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Correlation Between Hypertension and Oral Health Status: A Systematic Review

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ABSTRACT

Hypertension is a chronic medical condition that has a broad impact including on oral health. Periodontitis and pharmacological interventions are condition associated with hypertension that has significant and often overlooked impact on patient's oral health, yet no systematic review has presented data on the correlation between oral health status and hypertension. This systematic review aims to identify the correlation between oral health status and hypertension. Inclusion criteria comprised English-language research articles published within the last five years sourced from PubMed, the Cochrane Library, and Scopus in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. A total of 11 research articles consisting of 7 cross-sectional studies, 3 cohort studies, and 1 case-control study were identified involving hypertensive patients aged 20–73 years with oral health issues. All articles reported a significant correlation between hypertension and oral health conditions. The relationship between oral health and hypertension is a complex, bidirectional systemic pathophysiology involving both systemic inflammatory pathways and the effects of pharmacological interventions. There is a significant association between hypertension and oral health conditions.

Keyword : Hypertension; high blood pressure; oral health; dental health

Introduction

Hypertension is one of the most frequently encountered chronic medical conditions in clinical practice, as it can trigger cardiovascular disease, stroke, heart failure, and renal damage. Global medical guidelines define hypertension as a condition in which the systolic blood pressure is 140 mmHg or higher, and/or the diastolic blood pressure is 90 mmHg or higher. However, with the growing body of recent clinical trial evidence, this definition has undergone several adjustments. In 2017, the American College of Cardiology and the American Heart Association updated the diagnostic threshold for hypertension in adults to a much stricter criterion: a systolic blood pressure of 130 mmHg or higher, and/or a diastolic blood pressure of 80 mmHg or higher.¹⁻⁴

Based on global epidemiological reports, the World Health Organization (WHO) estimates that approximately 1.4 billion adults aged 30 to 79 years will suffer from hypertension, representing about 33% of the population in this age group in 2024.¹ This number marks a significant increase from approximately 650 million affected individuals in 1990, with the global population living with hypertension reaching 1.3 billion in 2019.¹ Approximately 75% to 78% of all individuals currently living with hypertension reside in low- and middle-income countries, where the prevalence rate continues to rise due to population aging, urbanization, and changes in lifestyle patterns. Conversely, developed and high-income countries have begun to exhibit a declining trend in prevalence, largely due to the effectiveness of preventive programs, medication availability, and a

highly adaptive level of public awareness.¹⁻⁴ The significant impact of pharmacological interventions for hypertension on the patient's oral cavity is often overlooked. Hypertensive patients are also highly susceptible to destructive periodontal diseases, such as periodontitis.⁵⁻⁸ Antihypertensive therapy also contributes to the exacerbation of oral diseases.⁷

The prevalence of oral manifestations in hypertensive patients reaches approximately 70.7%, indicating the presence of at least one oral manifestation. The most dominant complaint is dry mouth, affecting 60% to 79.3% of patients, followed by gingival bleeding at 50% to 82%, alongside high rates of periodontitis (27.6% - 60%) and gingivitis (76%).⁶⁻⁹

There has been a lack of systematic review studies linking hypertension and oral health conditions. Therefore, a systematic review is required to compile the available evidence and present the data systematically to bridge this knowledge gap. This review aims to identify the correlation between oral health status and hypertension.

Methods

This study included English-language articles published within the last five years that reported a correlation between oral health status and hypertension. The literature search was conducted through PubMed, Scopus, and the Cochrane Library using the following keywords: “hypertension”, “high blood pressure”, “hypertensive”, “oral hygiene”, “dental hygiene”, “oral health”, “oral care”, “self management”, “self care”, and “health behavior”. The search process was carried out in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, and the articles were selected based on the inclusion criteria to obtain suitable studies for the review. All data obtained were analysed using a qualitative approach, and the data were presented in descriptive tables. The quality of the articles was evaluated using the JBI (Joanna Briggs Institute) Critical Appraisal Checklist, applied appropriately according to the specific study design of each respective article.

