

OSHR - Periodontal Disease/Oral Health and Chronic Systemic Illness

General, Prevalence and Properties of Periodontal Disease

Schmalz G, Ziebolz D (2020). Editorial, Special Issue “Oral Health and Systemic Diseases” Gerhard Schmalz and Dirk Ziebolz *J Clin Med* 9: 3156 doi:10.3390/jcm9103156 At: https://www.researchgate.net/publication/344516094_Special_Issue_Oral_Health_and_Systemic_Diseases Summary: With an enormous prevalence worldwide, diseases of the oral cavity and respective tissues are a highly relevant global health issue. Beside of the oral health-related consequences of common oral diseases, like tooth loss, chewing deficiencies and quality of life impairment, oral and systemic disease interaction are apparent. Different systemic diseases and conditions have the potential to affect a risk of developing oral diseases, especially periodontitis; on the other hand, oral inflammation can have an effect on general health. Moreover, several general diseases are related to a potential risk of complications in dental therapy.

Kang M-S, Lee D, Lee D-S, Lee S-A, Kim M-S, Nam S-H (2020). Effects of probiotic bacterium *Weissella cibaria* CMU on periodontal health and microbiota: a randomised, double-blind, placebo-controlled trial. *BMC Oral Health* 20(243). DOI: <https://doi.org/10.1186/s12903-020-01231-2> At: <https://bmcoralhealth.biomedcentral.com/articles/10.1186/s12903-020-01231-2>. Abstract: **Background:** *Weissella cibaria* CMU (oraCMU) has been commercially available in the market for several years as oral care probiotics. The present study aimed to evaluate the effects of oraCMU-containing tablets on periodontal health and oral microbiota. **Methods:** A randomised, double-blind, placebo-controlled trial was conducted in 92 adults without periodontitis (20–39 years of age). All subjects received dental scaling and root planing, and were randomly assigned to either probiotic or placebo groups. The tablets were administered once daily for 8 weeks. Periodontal clinical parameters included bleeding on probing (BOP), probing depth (PD), gingival index (GI), and plaque index (PI). In addition, microbiota in the gingival sulcus were analysed. **Results:** BOP improved more in the probiotic group over 8 weeks. There were statistically significant differences in BOP of the maxilla buccal and lingual sites between the groups during the intervention ($P < 0.05$). No significant inter-group differences in PD, GI, and PI were observed during the intervention. Oral bacteria were observed to be fewer in the probiotic group. There was a significant change in levels of *Fusobacterium nucleatum* at four and 8 weeks between the two groups. Besides, there were significant differences at 8 weeks in levels of *Staphylococcus aureus*. **Conclusions:** We reported an improvement in BOP and microbial environment and demonstrated the antimicrobial activity of oraCMU against *F. nucleatum*. Thus, its supplementation may contribute to overall oral health. **Trial registration** Ethical issues approved by the Kangwon National University Institutional Review Board with a number of KWNUIRB-2018-05-003-005 and CRIS code Number of [KCT0005078](https://www.kctd.or.kr/regist/registDetail.do?registNo=KCT0005078) were retrospectively registered on 06/02/2020. This study was conducted in the period of July to November 2018.

Busch M (2020). Is a probiotic the key to better oral health? *DrBicuspid*. At: <https://www.drbuspid.com/index.aspx?sec=sup&sub=hyg&pag=dis&ItemID=327181>

Sampson V, Kamona N, Sampson A (2020). Could there be a link between oral hygiene and the severity of SARS-CoV-2 infections? *Br Dent J* 228, 971–97 <https://doi.org/10.1038/s41415-020-1747-8> At: <https://www.nature.com/articles/s41415-020-1747-8> Abstract: On 30 January 2020, the World Health Organisation identified COVID-19, caused by the virus SARS-CoV-2, to be a global emergency. The risk factors already identified for developing complications from a COVID-19 infection are age, gender and comorbidities such as diabetes, hypertension, obesity and cardiovascular disease. These risk factors, however, do not account for the other 52% of deaths arising from COVID-19 in often seemingly healthy individuals. This paper investigates the potential link between SARS-CoV-2 and bacterial load, questioning whether bacteria may play a role in bacterial superinfections and complications such as pneumonia, acute respiratory distress syndrome and sepsis. The connection between COVID-19 complications and oral health and periodontal disease is also examined, as the comorbidities at highest risk of COVID-19 complications also cause imbalances in the oral microbiome and increase the risk of periodontal disease. We explore the connection between high bacterial load in the mouth and post-viral complications, and how improving oral health may reduce the risk of complications from COVID-19.

Sampson V (2020). Oral Hygiene Risk Factor. *Brit Dent J* (228): 569. (Letter) <https://doi.org/10.1038/s41415-020-1545-3> At: <https://www.nature.com/articles/s41415-020-1545-3>

Sir, I would like to inform readers about the potential connection between high bacterial load in the mouth and complications associated with COVID-19 infection.

Oral hygiene should be improved during a COVID-19 infection in order to reduce the bacterial load in the mouth and the risk of a bacterial superinfection. We recommend that poor oral hygiene be considered a risk to COVID-19 complications, particularly in patients predisposed to altered biofilms due to diabetes, hypertension or cardiovascular disease. Bacteria present in patients with severe COVID-19 are associated with the oral cavity, and improved oral hygiene may reduce the risk of complications. Whilst COVID-19 has a viral origin, it is suspected that in severe forms of the infection, bacteria plays a part, increasing the chance of complications such as pneumonia, acute respiratory distress syndrome, sepsis, septic shock and death.

The development and severity of complications following a COVID-19 infection depend on numerous host and viral factors that will affect a patient's immune response. Whilst 80% of patients with COVID-19 infections have mild symptoms, 20% progress to have a severe form of infection associated with higher levels of inflammatory markers (Interleukin 2, 6, 10) and bacteria.^{2,3} They also exhibit a remarkably higher neutrophil count and lower lymphocyte count than in mild patients.⁴ A high neutrophil count is abnormal for a viral infection, but common for a bacterial infection, suggesting that in severe cases of COVID-19, bacterial superinfection is common.

The three main comorbidities associated with an increased risk of complications from COVID-19 are diabetes, hypertension and cardiovascular disease.⁵ These comorbidities are also associated with altered oral biofilms and periodontal disease. Periodontopathic bacteria are implicated in systemic inflammation, bacteraemia, and pneumonia.⁶ Bacteria present in the metagenome of patients severely infected with COVID-19 included high reads for *Prevotella*, *Staphylococcus*, and *Fusobacterium*, all usually commensal organisms of the mouth.⁷ Over 80% of patients in ICU exhibited an exceptionally high bacterial load,³ and treatment has been successful with a

dual regime of an antiviral and an antibiotic.⁸ It is clear that bacterial superinfections are common in patients suffering from a severe case of COVID-19.

1. World Health Organization. Clinical management of severe acute respiratory infection when COVID-19 is suspected. Interim guidance, 13 March 2020. Available at: [https://www.who.int/publications-detail/clinical-management-of-severe-acute-respiratory-infection-when-novel-coronavirus-\(ncov\)-infection-is-suspected](https://www.who.int/publications-detail/clinical-management-of-severe-acute-respiratory-infection-when-novel-coronavirus-(ncov)-infection-is-suspected) (accessed April 2020)
2. Gong J. Correlation Analysis Between Disease Severity and Inflammation-related Parameters in Patients with COVID-19 Pneumonia. Tongji Hospital, 2020.
3. Liu J. Neutrophil-to-Lymphocyte Ratio Predicts Severe Illness Patients with 2019 Novel Coronavirus. Beijing Ditan Hospital, 2020.
4. Zheng M, Gao Y, Wang G *et al.* Functional exhaustion of antiviral lymphocytes in COVID-19 patients. *Cell Moll Immunol* 2020; DOI: 10.1038/s41423-020-0402-2.
5. Zhou F, Yu T, Du R *et al.* Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: A retrospective cohort study. *Lancet* 2020; **395**: 1054-1062.
6. Nagaoka K. *Prevotella intermedia* induces severe bacteremic pneumococcal pneumonia in mice with upregulated platelet-activating factor receptor expression. American Society for Microbiology, 2014.
7. Chakraborty S. Metagenome of SARS-Cov2 patients in Shenzhen with travel to Wuhan: OSF Preprints, 2020.
8. Gautret P, Lagier J-C, Parola P *et al.* Hydroxychloroquine and azithromycin as a treatment of COVID-19: Results of an Open-Label Non-randomized trial. *Int J Antimicrob Agents* 2020; DOI: 10.1016/j.ijantimicag.2020.105949.

Pan W, Wang Q, Chen Q (2019). The cytokine network involved in the host immune response to periodontitis. *Int J Oral Sci* 11: 30 (2019). <https://doi.org/10.1038/s41368-019-0064-z> Abstract: Periodontitis is an inflammatory disease involving the destruction of both soft and hard tissue in the periodontal region. Although dysbiosis of the local microbial community initiates local inflammation, over-activation of the host immune response directly activates osteoclastic activity and alveolar bone loss. Many studies have reported on the cytokine network involved in periodontitis and its crucial and pleiotropic effect on the recruitment of specific immunocytes, control of pathobionts and induction or suppression of osteoclastic activity. Nonetheless, particularities in the stimulation of pathogens in the oral cavity that lead to the specific and complex periodontal cytokine network are far from clarified. Thus, in this review, we begin with an up-to-date aetiological hypothesis of periodontal disease and summarize the roles of cytokines in the host immune response. In addition, we also summarize the latest cytokine-related therapeutic measures for periodontal disease.

Chapple ILC, Mealey BL, Van Dyke TE, Bartold PM, Dommisch H, Eickholz P, Geisinger ML, Genco RJ, Glogauer M, Goldstein M, Griffin TJ, Holmstrup P, Johnson GK, Lang NP, Meyle J, Murakami S, Plemmons J, Romito GA, Shapira L, Tatakis DN, Tughels W, Trombelli L, Walter C, Wimmer G, Xenoudi P, Yoshie H (2018). Periodontal health and gingival diseases and conditions on an intact and a reduced periodontium: Consensus report of workgroup 1 of the 2017 World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions. *J Clin Periodont* 45 (Suppl 20)-568-577. DOI: <https://doi.org/10.1111/jcpe.12940> At: <https://onlinelibrary.wiley.com/doi/full/10.1111/jcpe.12940> Abstract: Periodontal health is defined by absence of clinically detectable inflammation. There is a biological level of immune surveillance

that is consistent with clinical gingival health and homeostasis. Clinical gingival health may be found in a periodontium that is intact, i.e. without clinical attachment loss or bone loss, and on a reduced periodontium in either a non-periodontitis patient (e.g. in patients with some form of gingival recession or following crown lengthening surgery) or in a patient with a history of periodontitis who is currently periodontally stable. Clinical gingival health can be restored following treatment of gingivitis and periodontitis. However, the treated and stable periodontitis patient with current gingival health remains at increased risk of recurrent periodontitis, and accordingly, must be closely monitored. --- Two broad categories of gingival diseases include non-dental plaque biofilm–induced gingival diseases and dental plaque-induced gingivitis. Non-dental plaque biofilm-induced gingival diseases include a variety of conditions that are not caused by plaque and usually do not resolve following plaque removal. Such lesions may be manifestations of a systemic condition or may be localized to the oral cavity. Dental plaque-induced gingivitis has a variety of clinical signs and symptoms, and both local predisposing factors and systemic modifying factors can affect its extent, severity, and progression. Dental plaque-induced gingivitis may arise on an intact periodontium or on a reduced periodontium in either a non-periodontitis patient or in a currently stable “periodontitis patient” i.e. successfully treated, in whom clinical inflammation has been eliminated (or substantially reduced). A periodontitis patient with gingival inflammation remains a periodontitis patient (Figure 1), and comprehensive risk assessment and management are imperative to ensure early prevention and/or treatment of recurrent/progressive periodontitis. --- Precision dental medicine defines a patient-centered approach to care, and therefore, creates differences in the way in which a “case” of gingival health or gingivitis is defined for clinical practice as opposed to epidemiologically in population prevalence surveys. Thus, case definitions of gingival health and gingivitis are presented for both purposes. While gingival health and gingivitis have many clinical features, case definitions are primarily predicated on presence or absence of bleeding on probing. Here we classify gingival health and gingival diseases/conditions, along with a summary table of diagnostic features for defining health and gingivitis in various clinical situations.

