

INFLUENCES OF HEART DISEASE ON ORAL HEALTH

Iulian Constantin¹, Patru Radu Stanciu^{1*}, Alina Mihaela Elisei^{1*}, Dragos Stanciu¹, Cristian Guțu¹, Diana Oita⁴, Alexandru Andrei Iliescu², Norina Consuela Fornas⁵, Anca Maria Fratila^{3,4}

¹Faculty of Medicine and Pharmacy, University "Dunarea de Jos" Galati, Romania

²University of Medicine and Pharmacy of Craiova, Romania, Faculty of Dentistry, Department of Oral Rehabilitation

³Faculty of Medicine, Lucian Blaga University of Sibiu, 5501169 Sibiu, Romania

⁴Military Clinical Emergency Hospital of Sibiu, 550024 Sibiu, Romania

⁵"Grigore T. Popa" University of Medicine and Pharmacy, 16 Universitatii Street, 700115, Iasi, Romania

*Corresponding authors: radupatru@yahoo.co.uk, a_elisei@yahoo.com

All authors have the same contribution.

Abstract

This review aims to explore and highlight the relationships between heart disease and oral health, highlighting the interconnections between oral health and overall heart condition. In light of recent research, it is becoming increasingly apparent that poor oral health, including conditions such as gingivitis and periodontitis, can contribute to the development or worsening of heart disease. This review looks at the biological mechanisms by which oral health problems can influence cardiovascular health, including aspects such as systemic inflammation and the dissemination of oral bacteria into the bloodstream. Prevention and management strategies for improving oral health in the context of heart disease are also discussed, highlighting the essential role of collaboration between dentists and cardiologists.

Keywords: oral health, periodontitis, heart disease, oral bacteria, oral prevention.

Introduction

Oral health and heart disease are two areas of human health that, at first glance, may seem distinct, but recent studies show that there is a significant connection between them. Various oral health problems, such as gingivitis and periodontitis, have been associated with an increased risk of developing cardiovascular disease, including atherosclerosis and myocardial infarction [1-3].

This connection is frequently mediated by inflammatory factors and the presence of bacteria from the oral cavity that can enter the

bloodstream, thus affecting other organs, such as the heart [1,2].

Understanding the link between oral health and heart disease offers significant opportunities for primary prevention of both conditions [2,3].

Individuals can potentially reduce their risk of heart complications by improving oral health. This knowledge can lead to earlier and more effective medical interventions for high-risk patients. Promoting an integrated approach to health management contributes to improving the patient's quality of life [1-3].