Results and Discussion

The search yielded a total of 6,026 articles identified across various databases. Subsequently, irrelevant articles were automatically excluded, and a duplication check was conducted. Twenty-five out

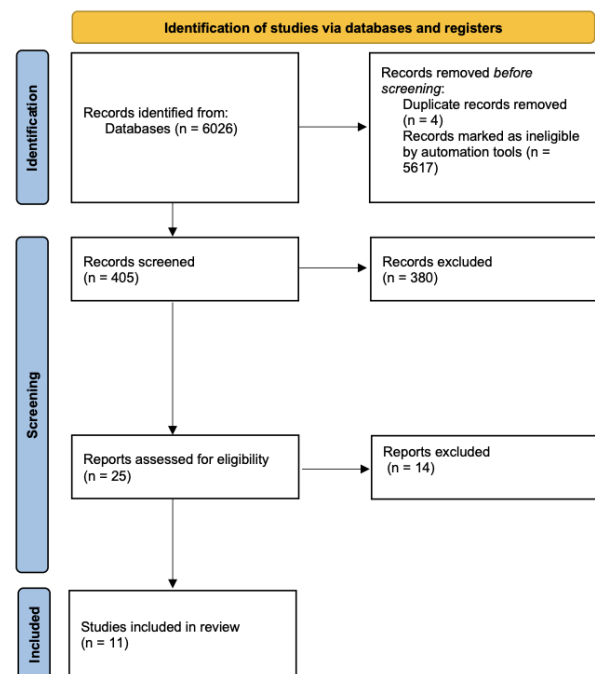


Diagram 1 PRISMA flow

of the 405 screened articles were deemed eligible for inclusion in the study. However, only 11 articles were analyzed and underwent data extraction for specific reasons. [Diagram 1]

Data extraction was performed on a total of 11 articles. Seven of these articles utilized a cross-sectional study design, and two studies were conducted in the United States. [Table 1]

A correlation between hypertension and oral cavity conditions was observed in patients aged between 20 to 73 years. Six of the 11 articles reported hypertension assessment parameters using clinical blood pressure measurements and medication history. Furthermore, six of the 11 articles used self-reported assessment parameters for oral health. All included articles indicated a significant correlation between hypertension and oral conditions. [Table 2]

Table 1 Article characteristic

No.	Title	Author	Year	Country	Study design	Research Objective
1	Exploring the link between self-rated poor oral health and cardiovascular risk: a cross-sectional study using SCORE2 ¹⁰	Nymberg et al.	2025	Sweden	Cross-Sectional Study	Investigate the association between self-reported (subjective) oral health and the risk of cardiovascular disease using the SCORE2 instrument.
2	Comparative analysis of oral health behaviour and utilisation of oral health care services in the general population and among patients with non-communicable diseases in Korea: a repeated cross-sectional survey conducted from 2008 to 2022 ¹¹	Pyo et al.	2025	South Korea	Cross-Sectional Study	Analyze trends in oral health behaviour and the use of dental services among patients with hypertension compared with the general population.
3	Comparison of perceived stress and oral health status using perceived stress scale and DMFT index between healthy, undiagnosed hypertensive, and known hypertensive dental patients ¹²	Atif et al.	2024	Pakistan	Cross-Sectional Study	Comparing stress levels and oral health status among healthy patients, patients with undiagnosed hypertension, and patients with diagnosed hypertension.
4	Denture use and risk for cardiometabolic disease: observational and Mendelian randomization analyses ¹³	Liu et al.	2024	China	Cohort	Examining the relationship, both observationally and in terms of genetic causality (Mendelian randomisation), between denture use and major cardiometabolic conditions.
5	The association between denture use and cardiovascular diseases. The United States National Health and Nutrition Examination Survey 2009–2018 ¹⁴	Liang et al.	2023	United States	Cross-Sectional Study	Examining the relationship between denture use and the prevalence of cardiovascular disease and hypertension.
6	Burning Mouth Syndrome and Hypertension: Prevalence, Gender Differences and Association with Pain and Psycho-Social Characteristics: A Case Control Study ¹⁵	Adamo et al.	2023	Italy	Case-control study	Assessing the prevalence of hypertension in patients with Burning Mouth Syndrome (BMS) and associated predictors of anxiety and pain.
7	The association of periodontal disease and oral health with hypertension, NHANES 2009-2018 ¹⁶	Li et al.	2023	United States	Cross-Sectional Study	Examining the effects of the interaction between oral health, periodontal disease and smoking habits on hypertension, based on data from the National Health and Nutrition Examination Survey (NHANES) in the United States.