Holmstrup P, Damgaard C, Olsen I, Klinge B, Flyvbjerg A, Nielsen CH, Hansen PR (2017). Comorbidity of periodontal disease: two sides of the same coin? An introduction for the clinician. *J Oral Microbiol.* 9(1):1332710. DOI: 10.1080/20002297.2017.1332710. PMID: PMC5508374. At: <https://pubmed.ncbi.nlm.nih.gov/28748036/> Abstract: Increasing evidence has suggested an independent association between periodontitis and a range of comorbidities, for example cardiovascular disease, type 2 diabetes, rheumatoid arthritis, osteoporosis, Parkinson's disease, Alzheimer's disease, psoriasis, and respiratory infections. Shared inflammatory pathways are likely to contribute to this association, but distinct causal mechanisms remain to be defined. Some of these comorbid conditions may improve by periodontal treatment, and a bidirectional relationship may exist, where, for example, treatment of diabetes can improve periodontal status. The present article presents an overview of the evidence linking periodontitis with selected systemic diseases and calls for increased cooperation between dentists and medical doctors to provide optimal screening, treatment, and prevention of both periodontitis and its comorbidities. **Keywords:** Alzheimer’s disease; Parkinson’s disease; Periodontitis; cardiovascular disease; comorbidity; low-grade inflammation; osteoporosis; periodontal disease; pneumonia; psoriasis; rheumatoid arthritis; type 2 diabetes.

Tsuchida S, Satoh M, Takuiwaki M, Nomura F (2017). Ubiquitination in Periodontal Disease: A Review *Int J Mol Sci* 18(7): 1476. DOI: [10.3390/ijms18071476](https://doi.org/10.3390/ijms18071476) At: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5535967/> Abstract: Periodontal disease (periodontitis) is a chronic inflammatory condition initiated by microbial infection that leads to gingival tissue destruction and alveolar bone resorption. The periodontal tissue's response to dental plaque is characterized by the accumulation of polymorphonuclear leukocytes, macrophages, and lymphocytes, all of which release inflammatory mediators and cytokines to orchestrate the immunopathogenesis of periodontal disease. Ubiquitination is achieved by a mechanism that involves a number of factors, including an ubiquitin-activating enzyme, ubiquitin-conjugating enzyme, and ubiquitin–protein ligase. Ubiquitination is a post-translational modification restricted to eukaryotes that are involved in essential host processes. The ubiquitin system has been implicated in the immune response, development, and programmed cell death. Increasing numbers of recent reports have provided evidence that many approaches are delivering promising reports for discovering the relationship between ubiquitination and periodontal disease. The scope of this review was to investigate recent progress in the discovery of ubiquitinated protein in diseased periodontium and to discuss the ubiquitination process in periodontal diseases.

Patil A, Mahale S (2017). Cytokines and anti-cytokine therapy in periodontal disease. *IOSR J Dent Med Sci* 16(3): 63-70. DOI: [10.9790/0853-1603026370](https://doi.org/10.9790/0853-1603026370) At: <https://www.iosrjournals.org/iosr-jdms/papers/Vol16-issue3/Version-2/M1603026370.pdf> Abstract: Periodontal disease is initiated by the presence of bacteria on tooth surface but it is the host response that helps in progression of disease. An intermediate mechanism that lies between bacterial stimulation and tissue destruction is the production of cytokines, which stimulates inflammatory events that activate effector mechanisms. There are various classes of cytokines depending on their chemical structure and origin. Owing to the unique mechanism of action, these micromolecules play a very important part in immune host defence. Anticytokine therapy for periodontal diseases especially targets proinflammatory cytokines, that is, TNF- α , IL-1, and IL-6, because these are essential for the initiation of the inflammatory immune reaction and are produced for prolonged periods in periodontitis. This therapy aims to bind the cytokines with the receptors present on target cells such as the fibroblasts. [Note: Chlorhexidine anti-microbial advice would go against theories about nitric oxide and oral microbiome and hypertension. See: Bescos R, Ashworth A, Cutler C, Brookes ZL, Belfield L, Rodiles A, Casas-Agustench P, Farnham G, Liddle L, White D, Easton C, Hickson M (2020.) Effects of Chlorhexidine mouthwash on the oral microbiome. *Sci Rep* 10, 5254 (2020). <https://doi.org/10.1038/s41598-020-61912-4> At: <https://www.nature.com/articles/s41598-020-61912-4?draft=marketing> and Ashworth A, Easton C, Liddle L, Hickson M, Moore M, Bescos R (2019). The effects of antibacterial mouthwash on the oral microbiome: potential consequences for intensive care patients. *Clin Nutr ESPEN* 29: 255-256. DOI: <https://doi.org/10.1016/j.clnesp.2018.12.022> At: [https://clinicalnutritionespen.com/article/S2405-4577\(18\)30659-4/abstract](https://clinicalnutritionespen.com/article/S2405-4577(18)30659-4/abstract)

Genco RJ, Williams RC, editors. Periodontal disease and overall health: A clinician's guide. 2nd ed. Yardley, PA: Professional Audience Communications; 2014. 370 pp. At: <http://www.Colgateprofessional.Com/professional-education/articles/periodontal-disease-and-overall-health-a-clinicians-guide-second-edition>

Prepared for International Conference: "The integration of Primary Care in Dental Practice - A Time That's Come," November 2021.

Wilder RS, Iacopino AM, Feldman CA, Guthmiller J, Linfante J, Livigne S, Paquette D (2008). Periodontal-Systemic Disease Education in U.S. and Canadian Dental Schools *J Dent Educ* 73(1): 35-52. At: <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.494.5786&rep=rep1&type=pdf> Abstract: Research has proliferated in recent years regarding the relationship of oral disease to systemic conditions. Specifically, periodontal disease has been studied as a potential risk factor for multiple conditions such as cardiovascular disease (CVD) and adverse pregnancy outcomes, while other research focuses on exposures or behaviors associated with oral disease. However, few articles have been published reporting how this information is integrated into schools of dentistry, both in the classroom and clinical curriculum. For our study, a thirty-three-item survey and cover letter were electronically mailed to academic deans at sixty-five accredited dental schools in the United States and Canada in the fall of 2007. The response rate was 77 percent. According to the responses to this survey, the primary topics covered in the didactic curriculum regarding periodontal oral-systemic disease are aging, CVD, diabetes, and tobacco use. Eighty-eight percent of the respondents reported that their students are knowledgeable about the role of inflammation and its impact on oral-systemic conditions. Forty-eight percent of the respondents said they provide formal training for their students in how to discuss or communicate aspects of periodontal oral-systemic disease with patients. Only seven schools reported teaching didactic content to dental students intermixed with other health professions students, and only two schools reported conducting joint projects. Only 9 percent of the respondents said they think nurses and physicians are knowledgeable about oral-systemic disease. The findings indicate that dental schools are confident about the knowledge of their students regarding oral-systemic content. However, much work is needed to educate dental students to work in a collaborative fashion with other health care providers to co-manage patients at risk for oral-systemic conditions.

Dörfer C; Benz C; Aida J; Campard G (2017). The relationship of oral health with general health and NCDs: A brief review. *Int. Dent. J.* 67: 14–18. DOI: [10.1111/idj.12360](https://doi.org/10.1111/idj.12360) At: <https://pubmed.ncbi.nlm.nih.gov/29023744/> Abstract: Oral health is closely related to systemic health. Periodontitis, a chronic inflammatory disease which is highly prevalent worldwide, interacts with a variety of noncommunicable diseases (NCDs). It is a risk factor in the complex pathogenesis of diabetes mellitus and cardiovascular disease and plays a role in the development of endocarditis and recurrent pneumonia in elderly people. However, the available data may be interpreted in different ways, and more and better-designed studies are still needed to answer relevant questions about the causal role of periodontitis in NCDs. What is clear is that periodontitis contributes to the systemic inflammatory burden. As periodontitis shares many common risk factors with NCDs, close collaboration between physicians and dentists is needed to increase the chance of early detection and improve the prevention and control of these conditions.

Prasad M, Manjunath C, Murthy AK, Sampath A, Jaiswal S, Mohapatra A (2019). Integration of oral health into primary health care: A systematic review. *J Family Med Prim Care* 8(6): 1838-1845. doi: [10.4103/jfmpc.jfmpc_286_19](https://doi.org/10.4103/jfmpc.jfmpc_286_19) At: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6618181/>

Eke PI, Dye BA, Wei L, Slade GD, Thornton-Evans GO, Borgnakke WS, Taylor GW, Page RC, Beck JD, Genco RJ (2015). Update on Prevalence of Periodontitis in Adults in the United States:

Prepared for International Conference: "The integration of Primary Care in Dental Practice - A Time That's Come," November 2021.

NHANES 2009 to 2012. *J Periodontol* 86(5): 611-622. doi: 10.1902/jop.2015.140520. Epub 2015 Feb 17. At: <https://www.ncbi.nlm.nih.gov/pubmed/25688694> Abstract: This study estimated the prevalence, severity, and extent of periodontitis in the adult U.S. population, with data from the 2009 and 2010 National Health and Nutrition Examination Survey (NHANES) cycle. Estimates were derived from a sample of 3,742 adults aged 30 years and older, of the civilian non-institutionalized population, having 1 or more natural teeth. Attachment loss (AL) and probing depth (PD) were measured at 6 sites *per* tooth on all teeth (except the third molars). Over 47% of the sample, representing 64.7 million adults, had periodontitis, distributed as 8.7%, 30.0%, and 8.5% with mild, moderate, and severe periodontitis, respectively. For adults aged 65 years and older, 64% had either moderate or severe periodontitis. Eighty-six and 40.9% had 1 or more teeth with AL \geq 3 mm and PD \geq 4 mm, respectively. With respect to extent of disease, 56% and 18% of the adult population had 5% or more periodontal sites with \geq 3 mm AL and \geq 4 mm PD, respectively. Periodontitis was highest in men, Mexican Americans, adults with less than a high school education, adults below 100% Federal Poverty Levels (FPL), and current smokers. This survey has provided direct evidence for a high burden of periodontitis in the adult U.S. population.

Manjunath BC, Praveen K, Chandrahekar BR, Vatchala Rani RM, Bhalla A (2011). Periodontal infections: A risk factor for various systemic diseases. *Natl Med J India* 24: 214-219. At: https://www.researchgate.net/profile/B_R_Chandra_Shekar/publication/51971750_Periodontal_infections_A_risk_factor_for_various_systemic_diseases/links/55a7b97f08ae8c88495195e6/Periodontal-infections-A-risk-factor-for-various-systemic-diseases.pdf Abstract: A healthy periodontium is vital for the general well-being of an individual. However, periodontal diseases are common and periodontal infections are increasingly associated with systemic diseases. We aimed to critically evaluate the literature on the association between periodontal infections and systemic diseases. We searched the PubMed database over a 20-year period for literature on periodontal diseases and their links to various systemic diseases, and examined the strength of association between periodontal disease and each systemic disease, the dose–response relationship, and the biological plausibility. We found that individuals with periodontal disease may be at higher risk for adverse medical outcomes including cardiovascular diseases, respiratory infections, adverse pregnancy outcomes, rheumatoid arthritis and diabetes mellitus. Many cohort, in vitro and animal studies suggest that systemic inflammation due to pathogens associated with periodontal disease may play a role in the initiation and progression of some systemic diseases. Periodontal infections should therefore be considered as a risk factor for various systemic diseases.

Nazir MA, Akhtar K, Almas K (2019). Dentists' awareness about the link between oral and systemic health. *J Family Community Med* 26(3): 206-212. doi: [10.4103/jfcm.JFCM_55_19](https://doi.org/10.4103/jfcm.JFCM_55_19) At: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6755758/> Abstract: **Background** Oral health is integral to systemic health. There is a growing body of evidence of an association between periodontal and systemic diseases. The aim of the study was to evaluate the awareness of dentists regarding link between oral and systemic health. **Materials and Method:** Data was collected using a self-administered pilot-tested questionnaire. Dentists awareness about link

between oral and systemic link was assessed on five point likert scale. Data was entered and analysed using SPSS. **Results** Of the 588 dentists, 500 completed the questionnaire (response rate 85.03%). About 93% of the participants (mean age 25.82 ± 4.21 years) agreed that oral health was associated with systemic health. Most dentists were aware of a connection between periodontal disease and diabetes (84.4%) and heart disease (70.2%). Similarly, 85.6% believed in the negative impact of oral disease on the quality of life of patients. More female than male dentists were aware of the relationship between periodontal disease and adverse pregnancy outcomes, diabetes, and rheumatoid arthritis ($P < 0.001$). Most dentists (97%) believed that more patients would seek oral care if they were aware of the oral-systemic link. After adjustments, private dentists were 4.65 times more likely than public dentists to believe in improving access to oral care with increased patient awareness of the oral-systemic connection ($P = 0.011$). **Conclusions** Most dentists were aware of the oral-systemic link. They believed that patients' access to oral care would improve if they were aware of a connection between oral and systemic health. Therefore, patients should be informed of the oral-systemic link to improve their oral health.

