant therapies has additional benefits in the reduction of HbA1c and periodontal clinical parameters. **Conclusions:** To promote glycaemic control and periodontal status, it is initially necessary to standardise the dental care process with SRP and, if financial possibilities permit, add adjuvant therapies.

**Keywords:** Systematic Review, Type 2 Diabetes Mellitus, Periodontitis, Dental Scaling.

## INTRODUCTION

Type 2 diabetes mellitus (T2DM) is a disease that in recent decades has shown high incidence and prevalence; Mexico ranks seventh with the most cases of T2DM worldwide<sup>1</sup>. T2DM is generally accompanied by oral pathologies, such as periodontal disease<sup>2</sup>, which ranks second with the highest prevalence both globally (20-50%) and nationally (60.5%)<sup>3,4</sup>. There are two types of periodontal disease: gingivitis and periodontitis. Gingivitis is a mild inflammatory disease caused by the accumulation of dental plaque, however, if it is not treated promptly it can progress to a more serious stage. Periodontitis is a chronic inflammatory disease that affects the soft and hard tissues that support the teeth<sup>5</sup>. Scientific evidence supports that the interaction between T2DM and periodontitis is bidirectional. T2DM exacerbates periodontitis by enhancing inflammatory reactions in periodontal tissue or by altering the homeostasis of subgingival microorganisms. In turn, the virulence factors produced in periodontitis generate dysfunction of the beta cells of the pancreatic islets of Langerhans and generate insulin resistance mechanisms, promoting the appearance of T2DM or metabolic imbalance<sup>6,7</sup>.

Scaling and Root Planing (SRP) is considered the gold standard for the treatment of periodontitis; it consists of the removal of organic deposits found on the tooth surface, both at the supragingival and subgingival levels<sup>8</sup>. This procedure may be compromised in the presence of deep periodontal pockets or furcation areas where complete mechanical removal of plaque and calculus deposits is difficult, thus new adjuvant treatment options are necessary. The objective of this research is to determine whether there are additional benefits in the percentage reduction of glycated haemoglobin (HbA1c) and in the reduction of the values of the periodontal clinical parameters in people with T2DM and periodontitis when applying adjuvant therapies as a complement to SRP.

## MATERIALS AND METHODS

The Systematic Review was based on the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) Statement guidelines and the Cochrane Handbook. Previously, the PICOS question was structured as follows: P: Men and women over 18 years of age with T2DM and periodontitis; I: SRP + adjuvant therapy (experimental group); C: SRP alone (control group); O: Reduction in HbA1c values and periodontal clinical parameters: periodontal probing depth, clinical attachment loss (CAL), plaque index (PI) and bleeding on probing; and S: Randomised Clinical Trials (RCT).

The inclusion criteria used for the review were RCTs, studies evaluating periodontal treatment in people living with T2DM and periodontitis (over 18 years of age), any intervention as

adjuvant therapy to SRP, languages in English or Spanish, published in the time period 2016-2021, evaluation of HbA1c before and after periodontal treatment and evaluation of at least two periodontal clinical parameters before and after periodontal treatment. Exclusion criteria considered included RCTs with samples of less than ten people, studies of diabetic population plus smoking, pregnant or lactating women, patients with antimicrobial therapy three months before entering the study, and patients with periodontal therapy three months before entering the study.

The search was carried out by consulting the PubMed®, Cochrane Library®, ScienceDirect® and Virtual Health Library databases. The search strategy used the Boolean operators “AND” and “OR”, as well as the following keywords contained in the Health Sciences Descriptors: Periodontal Diseases, Type 2 Diabetes Mellitus, Periodontitis, Therapeutics and Dental Scaling. Likewise, an additional secondary search was carried out in the bibliographic references of all selected studies in order to identify articles that may have been omitted or lost during the initial search.

Two researchers independently screened the titles, abstracts, and full texts of articles meeting the selection criteria, while disagreements were discussed and resolved by consensus. After selecting the studies, data were extracted independently by two reviewers into an *ad hoc* data extraction form in Microsoft® Excel (Microsoft Corporation, Redmond, USA) containing the author’s name, year of publication, country, control group treatment, experimental group treatment, follow-up time, clinical variables, results and other characteristics of interest to the research. Any disagreements were resolved through discussion with a third author.