8	Poor tooth brushing behavior is associated with high risk of cardiovascular events: A prospective observational study ¹⁷	Matsui et al.	2022	Japan	Cohort	Determine the impact of daily toothbrushing habits on the future incidence of cardiovascular disease.
9	Association between Dietary Pattern and Periodontitis: A Cross-Sectional Study ¹⁸	Altun et al.	2021	Germany	Cross-Sectional Study	Investigate the association between Dietary Approaches to Stop Hypertension (DASH), Mediterranean diets and the prevalence of periodontitis.
10	Self-reported periodontal health and incident hypertension: longitudinal evidence from the NutriNet-Santé e-cohort ¹⁹	Carra et al.	2021	France	Cohort	To test the hypothesis that periodontal health can predict the future onset (incidence) of hypertension in people who do not currently have hypertension.
11	Blood Pressure and Tooth Loss: A Large Cross-Sectional Study with Age Mediation Analysis ²⁰	Mendes et al.	2021	Portugal	Cross-Sectional Study	To investigate the correlation between blood pressure and the rate of tooth loss, and to examine the effect of mediation on age-related factors.

Table 2 Correlation between hypertension and oral health conditions

No.	Author	Pasients Age (Number of Patients)	Assessment Parameters		Key Findings
			Hypertension	Oral cavity	
1	Nymberg et al. ¹⁰	40 dan 50 (654)	Clinical blood pressure measurements	Self-rated oral health (SROH)	Correlation between poor oral health and hypertension shows significant results (p<0.001).
2	Pyo et al. ¹¹	>19 (860,889)	Self-reported physician diagnosis	Self-reported	Correlation between hypertension patients and the increasing trend in the number of hypertension patients who brush their teeth before bed and undergo scaling within a year shows significant results (p<0.001).
3	Atif et al. ¹²	48.84 ± 11.84 (72)	Clinical blood pressure measurements and medication history	Self-reported	Correlation between hypertension patients with a Mean Arterial Pressure (MAP) of: 104.79 ± 11.29 (p<0.001) and an increased Decayed, Missing, Filled Teeth (DMFT) index shows significant results (p<0.001).
4	Liu et al. ¹³	37 - 73 (26,271)	Clinical blood pressure measurements and medication history	Self-reported	Correlation between denture use and blood pressure above 140/80 mmHg shows significant results, with the number of Risk coefficient (95% CI) SBP 0.37 (0.22, 0.52)

					DBP -0.13 (-0.22, -0.05)
5	Liang et al. ¹⁴	30 – 59 (356)	Clinical blood pressure measurements and medication history	Self-reported	Correlation between denture problems and hypertension shows significant results (p< 0.01).
6	Adamo et al. ¹⁵	65.61±12.7 (133)	Clinical blood pressure measurements and medication history	Intraoral and extraoral clinical examination	Correlation between patients with hypertension taking antihypertensive drugs (beta-blockers, ACE inhibitors, diuretics) and burning mouth syndrome, xerostomia, dysgeusia, and a lump-in-the-throat sensation shows significant results (p< 0.001).
7	Li et al. ¹⁶	59±0.21 (11,017)	Clinical blood pressure measurements	Self-reported	Correlation between periodontal disease and poor oral health and the prevalence of hypertension shows significant results (p< 0.001).
8	Matsui et al. ¹⁷	63 ± 16 (75)	Clinical blood pressure measurements and medication history	Self-reported	Correlation between poor toothbrushing habits (infrequent brushing and short brushing duration) and hypertension shows significant results (p=0.01). Furthermore, it was noted that 68% of subjects had a history of tooth extraction due to periodontitis.
9	Altun et al.	52 – 71 (3,076)	Clinical blood pressure measurements and medication history	Full dental examination	Correlation between periodontal disease (moderate to severe), high plaque index, DMFT index and bleeding on probing (BOP) index and hypertension shows significant results (p<0.001).
10	Carra et al. ¹⁹	45.79 ± 13.87 (2,116)	Self-reported diagnosis	modified PERiodontal Screening Score (mPESS)	Correlation between the incidence of arterial hypertension in subjects with modified and validated PERiodontal Screening Score (mPESS)≥5 and hypertension shows significant results (p < 0.0001).
11	Mendes et al. ²⁰	44.9 ± 17.9 (1,384)	Clinical blood pressure measurements	Clinical and radiographic examination	Correlation between patients with tooth loss of ≥10 teeth and hypertension shows significant results (p<0.001).

