

Relationship between periodontal pathology and systemic conditions

Franklin Josue Vaicilla Quintanilla¹ Angel Fabricio Villacis Tapia²

¹Estudiante de odontología, Facultad de Ciencias de la Salud, Universidad Regional Autónoma de los Andes, Ambato, Ecuador.

Email: oa.franklinjq52@uniandes.edu.ec
<https://orcid.org/0000-0002-3384-9751>

²Docente de odontología, Facultad de Ciencias de la Salud, Universidad Regional Autónoma de los Andes, Ambato, Ecuador

Email: ua.angelvillacis@uniandes.edu.ec
<https://orcid.org/0000-0003-3062-8790>

Abstract

Periodontal diseases are infectious-inflammatory pathologies that can increase the risk of onset and/or progression of systemic conditions such as obesity, diabetes mellitus and cardiovascular disease. Objective. To identify the association of periodontal disease with systemic diseases. Materials and Methods. The research was descriptive with a qualitative and cross-sectional approach, the databases used were Science Source, Medigraphic, Google Scholar, PubMed and Scielo, using inclusion and exclusion criteria 21 articles were chosen. Results. Of the articles, most demonstrate that there is a relationship between periodontal disease and systemic diseases such as obesity, diabetes and cardiovascular disease. Conclusions. The relationship of periodontal disease with systemic diseases such as cardiovascular disease, diabetes mellitus and obesity is due to the fact that the periodontal inflammatory response leads to a poorly regulated immune response generating susceptibility to contract other diseases.

Key words: periodontal disease; obesity; diabetes mellitus; cardiovascular disease.

Introduction

Periodontal diseases are considered a public health problem. ¹ They are pathologies that affect the supporting tissues of the tooth, the designation periodontal disease includes gingivitis and periodontitis. ²

Gum disease is the most common in the population. Gingivitis denotes clinical signs of inflammation that are localized to the gum and are related to loss of tooth insertion. ³ Periodontitis is an inflammatory disease of the tissues that support the teeth caused by microorganisms that result in the gradual loss of the periodontal ligament and alveolar bone, with pocket formation and recession. ⁴

It is important to recognize that diseases of the periodontium are not limited to producing local damage. ⁵ The identification of periodontal diseases with systemic diseases such as obesity, diabetes mellitus and cardiovascular disease is relevant in dentistry identifying the association between periodontal and systemic pathologies in an effort to improve the periodontal and systemic health of patients. ¹

For all the above, it is completely justified to carry out the investigation of the association between periodontal disease and systemic conditions, in order to obtain reliable data to identify the relationship of periodontium pathologies with obesity, diabetes mellitus and cardiovascular disease.

The correlation between periodontal disease and systemic disorders is not a new concept. It has been

proposed that due to the inflammatory response there is a poorly regulated immune response generating that the patient is susceptible to acquiring other diseases. In the eighteenth century, Benjamin Rush claimed that arthritis could only be treated after extracting permanent teeth in poor condition. In 1910, physician William Hunter spoke of bacterial infections at the level of the brain, heart and lung from infected teeth. ⁶

A variety of recent studies have compiled multiple results showing that periodontal infections are implicated in the development of various systemic diseases. In 2019, Santos et al. ⁷ assessed the association between severe periodontitis with overweight and obesity, determining that severe periodontitis was significantly associated with obesity but not with overweight.

Villegas et al. ⁸ found that of the total number of patients examined in this study, 66.6% presented some type of periodontal disease, results that reflect that chronic diseases can generate the appearance of periodontal disease.

Hansen et al ⁹ evaluated the incidence of major cardiovascular events in patients with severe periodontitis treated in a hospital manner, concluding that periodontitis is an independent risk factor for cardiovascular diseases.

Periodontal treatment improves glycemic control in patients with Type 2 Diabetes Mellitus, because it decreases the state of systemic inflammation and therefore, also the number of inflammatory cells (such as IL6 and TNF- α) that cause alterations in insulin activity. ¹⁰

Periodontal treatment has a beneficial effect on some of the biochemical parameters considered cardiovascular risk, since it reduced levels of protein, tumor necrosis factor alpha, interleukin-6 and leukocytes, fibrinogen levels also improved considerably.¹¹

Two intervention studies on the influence of obesity on the effects of periodontal treatment showed that response to non-surgical periodontal therapy was better in non-obese patients than in obese patients.¹² It is relevant to know how periodontal disease can initiate or impair the clinical picture of systemic diseases since dentists can be facing patients with periodontal and systemic conditions so you must know how both are associated and thus give an adequate treatment to periodontal conditions, so the objective of this research is to show the relationship between periodontal diseases and systemic disorders.