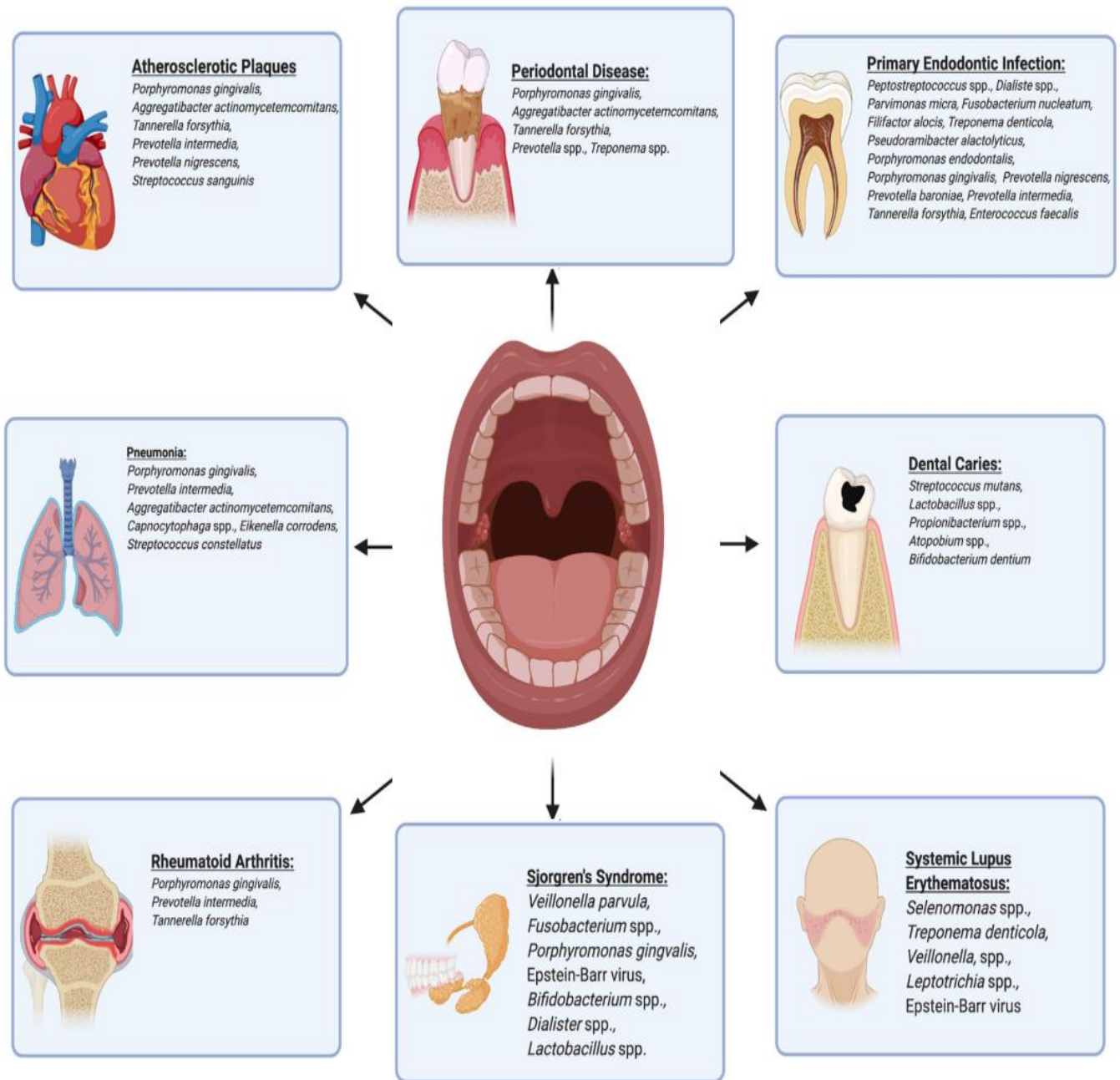


Image 1. Oral bacteria and systemic diseases [3].

The review will address in detail the mechanisms by which oral diseases can influence cardiovascular health and vice versa, providing an analysis of the latest research in this area. The ultimate goal is to raise awareness about this interdependence and promote a preventive approach that contributes to both oral and cardiovascular health in the population [1-3].

This will include specific suggestions for improving collaboration between dentists

and cardiologists in managing patients with or susceptible to these conditions [1-4].

The structure of the oral cavity

Teeth are vital elements for mastication, helping to shred food for proper digestion. Healthy teeth also contribute to speech clarity and aesthetics [2-4].

Gums, the protective tissue that surrounds and supports teeth. Healthy gums are essential to keep teeth stable and protect underlying structures from infection [2-4].

The tongue helps manipulate food during chewing and is a primary sensory organ

for taste, it is crucial for articulating words [2-4].