The risk of bias assessment of the RCTs was performed independently by two reviewers and consensus was reached on existing disagreements. It was performed using Review Manager (RevMan) version 5.4.1 software, using the Risk of Bias Tool (RoB 2) (The Cochrane Collaboration, London, United Kingdom), which consists of seven domains: random sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessors, incomplete outcome data, and other sources of bias.

The research protocol was approved by the Research Committee of the Institute of Health Sciences, registered with the Federal Commission for the Protection against Sanitary Risks (for its acronym in Spanish COFEPRIS), obtaining approval No. M/113/2021.

## RESULTS

The initial search in the four databases (PubMed®, Cochrane Library®, ScienceDirect® and Virtual Health Library) yielded a total of 13,939 articles. After applying the following search filters: publication date, language and type of article, 1,243 titles were identified. After reading the title, 98 articles were identified (PubMed® [n=37], Cochrane Library® [n=26], ScienceDirect® [n=6] and Virtual Health Library [n=29]). On the other hand, 38 studies were identified in the records of additional sources, ending with 136 studies according to the title and abstract, subsequently 57 duplicate articles were identified and eliminated. After reading the abstract, other 43 titles were excluded, leaving a total of 36 potentially relevant articles, which were subjected to a critical evaluation of the full text. Of these, 25 were excluded and finally, 11 articles were selected for a thorough review of their content and methodology (Figure 1).

The systematic review included 11 RCTs, involving a total of 611 participants in the age range 35-63 years, 48% were men and 52% were women. By country, 45.4% of the studies were from Brazil, 18.2% from Saudi Arabia, 18.2% from Türkiye, 9.1% from Italy and 9.1% from Egypt. Furthermore, 100% of the included studies were in the English language (Table 1).