Materials and methods

The present research is qualitative descriptive since the association between periodontal and systemic diseases will be identified. It is a cross-sectional research since scientific articles from the last 5 years will be examined.

The study population consisted of 21 scientific articles, which address issues related to periodontal disease and systemic issues such as obesity, diabetes and cardiovascular diseases, these articles. Mainly the databases Science Source, Medigraphic, Google Scholar, PubMed and Scielo were determined where searches of the topic were carried out. In each database the Boolean connector "AND" was used, this in order to obtain results more focused on the subject of study

The inclusion criteria were: studies published in the last 8 years, studies conducted on humans, studies focused on periodontal disease in relation to diabetes mellitus, obesity, and cardiovascular disease. The exclusion criteria were: studies older than 8 years, conducted on animals, focused on gestational diabetes or other metabolic pathologies.

We analyzed studies that met the inclusion criteria and designed a matrix that includes the author, objective, results and conclusions. The results were evidenced through tables.

Results

The main results of studies linking periodontal disease with obesity are presented in Table 1.

Table 1. Results obtained in articles on the relationship between periodontal disease and obesity

Author	Objective	Results	Conclusions
Keller et al. ¹²	To examine the time-dependent association between obesity and periodontitis and how weight changes may affect the development of periodontitis in the general population	They found a direct association between the degree of overweight and the risk of developing periodontitis.	Overweight, obesity, weight gain and increased waist circumference may be risk factors for the development of periodontitis or worsening periodontal measures.
Maura et al. ¹³	Meta-analysis of studies on obesity and periodontitis	The results indicated that the risk of periodontitis was associated with obesity in 25 studies. The meta-analysis showed that there is a significant relationship between obesity and periodontitis.	Obesity was associated with periodontitis. The production of cytokines can develop periodontal disease. It is necessary to identify the risk factors that aggravate these diseases to better understand this association.
Martinez et al. ¹⁴	Assess the relationship between obesity and periodontal disease	The studies described an association between obesity and periodontal disease, except for two articles that did not report such an association.	The association between obesity and periodontitis was consistent with a convincing pattern of increased risk of periodontitis in obese or overweight individuals.
Santos et al. ¹⁵	To assess the association of severe periodontitis with overweight and obesity.	Although severe periodontitis was significantly associated with obesity it was not associated with being overweight	Severe periodontitis was associated with obesity but not overweight

The main results of studies linking periodontal disease with diabetes are presented in Table 2.

Table 2. Results obtained in articles on the relationship between periodontal disease and diabetes

Author	Objective	Results	Conclusions
Ziukate et al. ¹⁶	To assess the prevalence of diabetes among people with periodontitis and to assess whether diabetes is related to the extent and severity of periodontitis	The prevalence of diabetes of 5375 patients with periodontitis was 3.7%, so no relationship could be established between diabetes and the extent or severity of periodontitis.	The prevalence of diabetes in a predominantly controlled diabetic population was not related to the extent and/or severity of periodontitis.

Table 2. Results obtained in articles on the relationship between periodontal disease and diabetes

Ramos et al. ¹⁷	To identify the presence of pigmentant black bacilli (BNP) in periodontal pockets of type II diabetic patients and determine a relationship with their glycemic control.	They identified pigmentant black bacilli in 20% of cases diagnosed with moderate to severe periodontitis, in patients with good to moderate glycemic control	The presence of BNP was identified in type 2 diabetic patients but more related to patients with moderate to severe periodontitis and with a good to moderate glycemic control, presenting no statistical significance.
Khanuja et al. ¹⁸	Investigating the link between glycosylated haemoglobin and diabetic complications with chronic periodontitis	The results of the study showed an association between glycemic control over time with chronic periodontitis.	They conclude that there is a strong association between inflamed periodontal surface area and sites with greater periodontal destruction (severity of periodontitis) with glycemic control.
Capellas et al. ¹⁹	To report the effect of periodontal therapy on glycaemic control	Periodontal therapy did not significantly reduce HbA1c or periodontal status at 3 months.	Nonsurgical periodontal therapy did not significantly reduce glycosylated haemoglobin in participants with type 2 diabetes

The main results of studies linking cardiovascular disease are presented in Table 3.