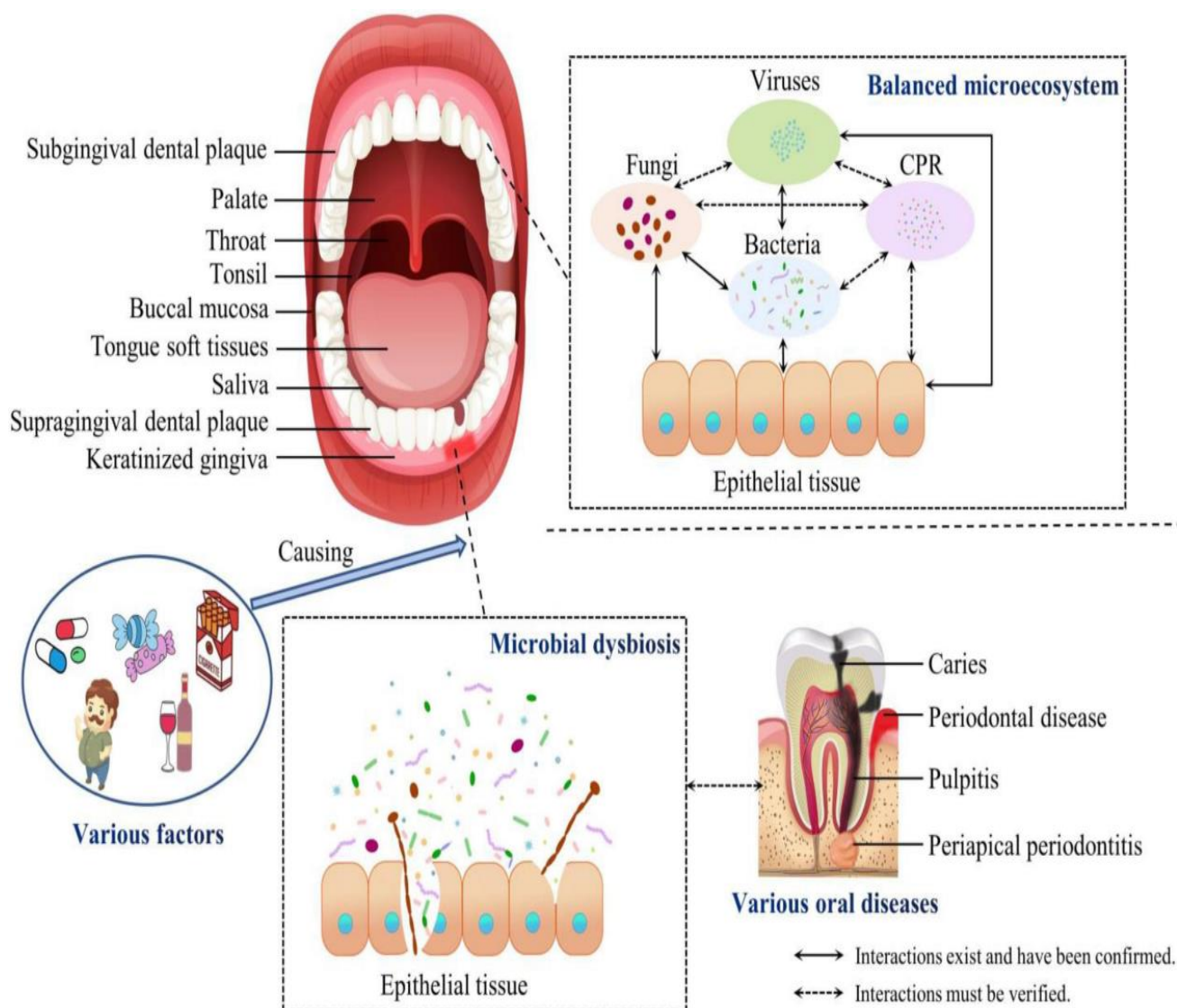


Image 2. Oral cavity and the influencing factors [4].

Oral mucosa, the layer of cells lining the entire oral cavity. This protects the underlying tissues and helps fight pathogens [3-5].

Saliva, the fluid produced by the salivary glands that helps moisten the mouth, initiate digestion and limit bacterial growth [3-5].

Main oral diseases

Various oral health problems can affect the components of the oral cavity. Damage to

tooth enamel caused by the action of acid produced by bacteria that metabolize sugars in the diet leads to tooth decay [4-6].

Gingivitis, inflammation of the gums caused by plaque buildup, which can progress to periodontitis if left untreated [5,6].

A serious infection that destroys the soft tissue and bone that supports teeth, potentially leading to tooth loss is periodontitis [5-7].

Halitosis (bad breath) can be caused by dental problems, poor oral hygiene, gum disease, or other medical conditions [5-7].