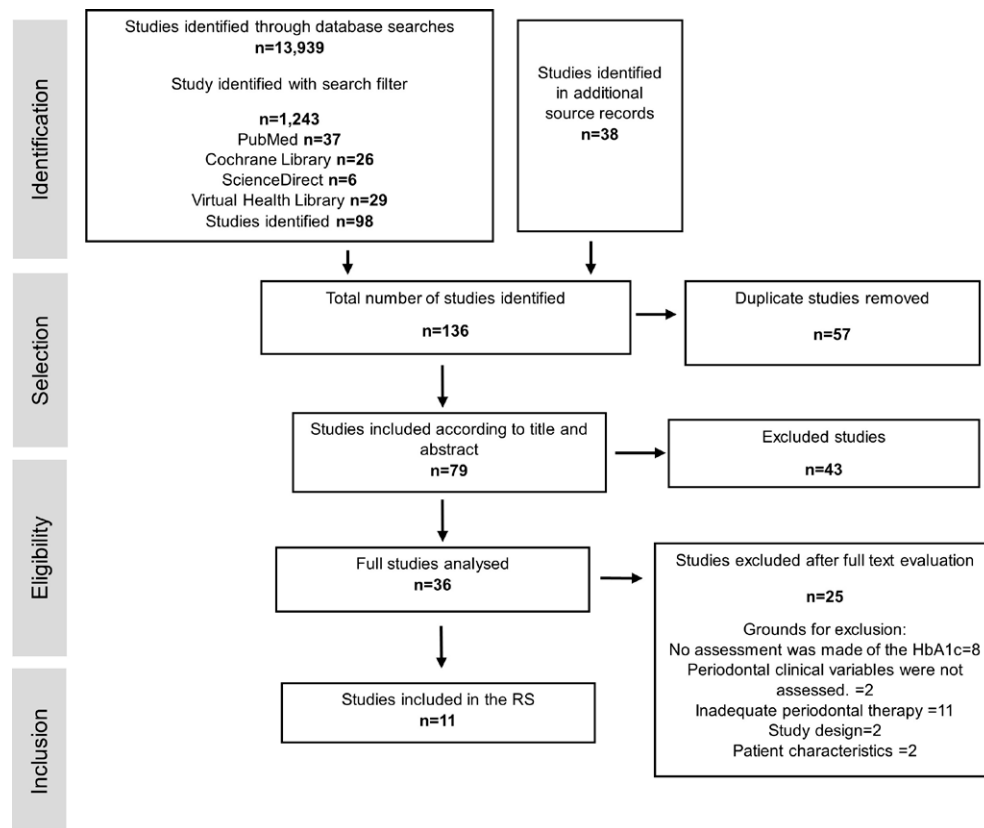


Figure 1. PRISMA flow diagram of the screening and study selection process

The RCTs described the care protocols in detail, ten reported performing the initial phase of periodontal treatment, that is, oral hygiene instructions<sup>9-18</sup>, five reported providing information on periodontitis and its systemic effects<sup>9,12-14,18</sup>, two reported providing patients with oral hygiene supplies<sup>12,15</sup>, three achieved tooth extractions in which a poor prognosis was assumed<sup>9,14,16</sup>, three carried out removal of carious lesions and poorly fitting restorations<sup>9,14,16</sup>, five underwent removal of supragingival dental calculus<sup>9,14-17</sup>, three made dental plaque control<sup>12,17,18</sup>, and only one reported indicating 0.12% chlorhexidine mouthwash<sup>10</sup>. All studies compared SRP alone versus SRP combined with the following adjuvant therapies: 1. Antimicrobial photodynamic therapy (aPDT)<sup>9,18</sup>, 2. Propolis<sup>10</sup>, 3. Essential oil-based mouthwash<sup>19</sup>, 4. Diode laser<sup>11,12</sup>, 5. Homeopathic therapy<sup>13</sup>, 6. Omega-3 + acetylsalicylic acid (ASA)<sup>14</sup>, 7. Probiotics<sup>15</sup>, 8. Ozone therapy<sup>17</sup>, and 9. Doxycycline<sup>16</sup>.

Most RCTs revealed a reduction in HbA1c levels in both the control-SRP alone groups (1.2% from baseline [maximum reduction]) and the experimental-SRP + adjuvant treatment groups (2.9% from baseline [maximum reduction]) three months after starting treatment (Table 2). When comparing the control and experimental groups, the difference in the latter was significant when the following were used as adjuvant therapy: diode laser ( $p < 0.05$ ), essential oil-based mouthwash ( $p < 0.05$ ), homeopathic therapy ( $p = 0.001$ ), omega-3 + ASA two months after SRP ( $p = 0.038$ ), aPDT ( $p = 0.039$ ) and doxycycline ( $p < 0.05$ ).

**Table 1.**  
**General characteristics and data extracted from the studies included in the systematic review**

Author/year	Country	Design	Number of patients with T2DM	SRP only (Control group)	SRP + Adjuvant treatment (Experimental group)	Clinical variables	Follow-up time (months)
Castro <i>et al.</i> <sup>9</sup> 2016	Brazil	RCT	20	SRP only	SRP + aPDT	Probing depth, CAL, bleeding on probing, PI, HbA1c	1, 3 y 6
El-Sharkawy <i>et al.</i> <sup>10</sup> 2016	Egypt	RCT	50	SRP + placebo	SRP + propolis	Probing depth, CAL, Bleeding on probing, HbA1c	3 y 6
Koçak <i>et al.</i> <sup>11</sup> 2016	Türkiye	RCT	60	SRP only	SRP + diode laser	Probing depth, PI, CAL, HbA1c	1 y 3
Alshehri <i>et al.</i> <sup>19</sup> 2017	Saudi Arabia	RCT	60	SRP + water	SRP + essential oil-based mouthwash	Probing depth, PI, Bleeding on probing, HbA1c	3
Dengizек <i>et al.</i> <sup>12</sup> 2019	Türkiye	RCT	37	SRP + placebo	SRP + diode laser	PI, Bleeding on probing, Probing depth, CAL, HbA1c	3 y 6
Mourão <i>et al.</i> <sup>13</sup> 2019	Brazil	RCT	80	SRP + placebo	SRP + homeopathic therapy	Probing depth, CAL, PI, Bleeding on probing, HbA1c	1, 6 y 12
Castro <i>et al.</i> <sup>14</sup> 2020	Brazil	RCT	75	SRP + placebo	- omega-3 + ASA, 2 months after SRP - omega-3 + ASA, 2 months before SRP	Probing depth, CAL, Bleeding on probing, HbA1c	3 y 6
Elsadek <i>et al.</i> <sup>15</sup> 2020	Saudi Arabia	RCT	58	SRP only	- aPDT + SRP - Probiotic + SRP	Probing depth, PI, Bleeding on probing, CAL, HbA1c	3
Lecio <i>et al.</i> <sup>16</sup> 2020	Brazil	RCT	40	SRP + placebo nanospheres	SRP + 20% doxycycline nanospheres	Probing depth, CAL, Bleeding on probing, PI, HbA1c	1, 3 y 6
Rapone <i>et al.</i> <sup>17</sup> 2020	Italy	RCT	100	SRP only	SRP + ozone therapy	PI, Probing depth, Bleeding on probing, CAL, HbA1c	3, 6, 9 y 12
Cláudio <i>et al.</i> <sup>18</sup> 2021	Brazil	RCT	31	SRP only	SRP + aPDT	Probing depth, Bleeding on probing, PI, HbA1c	3 y 6