Table 3. Results obtained in articles on the relationship between periodontal disease and cardiovascular disease

Author	Objective	Results	Conclusions
Hansen et al. ⁹	To analyze the relationship of periodontitis with the risk of cardiovascular mortality	Patients diagnosed with periodontitis in hospital had an increased risk of cardiovascular disease	Periodontitis is an independent risk factor as it releases free radicals from cardiovascular disease.
Meurman et al. ²⁰	Knowing the impact of periodontal disease on cardiovascular disease	20% increased risk of cardiovascular disease reported in patients with periodontal disease	Periodontal disease may contribute to the pathogenesis of cardiovascular disease
Desvarieux et al. ²¹	To investigate the relationship between periodontal microbiota and subclinical atherosclerosis.	The overall periodontal bacterial load was related to the measurement of carotid intima-media thickness. This relationship was specific to the causative bacterial load and the predominance of etiological bacteria in the microbiological niche observed	There is a direct relationship between periodontal microbiology and subclinical atherosclerosis

Discussion

The analysis of the articles of the present research refer that there is a relationship of the three systemic diseases mentioned above (Obesity, Diabetes Mellitus and Cardiovascular Disease).

Periodontitis and obesity are among the most common chronic disorders affecting the world's populations. Keller et al. ¹² found in two of the longitudinal studies a direct association between the degree of overweight at the beginning of the study and the subsequent risk of developing periodontitis, and three other studies found a direct association between obesity and the development of periodontitis in adults. Two studies found that response to non-surgical periodontal treatment was better among lean people than among obese people, while the remaining three studies reported no treatment differences between obese and lean participants.

A similar study by García et al. ¹³ found that the risk of periodontitis was associated with obesity in 25 studies, although it was not associated in 6 studies, however, they mention that the risk factors that

aggravate these diseases should be better clarified to elucidate the direction of this association.

Martinez et al. ¹⁴ found that the studies described an association between obesity and periodontal disease, except for two articles that did not report such an association. Regarding the study conducted by Santos et al. ¹⁵ It was mentioned that although severe periodontitis was significantly associated with obesity it was not associated with being overweight.

As for studies on the relationship of periodontal disease with diabetes. When assessing whether diabetes is related to the extent and severity of periodontitis, Ziukaite et al. ¹⁶ found that no relationship could be established between diabetes and the extent or severity of periodontitis, as the prevalence of diabetes in this sample of patients was 3.7% in a total of 5375 people with periodontitis. While Ramos et al. ¹⁷ identified the presence of pigmentant black bacilli (BNP) in periodontal pockets of type II diabetic patients, the majority of mild periodontitis (85%), moderate periodontitis (15%) and severe periodontitis (5%) and with a glycemic control between good and regular, being the group

with the highest presence of BNP those of moderate to severe periodontitis, which presented a regular glycemic control, so it can be interpreted that the presence of these BNPs would be related to a greater severity of the injury.

Untreated periodontitis affects glycemic control in people with diabetes. In a study by Kaur et al.¹⁸ they showed association between glycemic control over time with chronic periodontitis, since when evaluating the periodontal and glycemic effect of non-surgical periodontal therapy in type 2 diabetic patients, they concluded that individuals with good glycemic control respond to scaling and root planing as systemically healthy individuals and that patients with poor glycemic control have an unfavorable response periodontal, therefore, periodontal disease progresses, this was observed in the no treatment group and was higher in those with poor glycemic control. Kapellas et al.¹⁹ in their study they found that nonsurgical periodontal therapy did not significantly reduce glycosylated hemoglobin in participants with type 2 diabetes.

In studies that relate periodontal disease with cardiovascular diseases. Periodontitis and atherosclerosis are highly prevalent chronic inflammatory diseases, and periodontitis has been suggested to be an independent risk factor for cardiovascular disease, Hansen et al.⁹ showed that patients with periodontitis had an increased risk of cardiovascular mortality. The findings remained significant after adjustment for increased baseline comorbidity in patients with periodontitis compared to controls. While Desvarieux et al.²¹ In their study evaluating the relationship between periodontal microbiota and subclinical atherosclerosis, they found that there is a direct relationship between periodontal microbiology and subclinical atherosclerosis, as overall periodontal bacterial load was related to carotid intima-media thickness measurement.

Meurman et al.²⁰ when evaluating the impact of periodontal disease on cardiovascular disease, reported that there was a 20% increase in the risk of cardiovascular disease in those patients who have periodontal disease.

The literature shows that there is a relationship between periodontal disease and the three systemic diseases such as obesity, diabetes and cardiovascular disease. However, there are data that denote that there is no association between periodontal disease and obesity, in addition to studies showing that non-surgical periodontal therapy did not significantly reduce glycosylated hemoglobin in participants with type diabetes, so it is suggested to continue research.