Data analysis indicates that hypertension occurs across adult and elderly populations, with four articles identifying hypertension in populations aged ≥ 65 years.^{13,15,17,18} The prevalence of hypertension in the elderly population (≥ 65 years) affects approximately 70% of the individuals within this age group.²¹ The primary cause of this high incidence in the ≥ 65 age group is the natural biological aging process of the cardiovascular system. Arterial walls naturally thicken and become increasingly stiff over time, which is the main primary pathophysiological mechanism in the elderly. The loss of vascular elasticity often causes the elderly to present with a clinical feature known as isolated systolic hypertension, which causes a sharp spike in systolic blood pressure and pulse pressure due to the resistance of the stiffened vascular walls, while the diastolic blood pressure typically decreases or remains within the normal range.^{21,22} Therefore, the etiology of hypertension in the elderly is more closely associated with the structural degeneration of blood vessels.^{21,22}

The etiology and risk factors for hypertension in the adult population exhibit more complex characteristics, as they can be influenced by the interaction between genetics and lifestyle.²³ Nine of the 11 articles identified hypertension in the adult population.^{10-14,16,18-20} The prevalence of hypertension in adults is closely linked to unhealthy lifestyle habits and toxic environmental factors, such as work-related stress, emotional stress and daily socio-economic pressures, all of which can affect the cardiovascular system.^{22,23} Furthermore, family history and genetic factors are also known to contribute to a slight increase in the risk of hypertension, such as some individuals are genetically predisposed to a very high sensitivity to sodium intake, meaning that a poor diet can lead to hypertension at a young age.²²

All studies demonstrated a significant correlation between hypertension and oral cavity conditions.¹⁰⁻²⁰ Correlation between oral health status and hypertension represents a complex, bidirectional systemic pathophysiology involving systemic inflammatory pathways and the effects of pharmacological interventions.^{16,24} Poor oral hygiene and periodontal disease can be accompanied by the destruction of the pocket epithelium, allowing oral pathogenic bacteria and their endotoxins to enter the bloodstream (bacteraemia) thereby triggers the release of pro-inflammatory mediators, such as C-reactive protein (CRP), Interleukin-6 (IL-6), and Tumor Necrosis Factor-alpha (TNF- α).^{16,25,26} The presence of these systemic inflammatory mediators can induce

endothelial dysfunction to increase the peripheral vascular resistance and bind nitric oxide (NO) as the primary vasodilatory agent to consequently leading to arterial stiffness and a systemic increase in blood pressure.^{16,25,26} In contrast, hypertension itself induces lympho-hemocirculation changes in the gingival mucosa, characterized by the dilation of lymphatic and interstitial spaces thereby increasing tissue susceptibility to periodontal infections in hypertensive patients.²⁴

The use of antihypertensive medications such as Calcium Channel Blockers (CCB) frequently stimulate fibroblast proliferation, leading to gingival hyperplasia, whereas Angiotensin Receptor Blockers (ARB) are prone to inducing lichenoid reactions manifested as fibrous white streaks on the mucosa.⁷ Concurrently, the impairment of the autonomic function of the salivary glands, primarily caused by diuretics, results in xerostomia which can trigger a series of secondary complications, including halitosis, easily bleeding gums, gingivitis, and dysgeusia or altered taste sensation.⁵⁻⁸