Acronyms: ASA: Acetylsalicylic acid; aPDT: Antimicrobial photodynamic therapy; T2DM: Type 2 diabetes mellitus; RCT: Randomized clinical trial; HbA1c: Glycosylated haemoglobin; PI: Plaque index; CAL: Clinical Attachment Loss; SRP: Scaling and root planing.

**Table 2.**  
**Comparison between SRP alone and SRP + adjuvant treatment in the reduction of HbA1c values and periodontal parameters after periodontal treatment in the studies included in the systematic review.**

Control and experimental group	HbA1c	Probing depth	CAL	Bleeding on probing	PI
SRP (Control group)	1.2%	3.64 mm	3.64 mm	73.1%	35.5%
SRP + adjuvant treatment (Experimental group)	2.9% (Essential oil-based mouthwash)	4.23 mm (diode laser)	4.23 mm (diode laser)	68.7% (doxycycline)	50.4% (Essential oil-based mouthwash)

Acronyms: HbA1c: Glycosylated haemoglobin; PI: Plaque Index; CAL: Clinical Attachment Loss.

For the periodontal clinical parameters, it was evident in all the studies that three months later, there was a reduction in the values both in the control groups (probing depth: 3.64 mm, CAL: 3.64 mm, bleeding on probing: 73.1%, PI: 35.5% [maximum reductions]) and in the experimental groups (probing depth: 4.23 mm, CAL: 4.23, bleeding on probing: 68.7%, PI: 50.4% [maximum reductions]) (Table 2). Nevertheless, in the comparison between the groups, the difference was significant only in the experimental groups where they included the following as adjuvant therapy: diode laser, apDT, propolis, homeopathic therapy, essential oil-based mouthwash and doxycycline. Likewise, in the experimental groups, treatments with a greater number of parameters with statistically significant reduction were identified: SRP + 20% doxycycline nanospheres, SRP + essential oil-based mouthwash, SRP + diode laser and SRP + propolis (Table 3).

**Table 3.**  
**Significant reductions in clinical parameters after SRP + adjuvant treatment (experimental groups) from data extracted from the studies included in the systematic review**

Tratamiento periodontal (Grupo experimental)	Parameters with statistically significant reduction				
	HbA1c	Probing depth	CAL	Bleeding on probing	PI
SRP + 20% doxycycline nanospheres <sup>16</sup>	p<0.05	p<0.05	p<0.05	p<0.05	-
SRP + essential oil-based mouthwash <sup>19</sup>	p<0.05	-	-	p<0.05	p<0.01
SRP + diode laser <sup>11</sup>	p<0.05	p<0.05	p<0.05	-	p>0.05
SRP + propolis <sup>10</sup>	p>0.05	p<0.05	p<0.05	-	p>0.05
SRP + diode laser <sup>12</sup>	p>0.05	p<0.05	p>0.05	p<0.05	p>0.05

Acronyms: p<0.05: Statistically significant reduction; p>0.05: No statistically significant reduction; -: Parameter not evaluated; HbA1c: Glycosylated haemoglobin; PI: Plaque Index; CAL: Clinical Attachment Loss.