Conclusions

The relationship of periodontal disease with systemic diseases such as cardiovascular, diabetes mellitus and obesity, occurs since there is an inflammatory response presenting a poorly regulated immune response leads to the patient being susceptible to

contracting other diseases, although periodontal pathology can trigger systemic diseases, these can be at the same time a risk factor for periodontal disease to develop. The way in which periodontal disease is related to obesity, is based on the fact that in the inflammatory state of obesity the production of cytokines can develop periodontal disease, while in diabetes, it can influence the progression of periodontal disease and in addition, periodontitis can affect glycemic control and aggravate diabetes, While in cardiovascular diseases since the inflammation generated by periodontal disease releases free radicals that are well known for their role in the genesis of cardiovascular pathologies.

References

1. Vazquez, Y. Duran D. Borja, N. Ayala, N. Dimas, J. Relationship between systemic diseases and periodontal diseases. Education and Health Scientific Bulletin Institute of Health Sciences. [Internet]. 2022. Jul [cited 2022 Jul 29]; 10(20): 275-287. Available in: <https://doi.org/10.29057/icsa.v10i20.7386>
2. Tamayo, B. Pérez, L. Cabalé, M. Relationship between periodontal and systemic diseases. CCM [Internet]. 2019 Jun [cited 2022 Jul 29]; 23(2): 623-629. Available in: http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S1560-43812019000200623
3. Sokhod, Périer B, Zalberg J, Bouzegza A. El Halabi, B. Anagnostou, F. Periodontal disease and general health. EMC - Treatise on Medicine. [Internet]. 2022 [cited 2022 Jul 29] ; 26(1): 1-8. Available in: <https://www.sciencedirect.com/science/article/pii/S1636541022460430>
4. SriChinthu, K. Pavithra, V. Kumar, G. Prasad, H., Prema, P. Evaluation of gingival and periodontal status in obese and non-obese type II diabetic patients - a cross sectional study. Medicine and pharmacy reports. [Internet]. 2021 [citado 2022 Jul 29] ; 94(1), 94–98. Disponible en: <https://doi.org/10.15386/mpr-1686>
5. Anguiano, L. Zeron, To. Periodontal diseases and their relationship with systemic diseases. Rev Mex Periodontol [Internet]. 2018. [cited 2022 Jul 29] ; 6(2): 77-87. Available in: <https://www.medigraphic.com/pdfs/periodontologia/mp-2015/mp152e.pdf>
6. Soto, A., Ruiz, A., & Martínez, V. Classification of periodontal diseases. In Revista Mexicana de Periodontología. [Internet]. 2018. [cited 2022 Jul 29];9(1-2):24-27. Available in: https://www.medigraphic.com/pdfs/periodontologia/mp-2018/mp181_2f.pdf
7. Santos T, Ramos Cury P, Santos E, Vasconcelos R, Dos Santos JN, Pedreira Ramalho LM. Association between severe periodontitis and obesity degree: a preliminary study. Oral Health Prev Dent. [Internet]. 2019 [citado 2022 Jul 30]; ; 17(2): 173-7. Disponible en: [10.3290/j.ohpd.a42374](https://doi.org/10.3290/j.ohpd.a42374)