Pedersen AML (ed) (2016). *Oral Infections and General Health: From Molecule to General Health*. Springer-Nature. ISBN 978-3-319-25091-5 <https://www.springer.com/gp/book/9783319250892> Abstract: This book provides a wide-ranging update on the associations between oral infections and general health. Detailed consideration is given to the underlying mechanisms or pathways linking oral infections to general health, including metastatic spread of infection from the oral cavity as a result of transient bacteremia, metastatic injury from the effects of circulating oral microbial toxins, and metastatic inflammation caused by immunological dysfunction induced by oral microorganisms. The book also reviews the complex structure and development of oral biofilms in health and disease, and the molecular tools that are currently available for their analysis. The advantages and limitations of such techniques, as well as their impact on the future of diagnostics, prevention and patient management, are discussed.

Acharya A, VanWormer JJ, Waring SC, Miller AW, Fuehrer JT, Nycz GR (2013). Regional Epidemiological Assessment of Prevalent Periodontitis Using an Electronic Health Record System. *Am J Epidemiol* 177(7): 700-707. DOI: 10.3121/cmr.2012.1100.ps1-37 at: <https://academic.oup.com/aje/article/177/7/700/91274> Abstract: An oral health surveillance platform that queries a clinical/administrative data warehouse was applied to estimate regional prevalence of periodontitis. Cross-sectional analysis of electronic health record data collected between January 1, 2006, and December 31, 2010, was undertaken in a population sample residing in Ladysmith, Wisconsin. Eligibility criteria included: 1) residence in defined zip codes, 2) age 25–64 years, and 3) ≥ 1 Marshfield dental clinic comprehensive examination. Prevalence was established using 2 independent methods: 1) via an algorithm that considered clinical attachment loss and probe depth and 2) via standardized Current Dental Terminology (CDT) codes related to periodontal treatment. Prevalence estimates were age-standardized to 2000 US Census estimates. Inclusion criteria were met by 2,056 persons. On the basis of the American Academy of Periodontology/Centers for Disease Control and Prevention method, the age-

standardized prevalence of moderate or severe periodontitis (combined) was 407 per 1,000 males and 308 per 1,000 females (348/1,000 males and 269/1,000 females using the CDT code method). Increased prevalence and severity of periodontitis was noted with increasing age. Local prevalence of periodontitis was consistent with national estimates. The need to address potential sample selection bias in future electronic health record–based periodontitis research was identified by this approach. Methods outlined herein may be applied to refine oral health surveillance systems, inform dental epidemiologic methods, and evaluate interventional outcomes.

Cappuyns I, Gugerli P, Mombelli A (2005). Viruses in periodontal disease - a review. *Oral Dis* 11(4): 219-229. DOI: [10.1111/j.1601-0825.2005.01123.x](https://doi.org/10.1111/j.1601-0825.2005.01123.x) At : <https://www.ncbi.nlm.nih.gov/pubmed/15984953> Abstract: The purpose of this review was to evaluate the evidence supporting the hypothesis that viral infection plays a role in the development of periodontitis. An involvement in periodontal diseases has been suspected specifically for human immunodeficiency virus (HIV) and herpes viruses. An association has been demonstrated between HIV infection and some distinct forms of periodontal infection, i.e. necrotizing lesions. Furthermore, reports of increased prevalence and severity of chronic periodontitis in HIV-positive subjects suggests that HIV infection predispose to chronic periodontitis. Several studies, most of them from the same research group, have demonstrated an association of herpesviruses with periodontal disease. Viral DNA have been detected in gingival tissue, gingival cervical fluid (GCF) and subgingival plaque from periodontally diseased sites. In addition markers of herpesviral activation have been demonstrated in the GCF from periodontal lesions. Active human cytomegalovirus (HCMV) replication in periodontal sites may suggest that HCMV re-activation triggers periodontal disease activity. Concerns regarding sampling, methods and interpretation cast doubts on the role of viruses as causes of periodontal disease.

Craig RG, Boylan R, Yip J, Bamgboye P, Koutsolukos J, Mijares D, Ferrar J, Imam M, Socransky SS, Haffajee AD (2001). Prevalence and risk indicators for destructive periodontal diseases in 3 urban American minority populations. *J Clin Periodontol* 28(6): 524-535. DOI:[10.1034/j.1600-051x.2001.028006524.x](https://doi.org/10.1034/j.1600-051x.2001.028006524.x) At: <https://www.ncbi.nlm.nih.gov/pubmed/11350519> From Abstract: RESULTS: The African-American group had more missing teeth, deeper periodontal pocket depth and more attachment loss than the Asian-American or Hispanic groups. However, the African-American group were less likely to report having a private dentist, had a greater proportion of smokers and a greater proportion of unskilled individuals. The profile of subgingival species differed among the three ethnic/racial groups with *A. actinomycetemcomitans*, *N. mucosa*, *S. noxia* and *T. socranskii* significantly elevated in the Asian-American group and *P. micros* significantly elevated in the African-American group. When subset by occupational status, numbers of missing teeth, pocket depth, attachment level and prior disease activity were all found increased in the unskilled relative to the professional group. Local factors including the mean % of sites with plaque, marginal gingival erythema, bleeding upon probing and suppuration were also elevated in the unskilled group. The microbial profile differed among the 3 occupational groups with the unskilled group having elevated numbers of species associated with destructive periodontal diseases. CONCLUSIONS: Although greater

destructive periodontal disease prevalence and severity were found in the African-American group, these results suggest that environmental and demographic variables, such as occupational status, may have a greater influence on risk indicators associated with disease prevalence and progression in these populations.

Inflammation

Freire M, Van Dyke TE, “The Role of Inflammation in Oral-Systemic Interactions,” Chapter 4, Glick M, Ed. (2019) ed., *The Oral-Systemic Health Connection: A Guide to Patient Care*, 2nd ed. (Quintessence, LCCN 2018044816), pp. 86-101.

Oral Manifestations, Screening for Periodontal Disease

Nomura Y, Okada A, Kakuta E, Gunii T, Kajiura S, Hanada N (2016). A new screening method for periodontitis: an alternative to the community periodontal index. *BMC Oral Health* 16:64. doi: [10.1186/s12903-016-0216-x](https://doi.org/10.1186/s12903-016-0216-x) At: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4937556/>
Abstract: **Background** - Periodontal screening plays an important role in the prevention of periodontal disease and promotes an improvement in oral health-related quality of life. The World Health Organization’s Community Periodontal Index should be carried out by well-trained dentists. However, the Community Periodontal Index is an invasive technique, and if used for periodontal screening, increases the cost of evaluation. In order to overcome these issues, we developed saliva tests for periodontal screening. The purpose of this study was to calculate the sensitivity and specificity of our method for measuring hemoglobin and lactate dehydrogenase levels in saliva. **Methods** - Inclusion criteria were adults aged over 20 years with at least 20 teeth remaining. The study population comprised 38 men and 54 women with a mean age of 50.03 years. Oral examinations were carried out by dentists, and the number of remaining teeth, presence or absence of calculus, bleeding on probing and pocket depth were recorded. In this study, periodontitis was defined according to the criteria of the Center for Disease Control and Prevention in partnership with the American Academy of Periodontology. In order to examine hemoglobin and lactate dehydrogenase levels in saliva, participants were instructed to chew on a standard-sized tasteless and odorless gum base for 5 min, during which time, stimulated whole saliva was continuously collected. **Results** - The sensitivity and specificity for hemoglobin levels were 0.759 and 0.763, respectively, and 0.722 and 0.711, respectively, for lactate dehydrogenase levels. Combining these two tests, when samples tested positive for both hemoglobin and lactate dehydrogenase, the positive predictive value was 91.7 %. **Conclusion** Measuring hemoglobin and lactate dehydrogenase levels in saliva is a less invasive method than the Community Periodontal Index. Therefore, our saliva tests may be a viable alternative to the Community Periodontal Index for periodontal screening.

Fazel N, ed. (2019). *Oral Signs of Systemic Disease*. Springer. ISBN 978-3-030-10863-2

Napeñas JJ, ed. (2017). *Oral Manifestations of Systemic Diseases, An Issue of Atlas of the Oral & Maxillofacial Surgery Clinics (Volume 25-2) (The Clinics: Dentistry (Volume 25-2))* 1st Edition ISBN-13:978-0323545426.

Colorectal Cancer

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Lo C-H, Nguyen LH, Wu K, Ogino S, Chan AT, Giovannuci EL, Song M (2020). Periodontal Disease, Tooth Loss, and Risk of Serrated Polyps and Conventional Adenomas. *Cancer Prev Res* 13(8): 699-706. DOI: 10.1158/1940-6207.CAPR-20-0090 At: <https://cancerpreventionresearch.aacrjournals.org/content/13/8/699.abstract> Abstract: Growing data indicate an association between periodontal disease and the development of cancer. However, the evidence for colorectal cancer has been inconsistent and longitudinal study examining its precursor lesions is lacking. We prospectively collected information on periodontal disease and number of tooth loss in the Nurses' Health Study (1992–2002) and the Health Professionals Follow-up Study (1992–2010). Polyp diagnosis was acquired via self-reported questionnaires and confirmed through review of medical records. We used logistic regression to calculate the multivariate-adjusted ORs and 95% confidence intervals (CI) with adjustment for smoking and other known risk factors for periodontal disease and colorectal cancer. In this study, we included 17,904 women and 24,582 men. We documented 2,336 cases of serrated polyps and 4,102 cases of conventional adenomas among 84,714 person-endoscopies throughout follow-up. The ORs of serrated polyps and conventional adenomas comparing individuals with and without periodontal disease were 1.17 (95% CI, 1.06–1.29) and 1.11 (95% CI, 1.02–1.19), respectively. Compared with participants without tooth loss, those who lost ≥ 4 teeth had 20% (OR, 1.20; 95% CI, 1.03–1.39) greater risk of serrated polyps (P_{trend} 0.01). Among never smokers, similar associations with periodontal disease were observed for both serrated polyps (OR, 1.20; 95% CI, 1.02–1.41) and conventional adenomas (OR, 1.12; 95% CI, 1.00–1.26). History of periodontal disease and possibly higher number of tooth loss may modestly increase the risk of developing colorectal precursor lesions. Our

Periodontal Disease and Diabetes 2, Metabolic Syndrome

Schmalz G, Wolf C, Merle C, Kottmann T, Haak R, Ziebolz D (2020). Evaluation of a questionnaire-based diabetes screening concept in German patients with Stage 3 or 4 periodontitis – A practice-based study. *J Periodontol*;1–8. DOI: <https://doi.org/10.1002/JPER.20-0297> At: <https://pubmed.ncbi.nlm.nih.gov/33155276/> Abstract: **Background:** This practice-based retrospective study evaluated a screening method for diabetes (DM) in patients with stage 3 or 4 periodontitis using the FINDRISC questionnaire. **Methods:** Patients with stage 3 or 4 periodontitis who received FINDRISC screening in a German private dental practice were recruited. Individuals with positive FINDRISC scores (≥ 12 , FINDRISC+) were referred for diabetological examination. Several general and periodontal findings from the patients' documentation were recorded and analyzed. **Results:** A total of 179 patients (52.65 ± 11.49 years) were included. In DM screening, 24.6% ($n = 44$) patients were FINDRISC+, including all patients with currently known DM (21/21). Of the remaining FINDRISC+ patients, 82.6% (19/23) visited their general practitioner, and 63.2% (12/19, 7.6% of total cohort) had an HbA1c $\geq 5.7\%$. Accordingly, 75% of the FINDRISC+ patients were diabetologically conspicuous (HbA1c $\geq 5.7\%$), including those with already known DM. Patients with previously unknown DM showed higher mean age, more missing teeth, a higher periodontitis stage (more stage 4) and more frequently teeth with suppuration compared to the diabetologically inconspicuous individuals ($p < 0.01$). **Conclusion:** The FINDRISC questionnaire is appropriate for patients with stage 3 or 4 periodontitis and can be recommended in dental practice setting. This article is protected by copyright. All rights reserved. **Keywords:** Diabetes mellitus; Periodontal Medicine; Periodontitis.