On the left side of Figure 2 are the RCTs that were assessed for risk of bias by domain, where five studies had low risk of bias in all domains<sup>10,14,16,18,19</sup>, while only one study had unclear risk of bias in four domains and high risk of bias in two domains<sup>15</sup>. On the other hand, on the right side we can observe that the only domain that obtained 100% low risk of bias was that of incomplete results data, the domain of blinding of the result evaluators presented 45.5% of unclear risk of bias, while the domains of allocation concealment and blinding of participants and personnel revealed 27.3% high risk of bias.

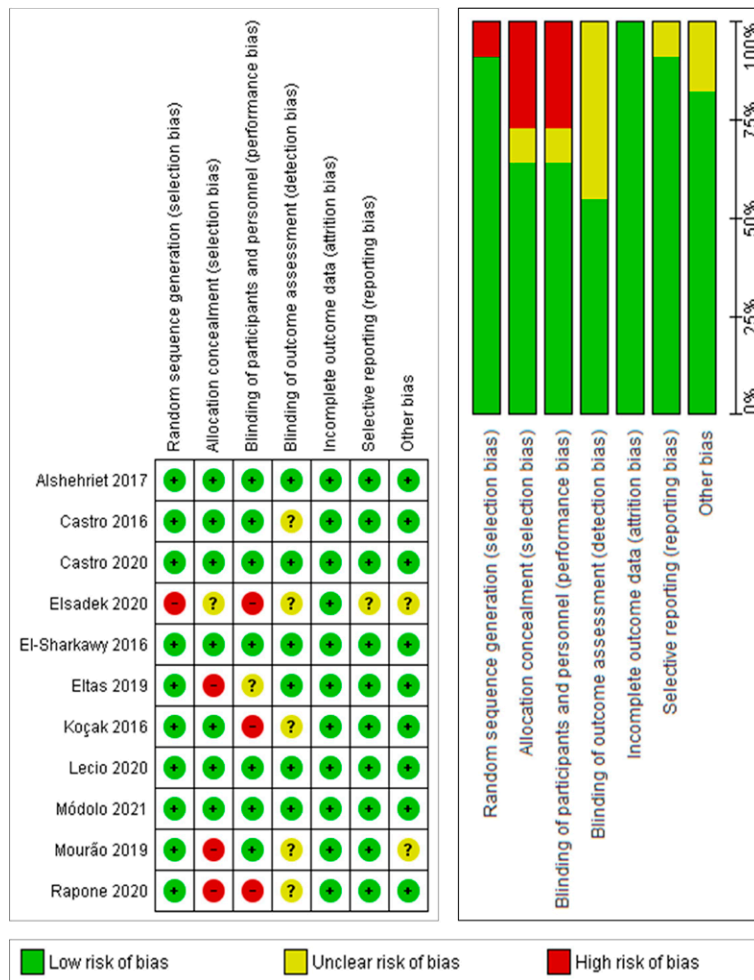


Figure 2. Summary of risk of bias of included RCTs

## DISCUSSION

The present systematic review was based on the hypothesis that combining SRP with adjuvant therapy in people living with T2DM and periodontitis improves HbA1c values and periodontal clinical parameters. It is evident that there is information on the decrease in HbA1c, and in periodontal clinical parameters (probing depth, CAL, bleeding on probing and PI) both when receiving SRP alone or SRP with adjuvant therapies. It is important to note that the ideal periods for observing changes in HbA1c parameters are between 90 and 120 days<sup>20</sup>, and in periodontal diseases it is defined between 14 and 90 days<sup>21</sup>. However, in the studies analysed, follow-up was heterogeneous and ranged from one to twelve months. In the case of HbA1c, in terms of efficient use of resources and adequate monitoring, measurements before 90 days are not ideal, a period in which no modification to the variable is observed. In the case of periodontal clinical parameters, they should be established between 14 and 90 days, and the periods in which the changes occur should be clearly indicated, both for SRP alone and with combined SRP.

We also identified that there are statistically significant differences in the reduction of HbA1c, between SRP alone vs SRP with the following adjuvant therapies: diode laser, essential oil-based mouthwash, homeopathic therapy, omega-3 + ASA, aPDT, and 20% doxycycline nanospheres.

For the particular case of SRP + diode laser, Soi *et al.*<sup>22</sup> identified significant differences, and for the SRP + aPDT case, Barbosa *et al.*<sup>23</sup> reported that there were no significant differences.