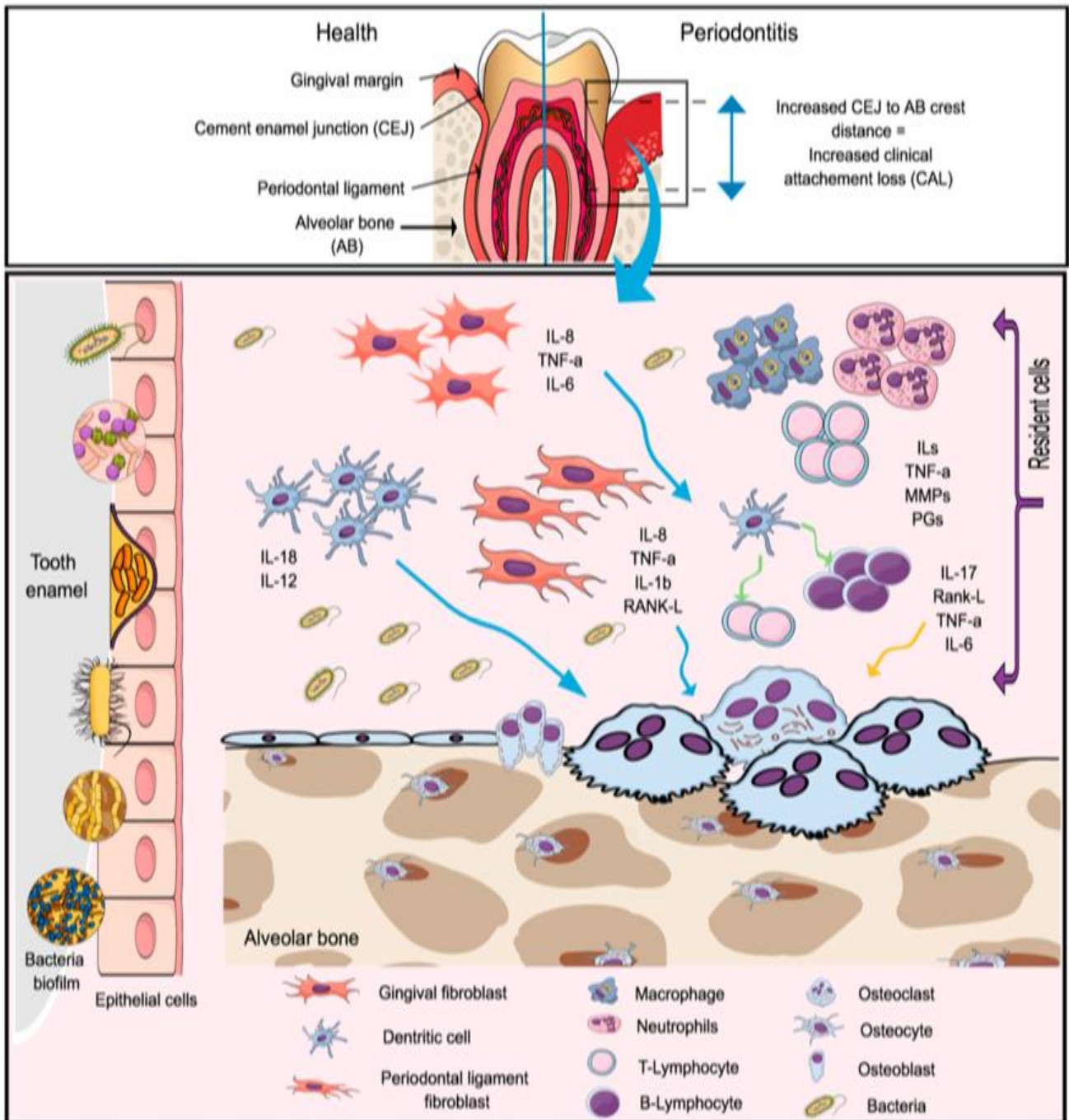


Image 3. Factors influencing oral health [6].

The importance of oral hygiene in the prevention of systemic diseases

Proper oral hygiene not only prevents oral diseases, but also plays a crucial role in the prevention of systemic diseases [7-9].

Bacteria from dental plaque can enter the bloodstream through affected gum tissues, reaching the heart and contributing to conditions like bacterial endocarditis [7-9].

Oral inflammation and infections can influence blood sugar control, making diabetes management more difficult [10-12].

Periodontal disease has been linked to premature birth and low birth weight, highlighting the importance of oral hygiene during pregnancy [11,12].