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Taylor HL, Rahurkar S, Treat J, Thyvalikakath TP, Schleyer TK (2020). Does Nonsurgical Periodontal Treatment Improve Systemic Health? *J Dent Res* : 22034520965958. DOI: 10.1177/0022034520965958. At: <https://pubmed.ncbi.nlm.nih.gov/33089733/> Online ahead of print. Abstract: Clinicians frequently stress the importance of maintaining good oral health for multiple reasons, including its link to systemic health. Because periodontal treatment reduces inflammation in oral tissues, some hypothesize it may positively affect systemic outcomes by reducing inflammation in the body. A significant number of systematic reviews (SRs) and meta-analyses (MAs) have evaluated the effect of periodontal treatment on systemic outcomes. However, inconsistent findings and questionable methodological rigor make drawing conclusions difficult. We conducted a systematic review of reviews that studied the effect of nonsurgical periodontal treatment on systemic disease outcomes. We report on outcomes evaluated, categorizing them as biomarkers, and surrogate or clinical endpoints. In addition, we used A Measurement Tool to Access systematic Reviews 2 (AMSTAR 2) to evaluate the methodological quality of the reviews. Of the 52 studies included in our review, 21 focused on diabetes, 15 on adverse birth outcomes, 8 on cardiovascular disease, 3 each on obesity and rheumatoid arthritis, and 2 on chronic kidney disease. Across all studies, surrogate endpoints predominated as outcomes, followed by biomarkers and, rarely, actual disease endpoints. Ninety-two percent of studies had "low" or "critically low" AMSTAR 2 confidence ratings. Criteria not met most frequently included advance registration of the protocol, justification for excluding individual studies, risk of bias from individual studies being included in the review, and appropriateness of meta-analytical methods. There is a dearth of robust evidence on whether nonsurgical periodontal treatment improves systemic disease outcomes. Future reviews should adhere more closely to methodological guidelines for conducting and reporting SRs/MAs than has been the case to date. Beyond improved reviews, additional rigorous research on whether periodontal treatment affects systemic health is needed. We highlight the potential of large-scale databases containing matched medical and dental record data to inform and complement future clinical research studying the effect of periodontal treatment on systemic outcomes. **Keywords:** biomarkers; clinical outcomes; inflammation; oral-systemic disease; periodontal disease; periodontal medicine.

Wisconsin Dept. of Health Services (2020). *Wisconsin Diabetes Mellitus Essential Care Guidelines*. At: <https://www.dhs.wisconsin.gov/diabetes/guidelines.htm> **Oral Care: (1) Medical-Dental Team Referral Form:** <https://www.dhs.wisconsin.gov/publications/p49356-med-dent.pdf> **(2) Diabetes: Screening Tool for Inspection of Gums and Teeth:** <https://www.dhs.wisconsin.gov/publications/p49356-gums.pdf>

Lamster IB, Lanado N, Fennoy I, "Obesity, Metabolic Syndrome, and Oral Health," Chapter 5, Glick M, Ed. (2019) ed., *The Oral-Systemic Health Connection: A Guide to Patient Care*, 2nd ed. (Quintessence, LCCN 2018044816), pp. 102-134.

Borgnakke WS, Genco RJ, "Associations Between Periodontal Disease and Hyperglycemia/ Diabetes," Chapter 6, Glick M, Ed. (2019) ed., *The Oral-Systemic Health Connection: A Guide to Patient Care*, 2nd ed. (Quintessence, LCCN 2018044816), pp. 164-179.

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Lamster IB, ed. (2014). *Diabetes Mellitus and Oral Health: An Interprofessional Approach* (Wiley) 258 pp

Glurich I, Schwei KM, Lindberg S, Shimpi N, Acharya A (2018). Integrating Medical-Dental Care for Diabetic Patients: Qualitative Assessment of Provider Perspectives. *Health Promot Pract* 19(4): 531-541. doi: [10.1177/1524839917737752](https://doi.org/10.1177/1524839917737752) At: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5878963/> Abstract: Globally, periodontal disease and diabetes have achieved epidemic proportions and have become a top healthcare priority. Mutual bidirectional exacerbation of these conditions driven by underlying inflammatory processes has been demonstrated. Creation of cross-disciplinary integrated care delivery (ICD) models that bridge the traditionally-siloed healthcare domains of dentistry and medicine are being advanced to improve management of both conditions. By engaging focus groups inclusive of both medical and dental providers and one-on-one interviews, this qualitative study investigated provider knowledgeability, receptiveness, and readiness to engage ICD and sought input from the medical/dental primary care practitioner participants on perceived opportunities, benefits, and challenges to achieving ICD models for patients with diabetes/prediabetes. Statewide regional representation and inclusivity of diverse practice settings were emphasized in soliciting participants. Thematic analysis of focus group and interview transcripts was undertaken to establish current state-of-the-art, gauge receptivity to alternative ICD models, and seek insights from practitioners surrounding opportunities and barriers to ICD achievement. Forty providers participated, and thematic analyses achieved saturation. Providers were well informed regarding disease interaction, receptive to ICD, including implementation of better screening and referral processes, and favored improving interdisciplinary communication inclusive of access to integrated electronic health records. Perceived barriers and opportunities communicated by participants for advancing ICD were documented.

Gurav AN (2014). The association of periodontitis and metabolic syndrome. *Dent Res J (Isfahan)* 11(1): 1-10. DOI: [10.4103/1735-3327.127175](https://doi.org/10.4103/1735-3327.127175) At: <https://www.ncbi.nlm.nih.gov/pubmed/24688553> Abstract: Metabolic syndrome (MS) is a condition, which constitutes a group of risk factors that occur together and increase the risk for Coronary Artery Disease, Stroke and type 2 diabetes mellitus. This disorder is found prevalent in the industrialized societies of the world in epidemic proportions. Periodontitis is an oral disease of microbial origin characterized by loss of attachment apparatus of tooth, resulting in edentulism if untreated. Periodontitis has been attributed to produce a low grade systemic inflammatory condition. The link of periodontitis to various systemic disorders has led to the evolution of a new branch termed as "periodontal medicine." Studies reviewed in the present paper have indicated a positive link between the MS and periodontitis and it is suggested that subjects displaying several components of MS should be submitted to periodontal examination. Present studies have displayed coherent relation between the two entities. This review will address the vicious association between MS and periodontitis, depicting the commonality of pathophysiological pathway between the two entities. Systematic reviews, meta-analysis addressing the concerned subject were screened. Whether the systematic periodontal therapy in individuals exhibiting MS has the potential to reduce the incidence of various adverse systemic complications remains a logical proposition.

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Further, longitudinal and controlled trials with a large population would be imperative to depict the robustness in the association between MS and periodontal disease in human subjects.

MA DSRIP (2020). Oral Health Integration for MassHealth ACOs. At: <https://www.ma-dsrip-ta.com/wp-content/uploads/2020/09/Oral-Health-FAQ-Factsheet.pdf> Summary: Why is integrating oral health into physical healthcare important for ACOs? • Tooth decay impairs quality of life. Tooth decay is the most common chronic childhood disease, and when left untreated, can affect a person's ability to speak and communicate, eat nutritious foods, sleep, play, learn, and work.² • Poor oral health negatively impacts overall health. Nearly 22% of individuals living with diabetes also have periodontal (gum) disease. Gum disease increases inflammation in the body which can make it more difficult for diabetic patients to control their blood sugar.³ • Despite access to care, oral health disparities persist. Children and adolescents from low-income families are more likely than higher-income peers to have untreated dental caries.⁴ • Poor oral health can be costly. Integration of oral health into primary care increases utilization of preventive dental services, thereby reducing costs.

Fisketjon PM, Johnson EL (2018). Periodontal Disease and Diabetes: Perceptions, Communication, and Referral Between Rural Primary Care Physicians and Dentists. *Diabetes Spectrum* ds170049. <https://doi.org/10.2337/ds17-0049> At: <https://spectrum.diabetesjournals.org/content/early/2018/04/06/ds17-0049> Abstract: **Background and objective.** Connections between oral health and systemic disease, specifically diabetes, are well described in the literature. Screening strategies for diabetes in dental settings and dental screenings in diabetes care settings exist. The purpose of this study was to evaluate the communication and referral patterns between dentists and physicians in a rural state with respect to recognition of dental disease and diabetes. **Methods.** Surveys were sent to the members of the North Dakota Academy of Family Physicians, the North Dakota Medical Association, and the North Dakota Dental Association. **Results.** Overall, 92 responses were collected, with 100% of responding physicians and 55% of responding dentists answering “yes” to a perceived link between oral and systemic health. Physician respondents tended to make a referral for dental evaluation in patients with prediabetes or diabetes more often than dentists referred patients with periodontal disease to physicians. **Conclusion.** Awareness of the link between dental disease and diabetes and of the need for referral is higher among physicians than among dentists. Opportunity exists to improve awareness and increase referrals

Verhulst MJL, Teeuw WJ, Bizzarro S *et al* (2019). A rapid, non-invasive tool for periodontitis screening in a medical care setting. *BMC Oral Health* (19) 87. <https://doi.org/10.1186/s12903-019-0784-7> At: <https://bmcoralhealth.biomedcentral.com/articles/10.1186/s12903-019-0784-7> Abstract: Background - Since periodontitis is bi-directionally associated with several systemic diseases, such as diabetes mellitus and cardiovascular diseases, it is important for medical professionals in a non-dental setting to be able examine their patients for symptoms of periodontitis, and urge them to visit a dentist if necessary. However, they often lack the time, knowledge and resources to do so. We aim to develop and assess “quick and easy” screening tools for periodontitis, based on self-reported oral health (SROH), demographics and/or salivary biomarkers, intended for use by medical professionals in a non-dental setting. Methods -

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Consecutive, new patients from our outpatient clinic were recruited. A SROH questionnaire (8 questions) was conducted, followed by a 30 s oral rinse sampling protocol. A complete clinical periodontal examination provided the golden standard periodontitis classification: no/mild, moderate or severe periodontitis. Total periodontitis was defined as having either moderate or severe. Albumin and matrix metalloproteinase-8 concentrations, and chitinase and protease activities were measured in the oral rinses. Binary logistic regression analyses with backward elimination were used to create prediction models for both total and severe periodontitis. Model 1 included SROH, demographics and biomarkers. The biomarkers were omitted in the analysis for model 2, while model 3 only included the SROH questionnaire. The area under the receiver operating characteristic curves (AUROCC) provided the accuracy of each model. The regression equations were used to create scoring algorithms, composed of the remaining predictors, each with its own weight. Results - Of the 156 patients participating in this study, 67% were classified with total periodontitis and 33% had severe periodontitis. The models for total periodontitis achieved an AUROCC of 0.91 for model 1, 0.88 for model 2 and 0.81 for model 3. For severe periodontitis, this was 0.89 for model 1, 0.82 for model 2 and 0.78 for model 3. The algorithm for total periodontitis (model 2), which we consider valid for the Dutch population, was applied to create a freely accessible, web-based screening tool. Conclusions - The prediction models for total and severe periodontitis proved to be feasible and accurate, resulting in easily applicable screening tools, intended for a non-dental setting.

Glurich I, Shimpu N, Scannapieco F, Vedre J, Acharya A (2019). "Interdisciplinary Care Model: Pneumonia and Oral Health," Chapter 9, Acharya A et al. (2019), eds. *Integration of Medical and Dental Care and Patient Data*, 2nd Ed., pp. 123-139. ISBN 978-3-319-98296-0. Springer-Nature.

McKernan SC, Kuthy RA, Reynolds JC, Tuggle L, García DT (2018). Medical-Dental Integration in Public Health Settings: An Environmental Scan. At: http://ppc.uiowa.edu/sites/default/files/ced_environmental_scan.pdf Executive Summary: Noncommunicable chronic diseases (NCDs) account for almost 90% of total deaths in the United States. The four most common NCDs—cardiovascular diseases, diabetes, cancers, and chronic respiratory diseases—share common risk factors, including cigarette use, alcohol use, and dietary behaviors associated with obesity and elevated blood sugar. The most common oral diseases—dental caries, periodontal disease, and oral cancer—also share these same risk factors. A coordinated approach to primary prevention, the "common risk factor approach," argues that coordinated primary prevention of oral and systemic diseases will reduce programmatic costs, and increase efficiency and effectiveness. However, use and evaluation of this coordinated approach in primary prevention activities in the United States has not been well documented. This report describes the results of an environmental scan to identify, categorize, and describe examples of medical-dental integration in US public health settings. Findings are intended to inform public health officials and other stakeholders about existing programs and policies that encourage coordination and integration. Conclusion: Public health activities targeting oral health and chronic diseases operate at multiple levels, including public policy, community-level campaigns, health care delivery systems, and clinical interventions. Well-developed efforts were especially noted for environmental approaches targeting sugar-sweetened beverage consumption, state-level efforts

targeting tobacco use and oral cancer, and co-location of medical and dental services. The lack of robust evaluation and effectiveness data surrounding most of the activities described in this report may hamper widespread implementation, sustainability, and stakeholder support.