Hypertension induced by poor oral hygiene and periodontal disease highlights the necessity of oral cavity examinations to ensure that hypertension is managed effectively and appropriately.^{26,27} Non-surgical interventions, such as scaling and root planing (SRP) eliminates pathogenic bacterial biofilms and subgingival calculus deposits, effectively disrupting the local infection cascade within the gingival pocket.^{26,27} SRP treatment in pre-hypertensive patients with periodontitis can achieve a statistically significant decrease in blood pressure, with systolic blood pressure (SBP) dropping by 4.7 to 5.2 mmHg and diastolic blood pressure (DBP) by 3.4 to 3.7 mmHg.²⁷ Furthermore, basic periodontal therapy has been shown to deliver an average reduction of up to 12.5 mmHg for SBP and 10.0 mmHg for DBP.²⁸ Analytical results revealed SRP treatment on periodontal tissue and brushing teeth before bed were effective and significantly capable to reduce blood pressure levels in patients.^{11,26,27}

Individuals with poor oral health and a history of periodontal disease exhibit a higher odds ratio for hypertension compared to those with excellent oral health.¹⁶ A clinical study evaluated oral clinical signs indicating that the hypertensive group experienced significantly more severe periodontal destruction, as objectively measured using Russell's Periodontal Index, compared with the group of patients with normal blood pressure. The study specifically highlighted a high incidence of oral symptoms among hypertensive patients,

including dry mouth (60%), halitosis (52.5%), and bleeding gums (50%).²⁴

Correlation between the DMFT (Decayed, Missing, and Filled Teeth) index and hypertension demonstrates strong significance, with two of the 11 articles reporting a significant correlation between a high DMFT index and hypertension.^{12,18} A large-scale study using data from the PERSIAN Guilan Cohort Study (PGCS), which involved a total of 10,520 participants aged 35 to 70 years, conducted standardized oral examinations and blood pressure measurements to investigate the correlation between the incidence of hypertension and dental health status, as measured by the DMFT index. The analytical results revealed a highly statistically significant difference ($p < 0.001$) between the two groups. Participants with hypertension exhibited a higher mean DMFT score of 15.80 ± 8.97 , compared to the non-hypertensive group, which had a mean score of only 13.67 ± 8.51 . These numbers provide strong evidence of an correlation between elevated systemic blood pressure and a decline in functional dental health status among the adult population.²⁹

There is a strong significant correlation between tooth loss and hypertension.²⁰ Completely edentulous individuals have nearly a five-fold increased risk of hypertension (Odds Ratio 4.94) compared to those with a complete dentition, whereas the partially edentulous group exhibits a 2.22-fold higher risk.³⁰ Another study reported that tooth loss is closely associated with the incidence of newly diagnosed hypertension. Participants who had lost 8 to 14 teeth, or more than 15 teeth, demonstrated a significantly higher risk (with a Hazard Ratio of up to 2.26) of developing hypertension compared to those with an intact dentition.³¹ Periodontal disease, which is the primary cause of tooth loss in the adult population, can trigger a chronic inflammatory response, allowing pathogenic bacteria and inflammatory cytokines from the periodontal tissues to enter the bloodstream. This invasion directly induces vascular inflammation and endothelial dysfunction, which constitute the primary pathophysiological mechanisms underlying the development of hypertension.³⁰

Conclusion

There is a significant bidirectional correlation between hypertension and oral health conditions, as demonstrated by all the identified articles showing strong significance. Routine oral examinations and

dental scaling every 6 months are the initial step in detecting primary oral manifestations and can help optimally control hypertension. Research with RCT and cohort designs is needed to strengthen the evidence of causality between hypertension and oral health.