8. Villegas Rojas Ivernís Mercedes, Díaz Rivero Abdiel, Domínguez Fernández Yodenis, Solís Cabrera Berta Alina, Tabares Alonso Yadelis. Prevalence and severity of periodontal disease in diabetic patients. *Rev. Med. Electron.* [Internet]. 2018 Dec [cited 2022 Jul 30]; 40(6): 1911-1930. Available in: http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S1684-18242018000601911&lng=es.
9. Hansen, G. Egeberg, A. Holmstrup, P. Hansen, P. Relation of Periodontitis to Risk of Cardiovascular and All-Cause Mortality (from a Danish Nationwide Cohort Study). *Am J Cardiol.* [Internet]. 2018 [citado 2022 Jul 30]; 118(4):489-493. Disponible en: [10.1016/j.amjcard.2016.05.036](https://doi.org/10.1016/j.amjcard.2016.05.036)
10. Becerra-Núñez Edgar, García-Muñoz Alejandro, Quiróz-Pérez Miguel Angel, Ibarra-González Felipe. Effects of non-surgical periodontal therapy on glycemic control of Type 2 Diabetes Mellitus: Literature review. *Vital Dentistry* [Internet]. 2020 Jun [cited 2022 Jul 30]; (32): 15-20. Available from: http://www.scielo.sa.cr/scielo.php?script=sci_arttext&pid=S1659-07752020000100015&lng=en.
11. Millan, R. Navarro, G. Recolons, S. Roig, M. Salas, J. Lopez, J. Effect of periodontal treatment in patients with cardiovascular disease: systematic review and metaanalysis. *Oral Medicine, Oral Pathology and Oral Surgery* [Internet]. 2019. [cited 2022 Jul 31]; 24(1): 15-23. Available from: <http://hdl.handle.net/2445/153580>
12. Keller A, Rohde JF, Raymond K, Heitmann BL. Association between periodontal disease and overweight and obesity: a systematic review. *J Periodontol.* [Internet]. 2018 [cited 2022 Jul 31]; 86(6): 766-76
13. Moura-Grec PG, Marsicano JA, Carvalho CA, Sales-Peres SH. Obesity and periodontitis: systematic review and meta-analysis. *Cien Saude Colet.* [Internet]. 2019 Jun; [cited 2022 Aug 01] 19(6):1763-72. doi: [10.1590/1413-81232014196.13482013](https://doi.org/10.1590/1413-81232014196.13482013).
14. Martínez-Herrera M, Silvestre-Rangil J, Silvestre FJ. Association between obesity and periodontal disease. A systematic review of epidemiological studies and controlled clinical trials. *Med Oral Patol Oral Cir Bucal.* [Internet]. 2017 Nov [cited 2022 Aug 01] 1;22(6):e708-e715. doi: [10.4317/medoral.21786](https://doi.org/10.4317/medoral.21786).
15. Santos T, Cury PR, Santos E, Vasconcelos R, Santos JND, Ramalho LMP. Association Between Severe Periodontitis and Obesity Degree: A Preliminary Study. *Oral Health Prev Dent.* [Internet]. 2019 [cited 2022 Aug 01] ;17(2):173-177. doi: [10.3290/j.ohpd.a42374](https://doi.org/10.3290/j.ohpd.a42374).
16. Ziukaite, DE Slot, CM Cobb. Prevalence of diabetes among patients diagnosed with periodontitis: A retrospective cross-sectional study. *International Journal of dental hygiene.* [Internet]. 2017 [cited 2022 Aug 01]; 12280:1-7. doi: [10.1111/idh.12280](https://doi.org/10.1111/idh.12280).
17. Ramos, D. Churata, O. Paccori, E. Malpartida, K. Robles, A. Huaman, A. Presence of pigmentant black bacilli in periodontal pockets of type 2 diabetic patients and their relationship with glycemic control. *Rev. Stomatol. Herediana* [Internet]. 2017 Jan [cited 2022 Aug 01]; 27(1): 30-38. Available in: <http://dx.doi.org/10.20453/reh.v27i1.3100>.
18. Khanuja PK, Narula SJ, Rajput R, Sharma K, Tewari S. Association of periodontal disease with glycemic control in patients with type 2 diabetes in India population. *Front. Med.* [Internet]. 2017 [cited 2022 Aug 01]; 11(1): 110–119. Disponible en: <https://academic.hep.com.cn/fmd/article/2017/2095-0217/2095-0217-11-1-110.shtml>
19. Capellas, G Mejia, PM Bartod, MR Skilton. Periodontal Therapy and glycaemic control among individuals with type 2 diabetes: reflections from the PerioCardio study. *Int J Dent Hygiene.* [Internet]. 2018 [cited 2022 Aug 01]; 10(1):1-10. doi: [10.1111/idh.12234](https://doi.org/10.1111/idh.12234)
20. Meurman JH, Sanz M, Janket SJ. Oral health, atherosclerosis, and cardiovascular disease. *Crit Rev Oral Biol Med.* [Internet]. 2018 Nov. [cited 2022 Aug 01] 1;15(6):403-13. doi: [10.1177/154411130401500606](https://doi.org/10.1177/154411130401500606)
21. Desvarieux M, Demmer RT, Rundek T, Boden-Albala B, Jacobs DR Jr, Sacco RL, Papapanou PN. Periodontal microbiota and carotid intima-media thickness: the Oral Infections and Vascular Disease Epidemiology Study (INVEST). *Circulation.* [Internet]. 2017 Feb [cited 2022 Aug 01]; 8(5):576-82. doi: [10.1161/01.CIR.0000154582.37101.15](https://doi.org/10.1161/01.CIR.0000154582.37101.15).