Pumerantz AS, Bissett SM, Dong F, Ochoa C, Wassall RR, Davila H, Barbee M, Nguyen J, Vila P, Preshaw PM (2017) Standardized screening for periodontitis as an integral part of multidisciplinary management of adults with type 2 diabetes: an observational cross-sectional study of cohorts in the USA and UK. *BMJ Open Diabetes Res Care* 5(1):e000413 DOI: <http://dx.doi.org/10.1136/bmjdr-2017-000413> At: <https://drc.bmj.com/content/5/1/e000413> or <https://www.ncbi.nlm.nih.gov/pubmed/28761663> Abstract: **Objective** To determine prevalence and factors predictive of periodontitis by using a standardized assessment model in adults with type 2 diabetes. **Research design and methods** We performed an observational cross-sectional study to determine the burden of periodontitis in adults with type 2 diabetes attending urban, ambulatory referral centers in the USA and UK. Full-mouth probing was performed and periodontitis was diagnosed based on either a low (≥ 5 mm at ≥ 1 site) or high pocket probing-depth threshold (≥ 6 mm at ≥ 1 site). Results were stratified into a five-stage schema and integrated with other clinical variables into the novel Diabetes Cross-Disciplinary Index to function as a balanced health scorecard. Corresponding demographic and routinely collected health data were obtained and comparisons were made between patients with and without periodontitis. Multivariable logistic regression was performed to identify factors predictive of the presence or absence of periodontitis. **Results** Between our two cohorts, 253 patients were screened. Caucasians comprised $>90\%$ and Hispanic Americans $>75\%$ of the UK and US cohorts, respectively. Males and females were equally distributed; mean age was 53.6 ± 11 years; and 17 (6.7%) were edentulous. Of the 236 dentate patients, 128 (54.2%) had periodontitis by low threshold and 57 (24.2%) by high threshold. Just 17 (7.2%) were periodontally healthy. No significant differences in age, HbA1c, blood pressure, body mass index, low-density lipoprotein cholesterol, or smoking status (all $p > 0.05$) were identified between those with or without periodontitis (regardless of threshold) and none was found to be a significant predictor of disease. **Conclusions** Periodontitis is frequent in adults with type 2 diabetes and all should be screened. Periodontal health status can be visualized with other comorbidities and complications using a novel balanced scorecard that could facilitate patient–clinician communication, shared decision-making, and prioritization of individual healthcare needs.

Glurich I, Nycz G, Acharya A (2017). Status Update on Translation of Integrated Primary Dental-Medical Care Delivery for Management of Diabetic Patients. *Clin Med Res* 15(1-2): 21-32. doi: 10.3121/cm.2017.1348. Epub 2017 Apr 3 At: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5572842/> Abstract: Escalating prevalence of both diabetes and periodontal disease, two diseases associated with bi-directional exacerbation, has been reported. Periodontal disease represents a modifiable risk factor that may reduce diabetes onset or progression, and integrated models of cross-disciplinary care are needed to establish and manage glycemic control in affected patients. An ad-hoc environmental scan of current literature and media sought to characterize factors impacting status of integrated care models based on review of the existing evidence base in literature and media surrounding: (1) current cross-disciplinary practice patterns, (2) epidemiological updates, (3) status on risk assessment and screening for dysglycemia in the dental setting, (4) status on implementation of quality metrics for oral health, (5) care model pilots, and (6) public health perspectives. The survey revealed: escalating

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prevalence of diabetes and periodontitis globally; greater emphasis on oral health assessment for diabetic patients in recent medical clinical practice guidelines; high knowledgeability surrounding oral-systemic impacts on diabetes and growing receptivity to medical-dental integration among medical and dental providers; increasing numbers of programs/studies reporting on positive impact of emerging integrated dental-medical care models on diabetic patient healthcare access and health outcomes; a growing evidence base for clinically significant rates of undiagnosed dysglycemia among dental patients reported by point-of-care pilot studies; no current recommendation for population-based screening for dysglycemia in dental settings pending a stronger evidence base; improved definition of true periodontitis prevalence in (pre)/diabetics; emerging recognition of the need for oral health quality indicators and tracking; evidence of persistence in dental access disparity; updated status on barriers to integration. The potential benefit of creating clinically-applicable integrated care models to support holistic management of an escalating diabetic population by targeting modifiable risk factors including periodontitis is being recognized by the health industry. Cross-disciplinary efforts supported by high quality research are needed to mitigate previously- and newly-defined barriers of care integration and expedite development and implementation of integrated care models in various practice settings. Implementation of quality monitoring in the dental setting will support definition of the impact and efficacy of interventional clinical care models on patient outcomes.

Teeuw WJ Gerdes VEA, Loos BGG (2010). Effect of Periodontal Treatment on Glycemic Control of Diabetic Patients: A systematic review and meta-analysis. *Diabetes Care* 33(2): 421-427. At: <https://care.diabetesjournals.org/content/33/2/421> DOI:: <https://doi.org/10.2337/dc09-1378>

Periodontal Disease and Diabetes 1

Duda-Sobczak A, Zozulinska-Ziolkiewicz D, Wyganowska-Swiatkowska M (2018). Type 1 Diabetes and Periodontal Health. *Clin Therapeut* 40(6): 823-827. DOI: <https://doi.org/10.1016/j.clinthera.2018.01.011> At: Abstract: It is well established that hyperglycemia affects periodontal outcomes. A body of evidence, predominantly over the past 20 years supports significant independent associations between periodontal disease and glycemic control or complications of diabetes. Association between periodontal tissue and hyperglycemia is possible through altered cellular immunity, increased proliferation of bacteria, microangiopathy, and formation of the advanced glycation end products. However, most studies focus solely on patients with type 2 diabetes or diabetes in general. There is still the paucity of data concerning patients with type 1 diabetes (T1D). Here, the authors consider the possible mechanisms linking periodontal disease with diabetes, focusing mainly on T1D and discuss possible diagnostic and therapeutic approaches.

Duran-Merino D, Molina-Frechero N, Castañeda-Castaneira E, Gaona E, Reyes-Reyes RE, Tremillo-Maldonado O, del Muro-Delgado R, Juárez-López ML and Bologna-Molina R (2017). Relationship between Periodontal Disease and Type 1 Diabetes in Adolescents. *Ann Med & Health Sci Res* 7: 350-354. DOI: [10.1155/2015/379626](https://doi.org/10.1155/2015/379626) At: <https://www.amhsr.org/articles/relationship-between-periodontal-disease-and-type-1-diabetes-in-adolescents.pdf> Abstract: Aim: The aim of this study was to evaluate the prevalence and severity of periodontal disease (PD) in adolescents with type 1 diabetes mellitus (DM) and assess the relationship with the clinical and metabolic control of diabetes in adolescents. Material and Methods: A descriptive

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and analytical study was conducted in patients of both sexes who had a definite diagnosis of type 1 DM and diabetes duration of at least 3 years. An odontologist evaluated PD using the American Dental Association criteria. The measured glycosylated hemoglobin (HbA1c) levels revealed an association between PD and the duration and metabolic control of DM. Results: One hundred and one patients with an average age of 15.02 ± 1.216 years were studied; 59.4% were female. Adolescents with a shorter diabetes duration (3 to 5 years) had a lower prevalence of PD (65.6% versus 34.4%); and for those with a disease duration > 6 years, stages II-IV PD predominated (56.8%, $p < 0.05$). The most severe stages of PD were present in young people with $\geq 9\%$ HbA1c ($p < 0.001$). Males had a higher prevalence of PD than females in terms of disease duration and metabolic control of diabetes ($p < 0.05$). **Conclusion:** The severity of PD was associated with the duration of diabetes and higher glycemic levels, with worse effects for males than females. **Keywords:** Periodontal disease; Type 1 diabetes mellitus; Metabolic control.

Meenawat A, Punn K, Srivastava V, Meeawat AS, Dolas RS, Govila V (2013). Periodontal disease and type I diabetes mellitus: Associations with glycemic control and complications. *J Indian Soc Periodntol* 17(5): 597-600. DOI: [10.4103/0972-124X.119286](https://doi.org/10.4103/0972-124X.119286) At: Abstract: **Objective:** The aim of the study was to evaluate periodontal health status in patients diagnosed with type 1 diabetes mellitus (DM1) and to establish a correlation between metabolic control and periodontal health status. **Materials and Methods:** Periodontal health parameters namely plaque index (PI), gingival index (GI), probing pocket depth (PPD) and clinical attachment loss (CAL) were recorded in 28 patients diagnosed with type 1 diabetes mellitus (DM1) and 20 healthy controls. Diabetes history was recorded based on the information provided by the physician and it included date of diagnosis, duration, age of diagnosis, latest values of glycosylated haemoglobin and existing diabetic complications. Statistical analysis was performed to evaluate the relationship between periodontal parameters and degree of metabolic control, the duration of the disease and the appearance of complications. **Results:** The periodontal health in the diabetic group was compromised and they had greater bleeding index ($P < 0.001$), probing pocket depth ($P < 0.001$) and clinical attachment level ($P = 0.001$). Patients diagnosed for diabetes for shorter duration of time (4-7 years) showed bleeding index-disease severity correlation to be 1.760 ± 0.434 . **Conclusion:** Periodontal disease was more evident in type 1 diabetes mellitus patients and periodontal inflammation is greatly increased in subjects with longer disease course, poor metabolic control and diabetic complications. **Keywords:** Complications, HbA1c, metabolic control, periodontitis, type I diabetes.

Periodontal Disease and Cardiovascular Diseases (CVDs)

Coi SE, Sima C, Pandya A (2020). 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* 43(3) : 563-571. DOI: <https://doi.org/10.2337/dc19-1201> At: <https://care.diabetesjournals.org/content/43/3/563.abstract> Abstract: **OBJECTIVE** Previous randomized trials found that treating periodontitis improved glycemic control in patients with type 2 diabetes (T2D), thus lowering the risks of developing T2D-related microvascular diseases and cardiovascular disease (CVD). Some payers in the U.S. have started covering nonsurgical periodontal treatment for those with chronic conditions, such as diabetes. We sought to identify the cost-effectiveness of expanding periodontal treatment coverage among patients with T2D. - **RESEARCH DESIGN AND METHODS** A cost-effectiveness analysis was conducted to estimate

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lifetime costs and health gains using a stochastic microsimulation model of oral health conditions, T2D, T2D-related microvascular diseases, and CVD of the U.S. population. Model parameters were obtained from the nationally representative National Health and Nutrition Examination Survey (NHANES) (2009–2014) and randomized trials of periodontal treatment among patients with T2D. - **RESULTS** Expanding periodontal treatment coverage among patients with T2D and periodontitis would be expected to avert tooth loss by 34.1% (95% CI –39.9, –26.5) and microvascular diseases by 20.5% (95% CI –31.2, –9.1), 17.7% (95% CI –32.7, –4.7), and 18.4% (95% CI –34.5, –3.5) for nephropathy, neuropathy, and retinopathy, respectively. Providing periodontal treatment to the target population would be cost saving from a health care perspective at a total net savings of \$5,904 (95% CI –6,039, –5,769) with an estimated gain of 0.6 quality-adjusted life years per capita (95% CI 0.5, 0.6). - **CONCLUSIONS** Providing nonsurgical periodontal treatment to patients with T2D and periodontitis would be expected to significantly reduce tooth loss and T2D-related microvascular diseases via improved glycemic control. Encouraging patients with T2D and poor oral health conditions to receive periodontal treatment would improve health outcomes and still be cost saving or cost-effective.

Tonetti MS, Graziani F, “The Cardiovascular System and Oral Infections,” Chapter 7, Glick M, Ed. (2019), *The Oral-Systemic Health Connection: A Guide to Patient Care*, 2nd ed. (Quintessence, LCCN 2018044816), pp. 164-179.