References

- [1] Global report on hypertension 2025: high stakes – turning evidence into action. Geneva: World Health Organization; 2025. Licence: CC BY-NC-SA 3.0 IGO.
- [2] Iqbal AM, Jamal SF. Essential Hypertension. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2026 [cited 2026 May 15]. Available from: <http://www.ncbi.nlm.nih.gov/books/NBK539859/> PubMed PMID: 30969681.
- [3] Mills KT, Stefanescu A, He J. The global epidemiology of hypertension. *Nat Rev Nephrol.* 2020 Apr;16(4):223–37. doi:10.1038/s41581-019-0244-2
- [4] Satoh M, Nakayama S, Nobayashi H, Iwabe Y, Izumi S, Murakami T, et al. Current hypertension epidemiology and contemporary approaches using the “Real-World Evidence Cycle” framework. *Hypertens Res.* 2026 Mar;49(3):756–67. doi:10.1038/s41440-025-02532-1
- [5] Li Y, Yuan X, Zheng Q, Mo F, Zhu S, Shen T, et al. The association of periodontal disease and oral health with hypertension, NHANES 2009–2018. *BMC Public Health.* 2023 Jun 12;23(1):1122. doi:10.1186/s12889-023-16012-z
- [6] Uppal B, Goyal P, Walia NK. Association of Oral Health and Periodontal Disease with Hypertension: A Cross-Sectional Study. *IJCDW.* 2024 May 25;9:206–12. doi:10.25259/IJCDW_5_2024
- [7] Apriasari ML, Aminudin ML, Hamdani R. Analysis of Clinical Oral Manifestation of Patients with Antihypertensive Therapy in South Kalimantan.
- [8] Kumar P, Mastan K, Chowdhary R, Shanmugam K. Oral manifestations in hypertensive patients: A clinical study. *J Oral Maxillofac Pathol.* 2012;16(2):215. doi:10.4103/0973-029X.99069
- [9] Soni ZZZ, Kusniati R, Rakhmawati AK. Gambaran Status Kesehatan Gigi dan Mulut pada Pasien Prolanis di Puskesmas Kedungmundu. *Medica Arteriana (Med-Art).*

- 2020 Jun 29;2(1):43. doi:10.26714/medart.2.1.2020.43-52
- [10] Nymberg P, Milos-Nymberg V, Grundberg A, Oscarson N, Stenman E, Sundquist K. Exploring the link between self-rated poor oral health and cardiovascular risk: a cross-sectional study using SCORE2. *BMC Oral Health*. 2025 Feb 24;25(1):298. doi:10.1186/s12903-025-05671-6
- [11] Pyo J, Jeong H, Mahmudah NA, Park YK, Ock M. Comparative analysis of oral health behaviour and utilisation of oral health care services in the general population and among patients with non-communicable diseases in Korea: a repeated cross-sectional survey conducted from 2008 to 2022. *Raghuveer P, editor. PLoS ONE*. 2025 Apr 22;20(4):e0321816. doi:10.1371/journal.pone.0321816
- [12] Atif S, Syed U, Rafiq M, Fatima A, Rana S, Tariq M. Comparison of perceived stress and oral health status using perceived stress scale and DMFT index between healthy, undiagnosed hypertensive, and known hypertensive dental patients. *Ghasemi H, editor. PLoS ONE*. 2024 Oct 10;19(10):e0311645. doi:10.1371/journal.pone.0311645
- [13] Liu Y, Qin H, Li T, Feng C, Han H, Cao Y, et al. Denture use and risk for cardiometabolic disease: observational and Mendelian randomization analyses. *European Journal of Preventive Cardiology*. 2024 Jan 5;31(1):13–20. doi:10.1093/eurjpc/zwad295
- [14] Liang X, Chou OHI, Cheung BMY. The association between denture use and cardiovascular diseases. *The United States National Health and Nutrition Examination Survey 2009–2018. Front Cardiovasc Med*. 2023 Jan 10;9:1000478. doi:10.3389/fcvm.2022.1000478
- [15] Adamo D, Canfora F, Calabria E, Coppola N, Sansone M, Spagnuolo G, et al. Burning Mouth Syndrome and Hypertension: Prevalence, Gender Differences and Association with Pain and Psycho-Social Characteristics—A Case Control Study. *IJERPH*. 2023 Jan 22;20(3):2040. doi:10.3390/ijerph20032040
- [16] Li Y, Yuan X, Zheng Q, Mo F, Zhu S, Shen T, et al. The association of periodontal disease and oral health with hypertension, NHANES 2009–2018. *BMC Public Health*. 2023 Jun 12;23(1):1122. doi:10.1186/s12889-023-16012-z
- [17] Matsui S, Maruhashi T, Kishimoto S, Kajikawa M, Yusoff FM, Nakashima A, et al. Poor tooth brushing behavior is associated with high risk of cardiovascular events: A prospective observational study. *International Journal of Cardiology*. 2022 Mar;350:111–7. doi:10.1016/j.ijcard.2021.12.056
- [18] Altun E, Walther C, Borof K, Petersen E, Lieske B, Kasapoudis D, et al. Association between Dietary Pattern and Periodontitis—A Cross-Sectional Study. *Nutrients*. 2021 Nov 21;13(11):4167. doi:10.3390/nu13114167
- [19] Carra MC, Fessi S, Detzen L, Darnaud C, Julia C, Hercberg S, et al. Self-reported periodontal health and incident hypertension: longitudinal evidence from the NutriNet-Santé e-cohort. *Journal of Hypertension*. 2021 Dec;39(12):2422–30. doi:10.1097/HJH.0000000000002941
- [20] Mendes JJ, Viana J, Cruz F, Pereira D, Ferreira S, Pereira P, et al. Blood Pressure and Tooth Loss: A Large Cross-Sectional Study with Age Mediation Analysis. *IJERPH*. 2021 Jan 2;18(1):285. doi:10.3390/ijerph18010285
- [21] Glazier JJ. Pathophysiology, Diagnosis, and Management of Hypertension in the Elderly. *Int J Angiol*. 2022 Dec;31(04):222–8. doi:10.1055/s-0042-1759486
- [22] High Blood Pressure - Causes and Risk Factors | NHLBI, NIH [Internet]. 2024 [cited 2026 May 19]. Available from: <https://www.nhlbi.nih.gov/health/high-blood-pressure/causes>
- [23] Hinton TC, Adams ZH, Baker RP, Hope KA, Paton JFR, Hart EC, et al. Investigation and Treatment of High Blood Pressure in Young People: Too Much Medicine or Appropriate Risk Reduction? *Hypertension*. 2020 Jan;75(1):16–22. doi:10.1161/HYPERTENSIONAHA.119.13820
- [24] Uppal B, Goyal P, Walia NK. Association of Oral Health and Periodontal Disease with Hypertension: A Cross-Sectional Study. *IJCDW*. 2024 May 25;9:206–12. doi:10.25259/IJCDW_5_2024
- [25] Paizan M, Vilela-Martin J. Is There an Association between Periodontitis and Hypertension? *CCR*. 2014 Jul 31;10(4):355–61. doi:10.2174/1573403X10666140416094901
- [26] Surma S, Romańczyk M, Witalińska-Łabuzek J, Czerniuk MR, Łabuzek K, Filipiak KJ. Periodontitis, Blood Pressure, and the Risk and