Regarding periodontal parameters, we found that the use of essential oil-based mouthwash significantly improved all parameters evaluated in combination with SRP. Likewise, the study by Azad *et al.*<sup>24</sup> reported that the values of probing depth, CAL, bleeding on probing and bacterial levels in the subgingival biofilm decrease with the use of mouthwash as adjuvant therapy. With reference to the diode laser, this research identified two studies with statistically significant differences in their evaluated parameters, which is consistent with what was reported by Slot *et al.*<sup>25</sup> and Zhao *et al.*<sup>26</sup> when using the same therapy. This treatment, due to its antimicrobial action, can replace the use of commonly prescribed antibiotics, thereby reducing adverse reactions and antimicrobial resistance, so its use could be an eventual alternative for treating periodontal disease.

Lecio *et al.*<sup>16</sup> performed SRP + 20% doxycycline nanospheres and included a protocol of oral hygiene instructions, extraction of teeth with a poor prognosis, removal of caries, detection of dental plaque and oral prophylaxis. Likewise, monthly periodontal follow-up was provided to control dental plaque and recommend oral hygiene, so the reduction in parameters observed in the systematic review can also be attributed to the care protocols carried out in the follow-up appointments. It is worth mentioning that the reduction in the clinical parameters evaluated should not only be attributed to dental actions, but also to the complementary comprehensive treatment that includes oral hypoglycaemic agents, insulin, lifestyles such as nutrition and physical activity, among others. Of these complementary actions, only half of the studies reported follow-up<sup>9-15</sup>, which should be considered for future analysis since they could lead to confusion, by influencing the magnitude of the results.

In Mexico there are currently thirteen Clinical Practice Guidelines (CPGs) especially for dentistry, most published between 2011 and 2013, but they have not been updated and none focuses specifically on the dental care of patients with T2DM and periodontitis even though both are serious public health problems. In this context, it must be recognised that there is a lack of tools that contribute to the standardisation of dental care processes for this population group, based on the paradigm of evidence-based medicine. Our research provides key recommendations for improving care and offers the basis for standardising periodontal treatment in people living with T2DM. The findings of this systematic review may support key recommendations for CPGs, so we recommend integrating a program to generate and update CPGs in dentistry. Furthermore, the same process needs to be done on other topics of interest in order to obtain scientific evidence of the main oral problems, and in this way standardise dental care and improve quality standards.

To our knowledge, this is the first systematic review summarising the role of various adjuvant therapies + SRP versus SRP alone in patients with T2DM and periodontitis. According to our results, SRP as a sole therapy is effective in decreasing both glycaemic and periodontal parameters, but it should be considered that there are additional benefits to using adjuvant therapies. An economic analysis is recommended to determine the cost-benefit between SRP alone and SRP + adjuvant therapies, because in the heterogeneous context of dental care in Mexico, most of these treatments are not included in the different public health institutions, and therefore patients must pay for them directly.

Among the identified limitations is that there is a small number of clinical trials in the area of dentistry, related to the topic of periodontitis in patients with T2DM. Similarly, the included RCTs have not thoroughly analysed and controlled the confusing variables, among which are

the use of hypoglycaemic drugs, time of evolution of T2DM, body mass index, diet, exercise, emotional state, comorbidities, polypharmacy and sociodemographic characteristics of the patients that could be altering the magnitude of the results. The periods in which HbA1c and periodontal clinical parameters should be measured have not been standardised either. Finally, the lack of blinding of outcome assessors was the domain with the most areas of opportunity, with a 45.5% unclear risk of bias.

## CONCLUSIONS

This systematic review provides important scientific evidence that can establish the link between research and dental practice. Essential oil-based mouthwash and diode laser were the adjuvant therapies to scaling and root planing that had more than one clinical parameter with statistically significant reductions. However, more scientific evidence is needed to lay the foundations for establishing key recommendations for national clinical practice guidelines focused on the dental care process. This allows us to offer services with high quality standards and standardise dental care processes for people living with type 2 diabetes mellitus and periodontitis. This procedure, combined with a healthy diet, regular physical activity and adequate medical treatment, would favour the control of these patients, in terms of improving glycosylated haemoglobin and periodontal clinical parameters.