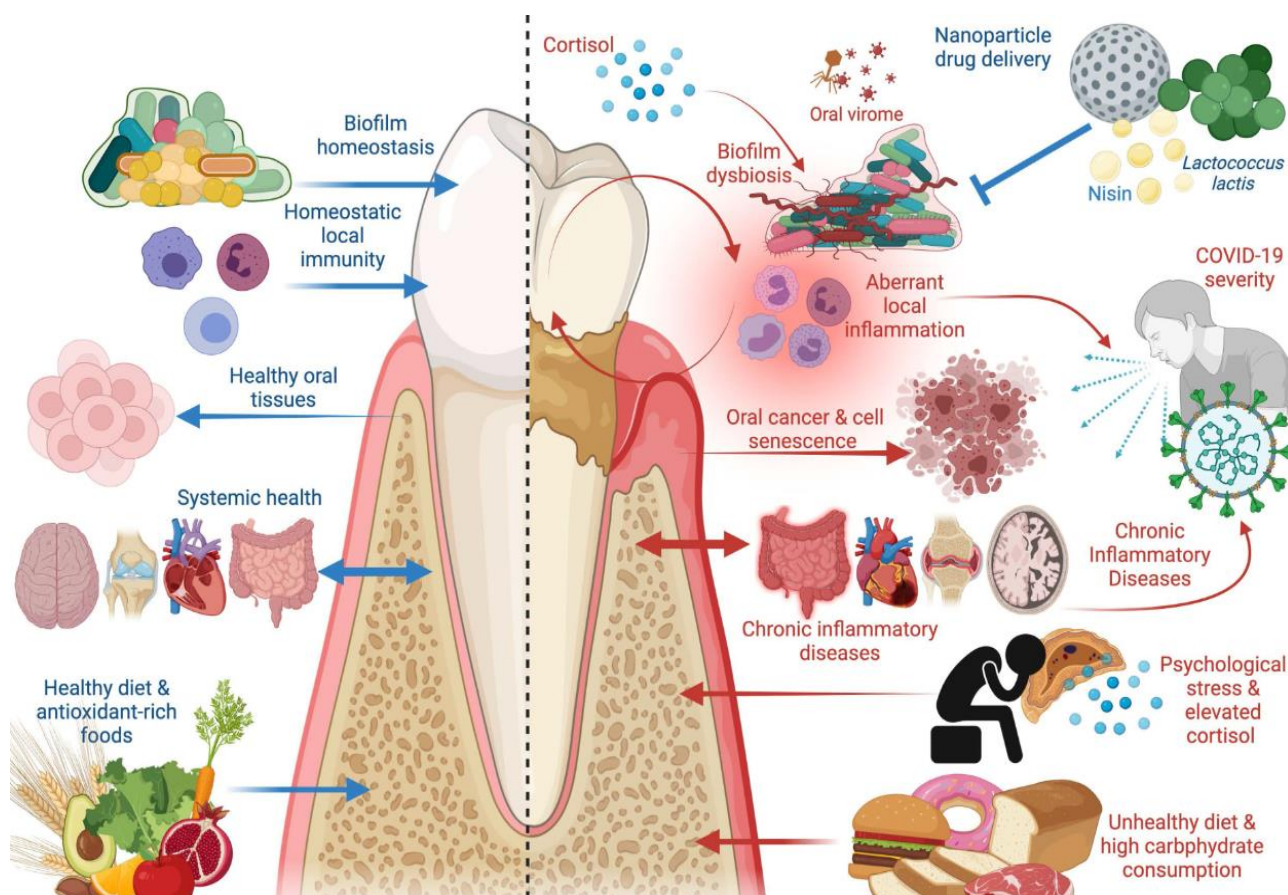


Image 4. Comparison of Healthy Oral Cavity vs. Consequences of Oral Diseases [12].

The link between oral health and heart disease

There are a number of mechanisms by which oral health problems can negatively influence heart health and vice versa. Understanding these connections can help prevent and manage both types of conditions more effectively [12-14].

One of the main mechanisms by which oral health problems affect the heart is through inflammation. Periodontitis (inflammation and infection of the gums) produces not only local inflammation, but also a systemic inflammatory response. When gum tissues are

infected and inflamed, they release proinflammatory cytokines (such as IL-6 and TNF- α) and C-reactive proteins into circulation [14-16].

These molecules are known for their role in promoting the formation and progression of atherosclerotic plaques in the arteries, which can lead to cardiovascular disease. It can increase the risk of major cardiovascular events, such as heart attack and stroke [14-16].

Inflamed and damaged gums allow bacteria from dental plaque to enter the bloodstream. Once oral bacteria, such as

Streptococcus sanguinis and *Porphyromonas gingivalis*, reach the circulation, they can reach the heart and other vital organs [15,16].

In the heart, these bacteria can colonize the heart valves and contribute to the development of bacterial endocarditis, a serious infection of the inner lining of the heart chamber and valves [15,16].

Chronic inflammation associated with oral diseases can impair the function of the

endothelium, the layer of cells that lines the inside of blood vessels [15,16].