Chang Y, Woo HG, Park J, Lee JS, Song TJ (2019). Improved oral hygiene care is associated with decreased risk of occurrence for atrial fibrillation and heart failure: a nationwide population-based cohort study. *Eur J Prev Cardiol*, doi: 10.1177/2047487319886018. [Epub ahead of print]. At: <https://www.ncbi.nlm.nih.gov/pubmed/31786965>

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Fagundes N C F, Almeida A P C P S C, Vilhena K F B, Magno M B, Maia L C, Lima R R (2019). Periodontitis as a risk factor for stroke: a systematic review and meta-analysis. *Vascular Health and Risk Management* 15: 519-532. Available at: <https://www.dovepress.com/periodontitis-as-a-risk-factor-for-stroke-a-systematic-review-and-meta-peer-reviewed-article-VHRM>

Patrakka O, Pienimäki JP, Tuomisto S, Ollikainen J, Tehtimäki T, Karhunen PJ, Martiskainen M (2019). Oral Bacterial Signatures in Cerebral Thrombi of Patients With Acute Ischemic Stroke Treated With Thrombectomy. *J Amer Heart Assn* 8: e012330. At: <https://www.ahajournals.org/doi/10.1161/JAHA.119.012330>

Pillai RS, Iyer K, Spin-Neto R, Kothari SF, Nielsen JF, Kothari M (2018). Oral Health and Brain Injury: Causal or Casual Relation? *Cerebrovasc Dis Extra* 8(1): 1–15. Published online 2018 Jan 9. doi: [10.1159/000484989](https://doi.org/10.1159/000484989) At: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5836263/>

Batty GD, Jun KJ, Mok Yejin, Lee SJ, Back JH, Lee S, Jee SH (2018). Oral health and later coronary heart disease: Cohort study of one million people. *Eur J Prev Cardiol* 25(6):598-605. Doi: 10-1177/2047487318759112 At: <https://journals.sagepub.com/doi/pdf/10.1177/2047487318759112>

Ishai A, Takx R, Abdelrahman A, El Kholy K, Van Dyke T, Tawakoi A (2018). Abstract 20033: Periodontal Disease Activity Independently Predicts Future Risk for Cardiovascular Events. *Circulation* 134, Supplement 1. https://www.ahajournals.org/doi/abs/10.1161/circ.134.suppl_1.20033

Allareddy V, Prakasam S, Rampa S, Stein K, Nalliah RP, Allareddy V, Venugopalan RS. (2017). Impact of Periapical Abscess on Infectious Complications in Patients Undergoing Extracorporeal Circulation Auxiliary to Open-Heart Surgical Procedures. *J Evid Based Dent Pract.* 2017 Mar;17(1):13-22.

Jockel-Schneider Y, Heß J, Schlagenhaut U. (2016). Was Parodontitis und Herz-Kreislauf-Erkrankungen verbindet. *wissen kompakt* 10, 95–102 (2016). <https://doi.org/10.1007/s11838-016-0025-8> At: <https://link.springer.com/article/10.1007/s11838-016-0025-8>
Zusammenfassung: Parodontitis wie auch kardiovaskuläre Erkrankungen stellen in der Bevölkerung weit verbreitete Gesundheitsprobleme dar. Die Assoziation beider Erkrankungen ist durch zahlreiche Studien gut belegt. Die genauen Zusammenhänge sind allerdings nur fragmentarisch entschlüsselt. Die Frage, welche Auswirkungen die Elimination einer parodontalen Entzündung hat, ist ebenfalls nur wenig untersucht. Erste Ergebnisse weisen aber auf eine Dosis-Wirkungs-Beziehung beider Erkrankungen hin.

Bokhari SAH, Khan AA, Leung WK, Wajid G (2015). Association of periodontal and cardiovascular diseases: South-Asian studies 2001–2012. *Indian Soc Periodontol* 19(5): 495-500. doi: 10.4103/0972-124X.157876. At: https://www.researchgate.net/publication/277978573_Association_of_periodontal_and_cardiovascular_diseases_South-Asian_studies_2001-2012 Abstract: Large proportion of Asian populations have moderate to severe periodontal disease and a substantial number are anticipated to be at high risk of cardiovascular diseases(CVD). This study reviews epidemiology and association of periodontal and CVDs from the South-Asian region. Observational studies and clinical trials published during January 2001–December 2012 focusing association between periodontitis and CVDs in South-Asian countries were retrieved from various databases and studied. Current evidence suggests that both periodontal and CVDs are globally prevalent and show an increasing trend in developing countries. Global data on epidemiology and association of periodontal and CVDs are predominantly from the developed world; whereas Asia with 60% of the world's population lacks substantial scientific data on the link between periodontal and CVDs. During the search period, 14 studies (5 clinical trials, 9 case–controls) were reported in literature from South-Asia; 100% of clinical trials and 77% case–control studies have reported a significant association between the oral/periodontal parameters and CVD. Epidemiological and clinical studies from South-Asia validate the global evidence on association of periodontal disease with CVDs. However, there is a need for meticulous research for public health and scientific perspective of the Periodontal and CVDs from South-Asia.

Fifer KM, Qadir S, Subramanian S, Vijayakumar J, Figueroa AL, Truong QA, Hoffman U, Brady TJ, Tawakoi A (2011). Positron emission tomography measurement of periodontal 18F-fluorodeoxyglucose uptake is associated with histologically determined carotid plaque inflammation. *J Am Coll Cardiol* 57(8):971-976. doi: 10.1016/j.jacc.2010.09.056

Dental Screening for CVD

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Lo C-H, Nguyen LH, Wu K, Ogino S, Chan AT, Giovannuci EL, Song M (2020). Periodontal Disease, Tooth Loss, and Risk of Serrated Polyps and Conventional Adenomas. *Cancer Prev Res* 13(8): 699–706. DOI: 10.1158/1940-6207.CAPR-20-0090 At: <https://cancerpreventionresearch.aacrjournals.org/content/13/8/699.abstract> Abstract: Growing data indicate an association between periodontal disease and the development of cancer. However, the evidence for colorectal cancer has been inconsistent and longitudinal study examining its precursor lesions is lacking. We prospectively collected information on periodontal disease and number of tooth loss in the Nurses' Health Study (1992–2002) and the Health Professionals Follow-up Study (1992–2010). Polyp diagnosis was acquired via self-reported questionnaires and confirmed through review of medical records. We used logistic regression to calculate the multivariate-adjusted ORs and 95% confidence intervals (CI) with adjustment for smoking and other known risk factors for periodontal disease and colorectal cancer. In this study, we included 17,904 women and 24,582 men. We documented 2,336 cases of serrated polyps and 4,102 cases of conventional adenomas among 84,714 person-endoscopies throughout follow-up. The ORs of serrated polyps and conventional adenomas comparing individuals with and without periodontal disease were 1.17 (95% CI, 1.06–1.29) and 1.11 (95% CI, 1.02–1.19), respectively. Compared with participants without tooth loss, those who lost ≥ 4 teeth had 20% (OR, 1.20; 95% CI, 1.03–1.39) greater risk of serrated polyps (P_{trend} 0.01). Among never smokers, similar associations with periodontal disease were observed for both serrated polyps (OR, 1.20; 95% CI, 1.02–1.41) and conventional adenomas (OR, 1.12; 95% CI, 1.00–1.26). History of periodontal disease and possibly higher number of tooth loss may modestly increase the risk of developing colorectal precursor lesions. Our findings advance our understanding of the interplay between oral health, microbiome, and early colorectal carcinogenesis.

Singer RH, Feaster DJ, Stoutenberg M, Hlaing WM, Pereyra M, Abel S, Pollack H, Gellman MD, Schneiderman N, Metsch LR (2019). Dentists' willingness to screen for cardiovascular disease in the dental care setting: Findings from a nationally representative survey. *Community Dent Oral Epidemiol* 47(4): 299–308. DOI: [10.1111/cdoe.12457](https://doi.org/10.1111/cdoe.12457) At: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6625893/> Abstract: **Objective:** Dental clinics offer an untapped health care setting to expand access to screening and early identification of cardiovascular disease (CVD) risk. This study examined the correlates of dentists' willingness to provide CVD screening in the dental care setting. **Methods:** Private practice and public health general dentists in the U.S. participated in a nationally representative survey from 2010–2011. The survey examined dentists' willingness to provide a finger stick test to support CVD screening and agreement that their professional role should include CVD screening. **Results:** Data analyzed from 1802 respondents indicated that 46.6% of dentists were willing to provide CVD screening. The adjusted odds ratio (AOR) of dentists' willingness to screen for CVD was associated with currently screening for hypertension (AOR = 1.49, 95% CI 1.01, 2.20), screening for obesity (AOR = 1.66, 95% CI 1.17, 2.36), and agreement that their role as health care professionals includes CVD screening (AOR = 3.03, 95% CI 2.15, 4.29). Dentists' agreement that their role includes CVD screening was associated with self-rated knowledge of CVD (good vs. none or limited) and CVD training during their professional education (5 to 8 hours of training vs. none or limited), (AOR = 5.75, 95% CI 2.26, 14.62) and (AOR = 3.84, 95% CI 2.17, 6.80), respectively. **Conclusions:** Our study highlights strategies that may be employed to expand future access to early detection of CVD risk. Including CVD screening instruction and clinical screening experiences in dental school curriculum may serve as catalysts to reshape the future scope of dental practice.

Periodontal Disease and Respiratory Diseases, including VAP, Covid-19

Zimmerman S, Sloan PD, Ward K, Wretman CJ, Stearns SC, Poole P, Preisser JS (2020). Effectiveness of a Mouth Care Program Provided by Nursing Home Staff vs Standard Care on Reducing Pneumonia Incidence: A Cluster Randomized Trial. *JAMA Network Open* 3(6): e204321 doi:10.1001/jamanetworkopen.2020.4321 At: <https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2767357> Abstract: IMPORTANCE Pneumonia affects more than 250 000 nursing home (NH) residents annually. A strategy to reduce pneumonia is to provide daily mouth care, especially to residents with dementia. OBJECTIVE To evaluate the effectiveness of Mouth Care Without a Battle, a program that increases staff knowledge and attitudes regarding oral hygiene, changes mouth care, and improves oral hygiene, in reducing the incidence of pneumonia among NH residents. DESIGN, SETTING, AND PARTICIPANTS This pragmatic cluster randomized trial observing 2152 NH residents for up to 2 years was conducted from September 2014 to May 2017. Data collectors were masked to study group. The study included 14 NHs from regions of North Carolina that evidenced proportionately high rehospitalization rates for pneumonia and long-term care residents. Nursing homes were pair matched and randomly assigned to intervention or control groups. INTERVENTION Mouth Care Without a Battle is a standardized program that teaches that mouth care is health care, provides instruction on individualized techniques and products for mouth care, and trains caregivers to provide care to residents who are resistant and in special situations. The control condition was standard mouth care. MAIN OUTCOMES AND MEASURES Pneumonia incidence (primary) and hospitalization and mortality (secondary), obtained from medical records. RESULTS Overall, the study enrolled 2152 residents (mean [SD] age, 79.4 [12.4] years; 1281 [66.2%] women; 1180 [62.2%] white residents). Participants included 1219 residents (56.6%) in 7 intervention NHs and 933 residents (43.4%) in 7 control NHs. During the 2-year study period, the incidence rate of pneumonia per 1000 resident-days was 0.67 and 0.72 in the intervention and control NHs, respectively. Neither the primary (unadjusted) nor secondary (covariate-adjusted) analyses found a significant reduction in pneumonia due to Mouth Care Without a Battle during 2 years (unadjusted incidence rate ratio, 0.90; upper bound of 1-sided 95% CI, 1.24; P = .27; adjusted incidence rate ratio, 0.92; upper bound of 1-sided 95% CI, 1.27; P = .30). In the second year, the rate of pneumonia was nonsignificantly higher in intervention NHs. Adjusted post hoc analyses limited to the first year found a significant reduction in pneumonia incidence in intervention NHs (IRR, 0.69; upper bound of 1-sided 95% CI, 0.94; P = .03). CONCLUSIONS AND RELEVANCE This matched-pairs cluster randomized trial of a mouth care program compared with standard care was not effective in reducing pneumonia incidence at 2 years, although reduction was found during the first year. The lack of significant results in the second year may be associated with sustainability. Improving mouth care in US NHs may require the presence and support of dedicated oral care aides.

Botros N, Iyer P, Ojcius DM (2020). Is there an association between oral health and severity of COVID-19 complications? *Biomed J* 43: 325-327. DOI: DOI: [10.1016/j.bj.2020.05.016](https://doi.org/10.1016/j.bj.2020.05.016) At: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7258848/pdf/main.pdf> Abstract: Most patients with severe complications from COVID-19 have underlying conditions such as obesity, diabetes, and hypertension. In parallel, there is growing evidence for a link between periodontitis and non-oral systemic diseases. The oral cavity is also a reservoir for respiratory pathogens, and patients with periodontal disease are more likely to develop hospital-acquired pneumonia than healthy

individuals. We therefore hypothesize that improving oral health could decrease the severity of COVID-19 symptoms and reduce the associated morbidity.