## BIBLIOGRAPHIC REFERENCES

1. Magliano DJ, Boyko EJ, Balkau B, Barengo N, Barr E, Basit A, *et al.* *IDF diabetes atlas*. 10 ed. Brussels: International Diabetes Federation; 2021. Disponible en: <https://diabetesatlas.org/>
2. Choi SE, Sima C, Pandya A. Impact of treating oral disease on preventing vascular diseases: A model-based cost-effectiveness analysis of periodontal treatment among patients with type 2 diabetes. *Diabetes Care*. 2020; 43(3): 563-571. DOI: 10.2337/dc19-1201
3. Secretaría de Salud. *Resultados del Sistema de Vigilancia Epidemiológica de Patologías Bucales SIVEPAB 2019*. México: Secretaría de Salud; 2020. <https://www.gob.mx/salud/documentos/informes-sivepab-2019>
4. Nazir M, Al-Ansari A, Al-Khalifa K, Alhareky M, Gaffar B, Almas K. Global prevalence of periodontal disease and lack of its surveillance. *Scientific World Journal*. 2020. 2146160. DOI: 10.1155/2020/2146160
5. Global Periodontal Health Project. *Salud y enfermedades periodontales. Guía práctica para reducir la carga mundial de morbilidad para las enfermedades periodontales*. Geneve: FDI World Dental Federation; 2018. <https://www.fdiworlddental.org/sites/default/files/2020-11/gphp-2018-toolkit-es.pdf>
6. Su Y, Ye L, Hu C, Zhang Y, Liu J, Shao L. Periodontitis as a promoting factor of T2D: current evidence and mechanisms. *Int J Oral Sci*. 2023; 15: 25. DOI: 10.1038/s41368-023-00227-2
7. Shi N, Kong C, Yuan L, Liu L, Zhao K, Lü J *et al.* The bidirectional relationship between periodontitis and diabetes: New prospects for stem cell-derived exosomes. *Biomed Pharmacother*. 2023. 165: 115219. DOI: 10.1016/j.biopha.2023.115219.
8. Estany Castella J. Raspado y alisado radicular en áreas de difícil acceso. *Periodoncia y Osteointegración*. 2003; 13(2): 143-153. <https://dialnet.unirioja.es/servlet/articulo?codigo=4558479>