Proinflammatory cytokines released from infected oral tissues can induce endothelial dysfunction, which is a precursor to atherosclerosis. Endothelial dysfunction reduces the ability of blood vessels to dilate properly, which contributes to hypertension and other heart problems [15-17].

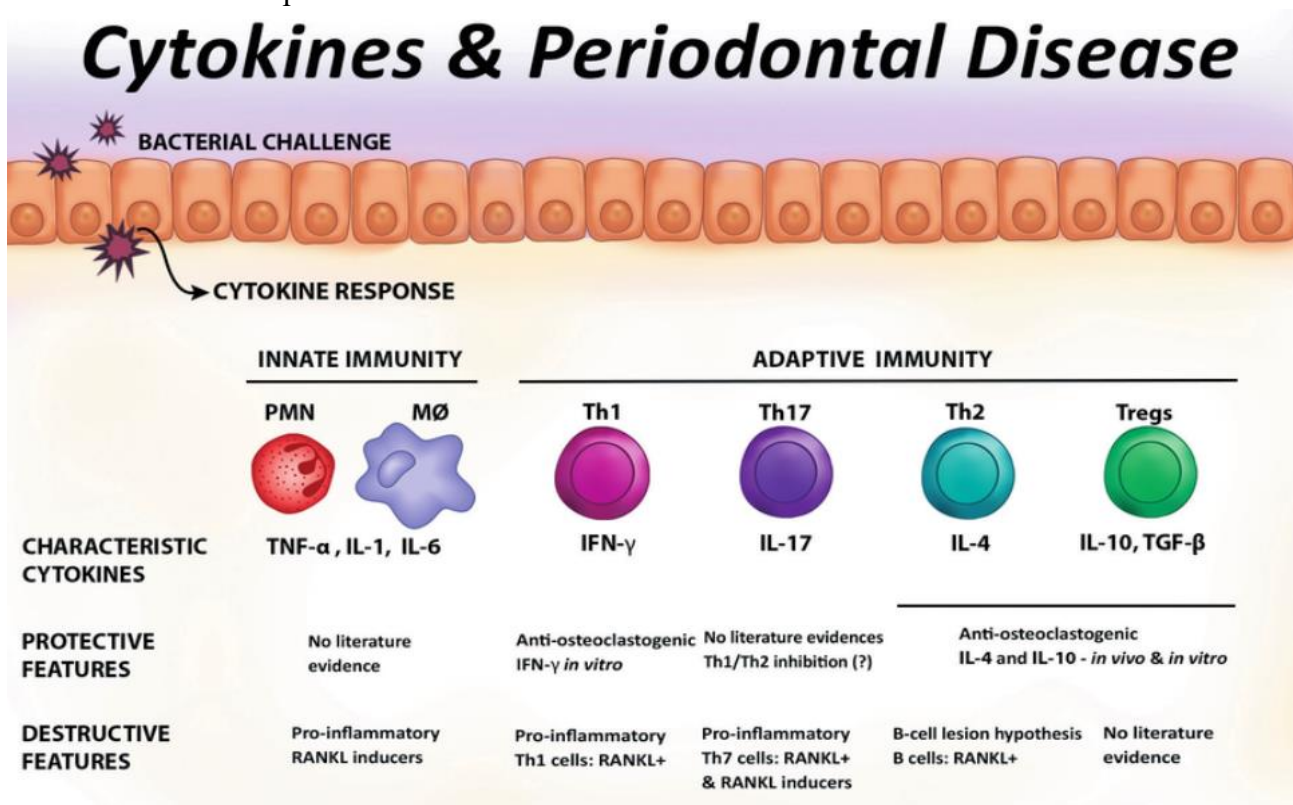


Image 5. The role of cytokines [16].