Komitas K, Ioannidou E, “The Association Between Oral Infections and Pulmonary Disease,” Chapter 9, Glick M, Ed. (2019), *The Oral-Systemic Health Connection: A Guide to Patient Care*, 2nd ed. (Quintessence, LCCN 2018044816), pp. 193-209

Dörfer C; Benz C; Aida J; Campard G (2017). The relationship of oral health with general health and NCDs: A brief review. *Int. Dent. J.* 67: 14–18. DOI: [10.1111/idj.12360](https://doi.org/10.1111/idj.12360) At: <https://pubmed.ncbi.nlm.nih.gov/29023744/> Abstract: Oral health is closely related to systemic health. Periodontitis, a chronic inflammatory disease which is highly prevalent worldwide, interacts with a variety of noncommunicable diseases (NCDs). It is a risk factor in the complex pathogenesis of diabetes mellitus and cardiovascular disease and plays a role in the development of endocarditis and recurrent pneumonia in elderly people. However, the available data may be interpreted in different ways, and more and better-designed studies are still needed to answer relevant questions about the causal role of periodontitis in NCDs. What is clear is that periodontitis contributes to the systemic inflammatory burden. As periodontitis shares many common risk factors with NCDs, close collaboration between physicians and dentists is needed to increase the chance of early detection and improve the prevention and control of these conditions

Manger D, Walshaw M, Fitzgerald R, Doughty J, Wanyony KL, White S, Gallagher JE (2017). Evidence summary: the relationship between oral health and pulmonary disease. *Br Dent J* 222, 527–533. doi: <https://doi.org/10.1038/sj.bdj.2017.315> At: <https://www.nature.com/articles/sj.bdj.2017.315>

Hue F, Xie H, Worthington HV, Furness S, Zhang Q, Li C, Cochrane Oral Health Group, Managing Eds. (2016). Oral hygiene care for critically ill patients to prevent ventilator-associated pneumonia. *Cochrane Database Syst Rev* 10: CD008367. DOI: [10.1002/14651858.CD008367.pub3](https://doi.org/10.1002/14651858.CD008367.pub3) At: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6460950/> Abstract: **Background** Ventilator-associated pneumonia (VAP) is defined as pneumonia developing in people who have received mechanical ventilation for at least 48 hours. VAP is a potentially serious complication in these patients who are already critically ill. Oral hygiene care (OHC), using either a mouthrinse, gel, toothbrush, or combination, together with aspiration of secretions, may reduce the risk of VAP in these patients. **Objectives** To assess the effects of oral hygiene care on incidence of ventilator-associated pneumonia in critically ill patients receiving mechanical ventilation in hospital intensive care units (ICUs). **Search methods** We searched the following electronic databases: Cochrane Oral Health’s Trials Register (to 17 December 2015), the Cochrane Central Register of Controlled Trials (CENTRAL) (the Cochrane Library, 2015, Issue 11), MEDLINE Ovid (1946 to 17 December 2015), Embase Ovid (1980 to 17 December 2015), LILACS BIREME Virtual Health Library (1982 to 17 December 2015), CINAHL EBSCO (1937 to 17 December 2016), Chinese Biomedical Literature Database (1978 to 14 January 2013), China National Knowledge Infrastructure (1994 to 14 January 2013), Wan Fang Database (January 1984 to 14 January 2013) and VIP Database (January 2012 to 4 May 2016). We searched ClinicalTrials.gov and the World Health Organization International Clinical Trials Registry Platform for ongoing trials to 17 December 2015. We placed no restrictions on the language or date of publication when searching the electronic databases. **Selection criteria** We included randomised controlled trials (RCTs) evaluating the effects of OHC (mouthrinse, swab,

Prepared for International Conference: "The integration of Primary Care in Dental Practice - A Time That's Come," November 2021.

toothbrush or combination) in critically ill patients receiving mechanical ventilation for at least 48 hours. **Data collection and analysis** At least two review authors independently assessed search results, extracted data and assessed risk of bias in included studies. We contacted study authors for additional information. We pooled data from trials with similar interventions and outcomes. We reported risk ratio (RR) for dichotomous outcomes and mean difference (MD) for continuous outcomes, using random-effects models unless there were fewer than four studies. **Main results** We included 38 RCTs (6016 participants). There were four main comparisons: chlorhexidine (CHX) mouthrinse or gel versus placebo/usual care; toothbrushing versus no toothbrushing; powered versus manual toothbrushing; and comparisons of oral care solutions. We assessed the overall risk of bias as low in five trials (13%), high in 26 trials (68%), and unclear in seven trials (18%). We did not consider the risk of bias to be serious when assessing the quality of evidence (GRADE) for VAP incidence, but we downgraded other outcomes for risk of bias. High quality evidence from 18 RCTs (2451 participants, 86% adults) shows that CHX mouthrinse or gel, as part of OHC, reduces the risk of VAP compared to placebo or usual care from 24% to about 18% (RR 0.75, 95% confidence intervals (CI) 0.62 to 0.91, $P = 0.004$, $I^2 = 35\%$). This is equivalent to a number needed to treat for an additional beneficial outcome (NNTB) of 17 (95% CI 9 to 50), which indicates that for every 17 ventilated patients in intensive care receiving OHC including chlorhexidine, one outcome of VAP would be prevented. There is no evidence of a difference between CHX and placebo/usual care for the outcomes of mortality (RR 1.09, 95% CI 0.96 to 1.23, $P = 0.20$, $I^2 = 0\%$, 14 RCTs, 2014 participants, moderate quality evidence), duration of mechanical ventilation (MD -0.09 days, 95% CI -1.73 to 1.55 days, $P = 0.91$, $I^2 = 36\%$, five RCTs, 800 participants, low quality evidence), or duration of intensive care unit (ICU) stay (MD 0.21 days, 95% CI -1.48 to 1.89 days, $P = 0.81$, $I^2 = 9\%$, six RCTs, 833 participants, moderate quality evidence). There is insufficient evidence to determine the effect of CHX on duration of systemic antibiotics, oral health indices, caregivers' preferences or cost. Only two studies reported any adverse effects, and these were mild with similar frequency in CHX and control groups.-- We are uncertain as to the effects of toothbrushing (\pm antiseptics) on the outcomes of VAP (RR 0.69, 95% CI 0.44 to 1.09, $P = 0.11$, $I^2 = 64\%$, five RCTs, 889 participants, very low quality evidence) and mortality (RR 0.87, 95% CI 0.70 to 1.09, $P = 0.24$, $I^2 = 0\%$, five RCTs, 889 participants, low quality evidence) compared to OHC without toothbrushing (\pm antiseptics). There is insufficient evidence to determine whether toothbrushing affects duration of mechanical ventilation, duration of ICU stay, use of systemic antibiotics, oral health indices, adverse effects, caregivers' preferences or cost. Only one trial (78 participants) compared use of a powered toothbrush with a manual toothbrush, providing insufficient evidence to determine the effect on any of the outcomes of this review. -- Fifteen trials compared various other oral care solutions. There is very weak evidence that povidone iodine mouthrinse is more effective than saline/placebo (RR 0.69, 95% CI 0.50 to 0.95, $P = 0.02$, $I^2 = 74\%$, three studies, 356 participants, high risk of bias), and that saline rinse is more effective than saline swab (RR 0.47, 95% CI 0.37 to 0.62, $P < 0.001$, $I^2 = 84\%$, four studies, 488 participants, high risk of bias) in reducing VAP. Due to variation in comparisons and outcomes among trials, there is insufficient evidence concerning the effects of other oral care solutions. **Authors' conclusions** OHC including chlorhexidine mouthwash or gel reduces the risk of developing ventilator-associated pneumonia in critically ill patients from 24% to about 18%. However, there is no evidence of a difference in the outcomes of mortality, duration of mechanical ventilation or duration of ICU stay. There is no evidence that OHC including both antiseptics and toothbrushing is different from OHC with antiseptics alone, and some weak

evidence to suggest that povidone iodine mouthrinse is more effective than saline/placebo, and saline rinse is more effective than saline swab in reducing VAP. There is insufficient evidence to determine whether powered toothbrushing or other oral care solutions are effective in reducing VAP. There is also insufficient evidence to determine whether any of the interventions evaluated in the studies are associated with adverse effects.

Gupta A, Guopta A, Sing TK, Saxsena A (2016). Role of oral care to prevent VAP in mechanically ventilated Intensive Care Unit patients. *Saudi J Anesth* 10(1): 95-97. DOI:

[10.4103/1658-354X.169484](https://doi.org/10.4103/1658-354X.169484) Abstract: Scannapieco F (2006). Pneumonia in nonambulatory patients. The role of oral bacteria and oral hygiene. *J Am Dent Assoc* 137 Suppl: 21S-25S doi: 10.14219/jada.archive.2006.0400. At: <https://pubmed.ncbi.nlm.nih.gov/17012732/> Abstract:

Background: Considerable evidence exists to support a relationship between poor oral health, the oral microflora and bacterial pneumonia, especially ventilator-associated pneumonia in institutionalized patients. Teeth or dentures have nonshedding surfaces on which oral biofilms (that is, dental plaque) form that are susceptible to colonization by respiratory pathogens. Subsequent aspiration of respiratory pathogens shed from oral biofilms into the lower airway increases the risk of developing a lung infection. In addition, patients may aspirate inflammatory products from inflamed periodontal tissues into the lower airway, contributing to lung insult.

Types of studies reviewed: The author reviewed laboratory studies, clinical trials and review articles. **Conclusions:** A number of studies have shown that the mouth can be colonized by respiratory pathogens and serve as a reservoir for these organisms. Other studies have demonstrated that oral interventions aimed at controlling or reducing oral biofilms can reduce the risk of pneumonia in high-risk populations. Taken together, the evidence is substantial that improved oral hygiene may prevent pneumonia in vulnerable patients. **Clinical**

implications: Institution of rigorous oral hygiene regimens for hospitalized patients and long-term-care residents may reduce the risk of developing pneumonia.

Periodontal Diseases and Inflammatory Auto-Immune Dseases

Lee YC, Jeong SJ, Eun Y-G, Song R, Oh IH (2020). Risk of autoimmune diseases in recurrent aphthous ulcer patients: A nationwide population study. *Oral Dis* doi:10.1111/odi.13659 At: <https://onlinelibrary.wiley.com/doi/abs/10.1111/odi.13659> Abstract: Objective To estimate the risk of developing autoimmune disease in patients diagnosed having recurrent aphthous stomatitis (RAS) through a nationwide population-based cohort study. Methods This study included two group of patients 'patients who had three or more episodes with aphthae diagnosed from their physician (RAS group) and a similar matched group of patients without aphthae (control group). Both groups were collected within the period of 2005-2007 from the Korean National Health Insurances claims database. Non-RAS cohort were matched after frequency matching. The final enrolled subjects were observed during a follow-up period from 2008 to 2015 and those who received autoimmune diseases diagnoses during follow-up were identified. The hazard ratio (HR) for developing autoimmune diseases was estimated. Results A total of 4,637 patients with RAS and 4,637 controls were included. The risk of overall autoimmune diseases was significantly increased in the RAS group. (adjusted HR (aHR), 1.19) With regard to each disease entity, patients with RAS showed an increased risk of Bechet's disease (31.16), systemic lupus erythematosus (SLE) (1.74), ankylosing spondylitis (AS) (1.47), gout (1.47), Hashimoto thyroiditis(1.42), Graves' disease (1.37). and rheumatoid arthritis (RA) (1.19). Conclusion RAS like lesion may be an early sign of systemic autoimmune disease, as it

was associated with an increased risk of Graves' disease, Hashimoto thyroiditis, SLE, AS, gout, RA, and Bechet's disease from real world data.

Busch M (2020). Mouth ulcers may be early sign of autoimmune disease. *DrBicuspid*. At: <https://www.drBicuspid.com/index.aspx?sec=nws&sub=rad&pag=dis&ItemID=327375>

Eriksson K, Fei G, Ludmark A, Benchimol D, Lee L, Hu Y, Kats A, Saevarsdottir S, Catrina AI, Klinge B, Andersson AF, Klaarskog L, Lundberg K, Jansson L, Yucel-Lidberg T (2019). Periodontal Health and Oral Microbiota in Patients with Rheumatoid Arthritis. *J Clin Med* 8(5). Pii: E60. doi: 10.3390/jcm8050630 At: <https://www.ncbi.nlm.nih.gov/pubmed/31072030>

Lin C-Y, Tseng C-F, Liu J-M, Chuang H-C, Lei W-T, Liu LY-M, Yu Y-C, Hsu R-J (2019). Association between Periodontal Disease and Subsequent Sjögren's Syndrome: A Nationwide Population-Based Cohort Study. *Int J Environ Res Public Health* 16(5): 771. DOI: [10.3390/ijerph16050771](https://doi.org/10.3390/ijerph16050771) At: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6427323/> Potempa J, Mydel P, Koziel J (2017). The Case for Periodontitis in the Pathogenesis of Rheumatoid Arthritis. *Nat Rev Rheumatol* 13(10): 606-620. doi: 10.1038/nrrheum.2017.132. Epub 2017 Aug 24. At: <https://pubmed.ncbi.nlm.nih.gov/28835673/> Abstract: Rheumatoid arthritis (RA), an autoimmune disease that affects ~1% of the human population, is driven by autoantibodies that target modified self-epitopes, whereas ~11% of the global adult population are affected by severe chronic periodontitis, a disease in which the commensal microflora on the tooth surface is replaced by a dysbiotic consortium of bacteria that promote the chronic inflammatory destruction of periodontal tissue. Despite differences in aetiology, RA and periodontitis are similar in terms of pathogenesis; both diseases involve chronic inflammation fuelled by pro-inflammatory cytokines, connective tissue breakdown and bone erosion. The two diseases also share risk factors such as smoking and ageing, and have strong epidemiological, serological and clinical associations. In light of the ground-breaking discovery that *Porphyromonas gingivalis*, a pivotal periodontal pathogen, is the only human pathogen known to express peptidylarginine deiminase, an enzyme that generates citrullinated epitopes that are recognized by anti-citrullinated protein antibodies, a new paradigm is emerging. In this Review, the clinical and experimental evidence supporting this paradigm is discussed and the potential mechanisms involved in linking periodontitis to RA are presented.