Control of Arterial Hypertension: Epidemiological, Clinical, and Pathophysiological Aspects—Review of the Literature and Clinical Trials. *Curr Hypertens Rep.* 2021 May;23(5):27. doi:10.1007/s11906-021-01140-x

- [27] Lanau N, Mareque-Bueno J, Zabalza M. Impact of Nonsurgical Periodontal Treatment on Blood Pressure: A Prospective Cohort Study. *Eur J Dent.* 2024 May;18(02):517–25. doi:10.1055/s-0043-1772246
- [28] Gatarayiha A, Sagam CK, Ntaganira J, Rulisa S, Mutesa L, Brookes Z. Oral hygiene and periodontal treatment interventions for reducing blood pressure in hypertensive adults from low and middle-income countries: a systematic review. *PAMJ-CM.* 2024;15. doi:10.11604/pamj-cm.2024.15.20.42793
- [29] Samami M, Joukar F, Hassanipour S, Rabiei M, Valaei-Barhagh A, Darizin M, et al. Hypertension and DMFT: insights from the PERSIAN Guilan Cohort Study. *BMC Oral Health.* 2024 Nov 30;24(1):1456. doi:10.1186/s12903-024-05236-z
- [30] Tada A, Tano R, Miura H. The relationship between tooth loss and hypertension: a systematic review and meta-analysis. *Sci Rep.* 2022 Aug 3;12(1):13311. doi:10.1038/s41598-022-17363-0
- [31] Woo HG, Chang Y, Lee JS, Song TJ. Tooth loss is associated with an increased risk of hypertension: A nationwide population-based cohort study. Hosadurga R, editor. *PLoS ONE.* 2021 Jun 15;16(6):e0253257. doi:10.1371/journal.pone.0253257