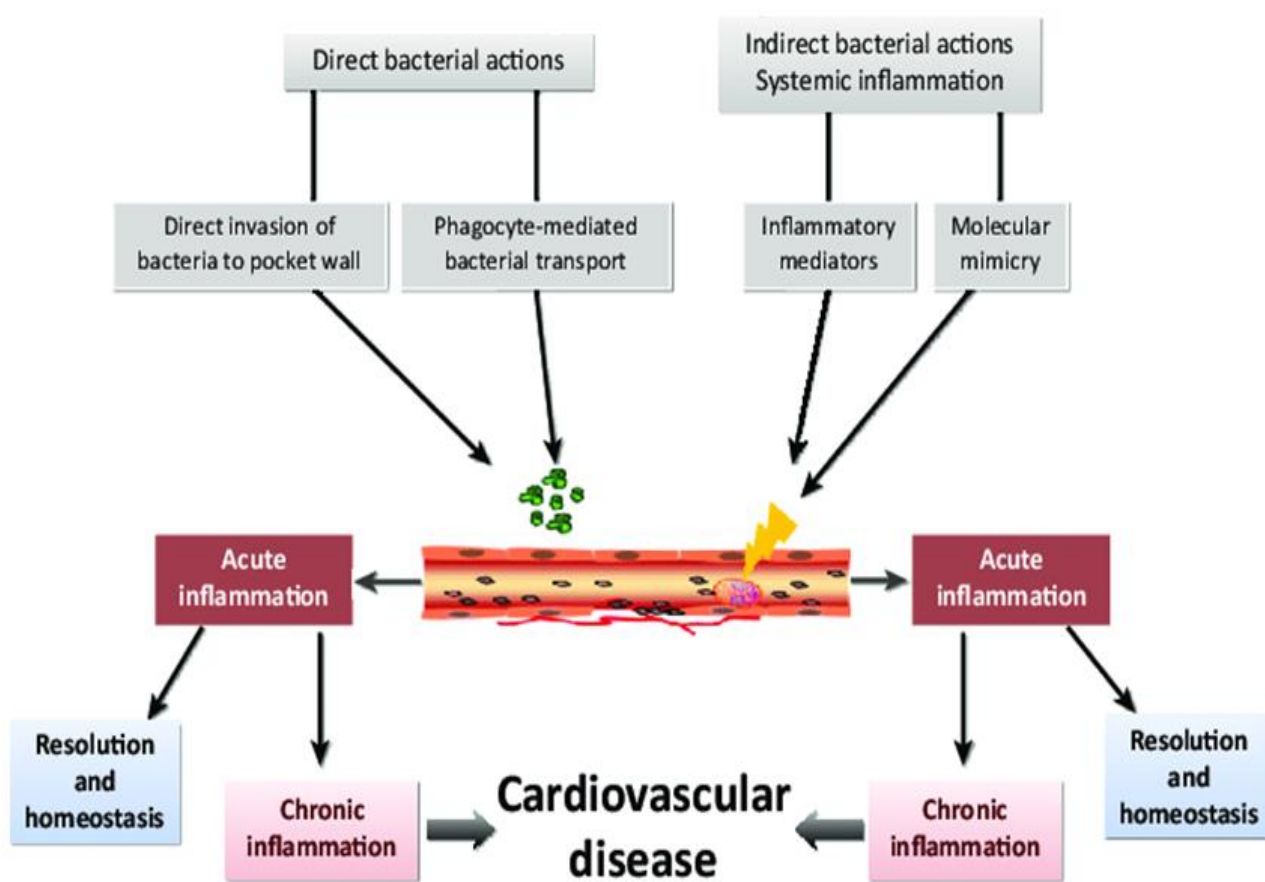


Image 6. The mechanism between periodontal disease and cardiovascular disease [18].

Oral bacteria can also influence platelet aggregation, increasing the risk of thrombus formation. This can happen directly, through the release of toxins by platelet-activating bacteria, or indirectly, by influencing clotting factor levels via the inflammatory response. Increased blood clots can lead to clogged arteries, contributing to the risk of heart attack and stroke [16-18].

Heart disease, especially those affecting arteries and blood vessels, can reduce blood flow to oral tissues, which can compromise the health of gums and other tissues in the oral cavity.[16-18]

Some medications used to treat cardiovascular disease, such as antihypertensives or anticoagulants, can have side effects that affect oral health, including dry mouth, which can increase susceptibility to tooth decay and gum infections [16-18].

6. Management and prevention

Due to the proven link between oral health and cardiovascular disease, effective oral health management becomes essential in the prevention of cardiovascular disease. It is essential to inform patients about the link between oral health and heart disease. Patients should be aware of how neglecting oral hygiene can have serious consequences for heart health. [16-18].