Skudutyte-Rysstad R, Slevolden EM, Hansen BF, Sandvik L, Ragnar-Preus HR (2014). Association between moderate to severe psoriasis and periodontitis in a Scandinavian population. *BMC Oral Health* 14: 139. Association between moderate to severe psoriasis and periodontitis in a Scandinavian population. Published online 2014 Nov 26. doi: [10.1186/1472-6831-14-139](https://doi.org/10.1186/1472-6831-14-139) At: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4280688/> Abstract: **Background** The aim of the present study was to compare the prevalence of periodontitis and alveolar bone loss among individuals with psoriasis and a group of randomly selected controls. **Methods** Fifty individuals with psoriasis and 121 controls completed a structured questionnaire, and were examined clinically and radiographically. Oral examination included numbers of missing teeth, probing pocket depth (PPD), clinical attachment level (CAL), presence of dental plaque and bleeding on probing, as well as alveolar bone loss from radiographs. Questionnaires requested information on age, gender, education, dental care, smoking habits, general diseases and medicament use. For adjustment for baseline differences between psoriasis individuals and controls the propensity score based on gender, age and education was computed using multivariate logistic

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regression. A subsample analysis for propensity score matched psoriasis individuals (n = 50) and controls (n = 50) was performed. **Results** When compared with controls, psoriasis individuals had significantly more missing teeth and more sites with plaque and bleeding on probing. The prevalence of moderate and severe periodontitis was significantly higher among psoriasis individuals (24%) compared to healthy controls (10%). Similarly, 36% of psoriasis cases had one or more sites with radiographic bone loss ≥ 3 mm, compared to 13% of controls. Logistic regression analysis showed that the association between moderate/severe periodontitis and psoriasis remained statistically significant when adjusted for propensity score, but was attenuated when smoking was entered into the model. The association between psoriasis and one or more sites with bone loss ≥ 3 mm remained statistically significant when adjusted for propensity score and smoking and regularity of dental visits. In the propensity score (age, gender and education) matched sample (n = 100) psoriasis remained significantly associated with moderate/severe periodontitis and radiographic bone loss. **Conclusions** Within the limits of the present study, periodontitis and radiographic bone loss is more common among patients with moderate/severe psoriasis compared with the general population. This association remained significant after controlling for confounders.

Üstün K, Sezer U, Kısacık B. *et al.* (2013). Periodontal Disease in Patients with Psoriatic Arthritis. *Inflammation* 36, 665–669 <https://doi.org/10.1007/s10753-012-9590-y> At: <https://link.springer.com/article/10.1007/s10753-012-9590-y> Abstract: Rheumatological diseases and periodontal disease are both characterized by dysregulation of the host inflammatory response. The aim of this study was to determine the possible relationship between periodontitis and psoriatic arthritis (PsA). Fifty-one adults with PsA (27 men and 24 women; mean age 41.73 ± 11.27 years) and 50 age- and gender-balanced systemically healthy control subjects participated in the study. Participants' periodontal status as determined by probing pocket depth, clinical attachment loss (CAL), plaque index, and gingival index was evaluated. The CAL levels of the PsA group were significantly higher than those of the control group ($p < 0.05$) There were no statistically significant differences in the frequency of periodontitis, probing pocket depth, plaque index, or gingival index between the two groups. The results of the present study show that periodontitis severity as determined by CAL was higher in the PsA group; therefore, periodontal evaluation must be considered when PsA is diagnosed.

Bingham COIII, Moni M (2013). Periodontal disease and rheumatoid arthritis: the evidence accumulates for complex pathobiologic interactions. *Curr Opin Rheumatol* 25(3): 345-353. doi: [10.1097/BOR.0b013e32835fb8ec](https://doi.org/10.1097/BOR.0b013e32835fb8ec) At: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4495574/>

Corrêa JD, Fernandes GR, Calderaro DC, Souza Mendonça SM, Silva JM, Albiero ML, Cunha FQ, Xiao E, Ferreira GA, Teixeira AL, Mukherjee C, Leys EJ, Silva TA, Graves DT (2019). Oral microbial dysbiosis linked to worsened periodontal condition in rheumatoid arthritis patients. *Sci Rep* 9, 8379 <https://doi.org/10.1038/s41598-019-44674-6> At: <https://www.nature.com/articles/s41598-019-44674-6>

Maresz KJ, Hellvard A, Sroka A, Adamowicz K, Bielecka E, Koziel J, Gawron K, Mizgalska D, Marcinska KA, Benedyk M, Pyrc K, Quirke AM, Jonsson R, Alzabin S, Venables PJ, Nguyen KA, Mydel P, Potempa J (2013). *Porphyromonas gingivalis* facilitates the development and progression of destructive arthritis through its unique bacterial peptidylarginine deiminase

Prepared for International Conference: "The integration of Primary Care in Dental Practice - A Time That's Come," November 2021.

(PAD). *PLoS Pathog* 9(9):e1003627. doi: 10.1371/journal.ppat.1003627. Epub 2013 Sep 12. PMID: 24068934 At: <https://pubmed.ncbi.nlm.nih.gov/24068934/> Abstract: Rheumatoid arthritis and periodontitis are two prevalent chronic inflammatory diseases in humans and are associated with each other both clinically and epidemiologically. Recent findings suggest a causative link between periodontal infection and rheumatoid arthritis via bacteria-dependent induction of a pathogenic autoimmune response to citrullinated epitopes. Here we showed that infection with viable periodontal pathogen *Porphyromonas gingivalis* strain W83 exacerbated collagen-induced arthritis (CIA) in a mouse model, as manifested by earlier onset, accelerated progression and enhanced severity of the disease, including significantly increased bone and cartilage destruction. The ability of *P. gingivalis* to augment CIA was dependent on the expression of a unique *P. gingivalis* peptidylarginine deiminase (PPAD), which converts arginine residues in proteins to citrulline. Infection with wild type *P. gingivalis* was responsible for significantly increased levels of autoantibodies to collagen type II and citrullinated epitopes as a PPAD-null mutant did not elicit similar host response. High level of citrullinated proteins was also detected at the site of infection with wild-type *P. gingivalis*. Together, these results suggest bacterial PAD as the mechanistic link between *P. gingivalis* periodontal infection and rheumatoid arthritis.

Keikkinen AM, Söder B, Söder P-Ö, Toppila-Salmi S, Meurman JH (2017). Autoimmune Diseases and Oral Health: 30-Year Follow-Up of a Swedish Cohort. *Dent J* (Basel) 6(1). pii: E1. doi: 10.3390/dj6010001. At: <https://www.ncbi.nlm.nih.gov/pubmed/29563402>

Delta Dental (2016). The link between rheumatoid arthritis and oral health. At: https://www.deltadentalins.com/oral_health/rheumatoid-arthritis.html

Bingham CO, III Moni M (2013). Periodontal disease and rheumatoid arthritis: the evidence accumulates for complex pathobiologic interactions. *Curr Opin Rheumatol* 23(3): 345-353. DOI: [10.1097/BOR.0b013e32835fb8ec](https://doi.org/10.1097/BOR.0b013e32835fb8ec) At: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4495574/> Abstract: **Purpose of review** This review was conducted to focus on the recent clinical and translational research related to the associations between periodontal disease and rheumatoid arthritis. **Recent findings** There is a growing interest in the associations between oral health and autoimmune and inflammatory diseases. A number of epidemiologic studies have described associations between rheumatoid arthritis and periodontal disease. Recent clinical studies continue to support these reports, and are increasingly linked with biological assessments to better understand the nature of these relationships. A number of recent studies have evaluated the periopathogenic roles of *Porphyromonas gingivalis*, the oral microbiome, and mechanisms of site-specific and substrate-specific citrullination. These are helping to further elucidate the interactions between these two inflammatory disease processes. **Summary** Studies of clinical oral health parameters, the gingival microenvironment, autoantibodies and biomarkers, and rheumatoid arthritis disease activity measures are providing a better understanding of the potential mechanisms responsible for rheumatoid arthritis and periodontal disease associations. The cumulative results and ongoing studies have the promise to identify novel mechanisms and interventional strategies to improve patient outcomes for both conditions. **Keywords:** citrullination, periodontal disease, periodontitis, *Porphyromonas gingivalis*, rheumatoid arthritis.

Scully C, Hodgson T, Lachmann H (2008). Auto-inflammatory syndromes and oral health. *Oral Dis* 14(8): 690-699. doi: 10.1111/j.1601-0825.2008.01484.x. At: <https://www.ncbi.nlm.nih.gov/pubmed/19193198>

Periodontal Disease and Renal Conditions

Komitas K, Iannidou E, "The Association between Oral Infections and Renal Disease," Chapter 8, Glick M, Ed. (2019), *The Oral-Systemic Health Connection: A Guide to Patient Care*, 2nd ed. (Quintessence, LCCN 2018044816), pp. 180-192.

Sharma P, Dietrich T, Ferro CJ, Cockwell P, Chapple ILC (2016). Association between periodontitis and mortality in stages 3–5 chronic kidney disease: NHANES III and linked mortality study. *J Clin Periontol* 43(2): 104-113. DOI: <https://doi.org/10.1111/jcpe.12502> At: <https://onlinelibrary.wiley.com/doi/full/10.1111/jcpe.12502> Abstract: Introduction Periodontitis may add to the systemic inflammatory burden in individuals with chronic kidney disease (CKD), thereby contributing to an increased mortality rate. This study aimed to determine the association between periodontitis and mortality rate (all-cause and cardiovascular disease-related) in individuals with stage 3–5 CKD, hitherto referred to as "CKD". Methods Survival analysis was carried out using the Third National Health and Nutrition Examination Survey (NHANES III) and linked mortality data. Cox proportional hazards regression was employed to assess the association between periodontitis and mortality, in individuals with CKD. This association was compared with the association between mortality and traditional risk factors in CKD mortality (diabetes, hypertension and smoking). Results Of the 13,784 participants eligible for analysis in NHANES III, 861 (6%) had CKD. The median follow-up for this cohort was 14.3 years. Adjusting for confounders, the 10-year all-cause mortality rate for individuals with CKD increased from 32% (95% CI: 29–35%) to 41% (36–47%) with the addition of periodontitis. For diabetes, the 10-year all-cause mortality rate increased to 43% (38–49%). Conclusion There is a strong, association between periodontitis and increased mortality in individuals with CKD. Sources of chronic systemic inflammation (including periodontitis) may be important contributors to mortality in patients with CKD.

Gupta M, Gupta M, Abhishek (2015). Oral conditions in renal disorders and treatment considerations – A review for pediatric dentist. *Saudi Dent J* 27(3): 113-119. Published online 2015 Apr 23. doi: [10.1016/j.sdentj.2014.11.014](https://doi.org/10.1016/j.sdentj.2014.11.014) At: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4501439/> Abstract: This article reviews the current understanding of the oral and dental aspects of chronic renal disease (CRD). A PubMed literature search was performed and all relevant studies were assessed. As the number of people suffering from CRD increases worldwide, dentists are expected to encounter more patients with CRD who need oral care. In children, CRD can elicit a wide spectrum of oral manifestations in the hard and soft tissues. Bleeding, altered drug metabolism, impaired immune function, and an increased risk of dentally induced bacterial endocarditis are some important features that require attention. Dental management of patients with CRD requires that clinicians appreciate that multiple systems can be affected by the disease. Dentists should consult with nephrologists regarding the specific precautions required for each patient. Medical treatments in these patients may need to be postponed due to an unfavorable oral health status or potential risk of life-threatening infection after surgery. Improving oral hygiene and performing necessary dental and oral treatment before hemodialysis or transplantation may prevent endocarditis and septicemia in these

patients. Hence, treatment plans should be formulated to restore the patient's dentition and protect them from potentially severe infections of dental origin.

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