9. Castro dos Santos NC, Andere NMRB, Araujo CF, de Marco AC, dos Santos LM, Jardini MAN et al. Local adjunct effect of antimicrobial photodynamic therapy for the treatment of chronic periodontitis in type 2 diabetics: split-mouth double-blind randomized controlled clinical trial. *Lasers Med Sci.* 2016; 31(8): 1633-1640. DOI: 10.1007/s10103-016-2030-8
10. El-Sharkawy HM, Annes MM, Van Dyke TE. Propolis improves periodontal status and glycemic control in patients with type 2 diabetes mellitus and chronic periodontitis: A randomized clinical trial. *J Periodontol.* 2016; 87(12):1418-1426. DOI: 10.1902/jop.2016.150694
11. Koçak E, Sağlam M, Kayış SA, DüNDAR N, Kebapçılar L, Loos BG, et al. Nonsurgical periodontal therapy with/without diode laser modulates metabolic control of type 2 diabetics with periodontitis: A randomized clinical trial. *Lasers Med Sci.* 2016; 31: 343-353. DOI: 10.1007/s10103-016-1868-0
12. Eltas SD, Gursel M, Eltas A, Alptekin NO, Ataoglu T. Evaluation of long-term effects of diode laser application in periodontal treatment of poorly controlled type 2 diabetic patients with chronic periodontitis. *Int J Dent Hyg.* 2019; 17(4): 292-299. DOI: 10.1111/idh.12384
13. Mourão L, Carillo R, Linares SM, Canabarro A, Fischer RG. Homeopathy and periodontal treatment in type II diabetic patients: A 1-year randomized clinical trial. *Braz Dent J.* 2019; 30(2): 139-145. DOI: 10.1590/0103-6440201902124
14. Castro dos Santos NC, Andere NMRB, Araujo CF, de Marco AC, Kantarci A, Van Dyke TE, et al. Omega-3 PUFA and aspirin as adjuncts to periodontal debridement in patients with periodontitis and type 2 diabetes mellitus: Randomized clinical trial. *J Periodontol.* 2020; 91(10): 1318-1327. DOI: 10.1002/JPER.19-0613
15. Elsadek MF, Ahmed BM, Alkhawtani DM, Siddiqui AZ. A comparative clinical, microbiological and glycemic analysis of photodynamic therapy and *Lactobacillus reuteri* in the treatment of chronic periodontitis in type-2 diabetes mellitus patients. *Photodiagnosis Photodyn Ther.* 2020; 29: 101629. DOI: 10.1016/j.pdpdt.2019.101629
16. Lecio G, Ribeiro FV, Pimentel SP, Reis AA, da Silva RVC, Nociti-Jr F, et al. Novel 20% doxycycline-loaded PLGA nanospheres as adjunctive therapy in chronic periodontitis in type-2 diabetics: randomized clinical, immune and microbiological trial. *Clin Oral Investig.* 2020; 24: 1269-1279. DOI: 10.1007/s00784-019-03005-9
17. Rapone B, Ferrara E, Corsalini M, Converti I, Grassi FR, Santacroce L, et al. The effect of gaseous ozone therapy in conjunction with periodontal treatment on glycated hemoglobin level in subjects with type 2 diabetes mellitus: An unmasked randomized controlled trial. *Int J Environ Res Public Health.* 2020; 17(15): 5467. DOI: 10.3390/ijerph17155467
18. Cláudio MM, Nuernberg MAA, Rodrigues JVS, Belizário LCG, Batista JA, Duque C, et al. Effects of multiple sessions of antimicrobial photodynamic therapy (aPDT) in the treatment of periodontitis in patients with uncompensated type 2 diabetes: A randomized controlled clinical study. *Photodiagnosis Photodyn Ther.* 2021; 35: 102451. DOI: 10.1016/j.pdpdt.2021.102451
19. Alshehri M, Alshail F, Alshehri FA. Effect of scaling and root planing with and without adjunctive use of an essential-oil-based oral rinse in the treatment of periodontal inflammation in type-2 diabetic patients. *J Investig Clin Dent.* 2017; 8(1) e12188. DOI: 10.1111/jicd.12188
20. Escribano-Serrano J, García-Domínguez L, Díaz-Pintado MT. Glucohemoglobina HbA1c. Primera parte: conocerla. *Semergen.* 2010; 36(2): 82-88. DOI: 10.1016/j.semerg.2009.11.005
21. Echeverría JJ, Lang, NP (eds.). *Periodoncia clínica. Periodontal diagnosis and treatment.* 11 int. ed. Madrid:SEPA;2018. <https://sepa.es/download/periodoncia-clinica-11-international-edition-ano-2018/>
22. Soi S, Bains VK, Srivastava R, Madan R. Comparative evaluation of improvement in periodontal and glycemic health status of type 2 diabetes mellitus patients after scaling and root planing with or without adjunctive use of diode laser. *Lasers Med Sci.* 2021; 36: 1307-1315. DOI: 10.1007/s10103-021-03261-w

23. Barbosa FI, Araújo PV, Machado LJC, Magalhães CS, Guimarães MMM, Moreira AN. Effect of photodynamic therapy as an adjuvant to non-surgical periodontal therapy: periodontal and metabolic evaluation in patients with type 2 diabetes mellitus. *Photodiagnosis Photodyn Ther.* 2018; 22: 245-250. DOI: 10.1016/j.pdpdt.2018.04.013
24. Azad MF, Schwiertz A, Jentsch HFR. Adjunctive use of essential oils following scaling and root planing -a randomized clinical trial. *BMC Complement Altern Med.* 2016; 16: 171. DOI: 10.1186/s12906-016-1117-x
25. Slot DE, Jorritsma KH, Cobb CM, Van der Weijden FA. The effect of the thermal diode laser (wavelength 808-980 nm) in non-surgical periodontal therapy: a systematic review and meta-analysis. *J Clin Periodontol.* 2014; 41(7): 681-692. DOI: 10.1111/jcpe.12233
26. Zhao P, Song X, Wang Q, Zhang P, Nie L, Ding Y, *et al.* Effect of adjunctive diode laser in the non-surgical periodontal treatment in patients with diabetes mellitus: a systematic review and meta-analysis. *Lasers Med Sci.* 2021; 36: 939-950. DOI: 10.1007/s10103-020-03208-7