Heart disease can affect oral health through various mechanisms, including altering blood flow, which can influence tissue healing and susceptibility to infections. An innovative response to this problem is the use of essential oil-laden nanoparticles, which provide delayed release[19-24]. These nanoparticles can be used to treat or prevent oral conditions, having the ability to gradually release active ingredients directly into the affected area, ensuring a more effective and focused therapy. This is a promising field that combines nanotechnology with phytotherapy

to improve oral health in patients with cardiovascular disease [14-27].

Heart disease can influence oral health, complicating orthodontic treatments through increased risk of infection and poor response to healing. Orthodontic management of cardiac patients requires a cautious approach, adapting techniques and materials to minimize stress and inflammation [28-33]. Interdisciplinary collaboration with cardiologists is essential to adjust orthodontic treatment, ensuring close monitoring of general and oral health, to prevent complications and optimize orthodontic treatment outcomes in the context of the presence of heart disease [33].

Heart disease can affect oral health, and oral paraclinical investigations become crucial for the early detection of complications. The selection of biocompatible dental materials is essential for cardiac patients, as they reduce the risk of side effects and inflammation. The use of biocompatible materials minimizes negative interactions, promotes healing, and supports safe oral rehabilitation. Close collaboration between cardiologists and dentists is vital to coordinate treatment and ensure the safest and most effective solutions for maintaining oral health in the context of heart disease [34-45].

Education on proper brushing techniques, flossing and other oral hygiene products can significantly reduce the incidence of oral diseases and, implicitly, cardiac complications [46-47].

The general recommendation is that patients visit the dentist for professional check-ups and cleanings every six months. Patients diagnosed with periodontitis should also be evaluated for cardiovascular risks, as inflammation and bacteria can affect heart health [46-47].

When a patient suffers from oral cardiac conditions and another general affections simultaneously, treatment should be managed collaboratively by the dentist and specialist in medicine field to optimize the patient's health outcomes [46-47,48-59].

Recommendations for a healthy diet rich in fruits, vegetables, and fiber, low in sugars and saturated fats, along with promoting regular exercise, are essential for maintaining oral and heart health [46-47].

For patients with certain heart conditions who are at increased risk of bacterial endocarditis, antibiotics may be necessary prior to dental procedures that may induce bacteremia [46-47, 60,61].

Modern techniques, such as laser therapy or quantification of biomarkers of inflammation, may play a role in the effective monitoring and treatment of periodontitis [46-47].

Conclusions

Maintaining good oral hygiene proves to be a crucial strategy not only for preventing cavities and gum disease, but also for minimizing the risk of serious heart disease.

Collaboration between dentists and cardiologists is essential to provide holistic care to patients, which can lead to early detection and more effective treatment of potentially related health problems.

Informing patients about the connection between oral health and heart disease is vital. Awareness of this link can motivate patients to adopt better oral care practices and actively participate in preventing long-term health problems.

Adopting a balanced diet, exercising regularly, avoiding smoking and maintaining a regular schedule of medical checkups are recommendations that support both oral and cardiovascular health.

By maintaining good oral health and having regular checkups with your dentist, you can significantly reduce your risk of heart complications associated with oral inflammation and bacterial dissemination. It underlines the importance of a preventive and interdisciplinary approach to managing patients' health.

References

1. Najafipour H, Malek Mohammadi T, Rahim F, Haghdoost AA, Shadkam M, Afshari M. Association of oral health and cardiovascular disease risk factors "results from a community based study on 5900 adult subjects". *ISRN Cardiol.* 2013 Jul 9;2013:782126. doi: 10.1155/2013/782126. PMID: 23956878; PMCID: PMC3727197.
2. Gianos E, Jackson EA, Tejpal A, Aspary K, O'Keefe J, Aggarwal M, Jain A, Itchhaporia D, Williams K, Batts T, Allen KE, Yarber C, Ostfeld RJ, Miller M, Reddy K, Freeman AM, Fleisher KE. Oral health and atherosclerotic cardiovascular disease: A review. *Am J Prev Cardiol.* 2021 Apr 5;7:100179. doi: 10.1016/j.ajpc.2021.100179. PMID: 34611631; PMCID: PMC8387275.
3. Khor, Brandon & Snow, Michael & Herrman, Elisa & Ray, Nicholas & Mansukhani, Kunal & Patel, Karan & Said-Al-Naief, Nasser & Maier, Tom & Machida, Curt. (2021). Interconnections Between the Oral and Gut Microbiomes: Reversal of Microbial Dysbiosis and the Balance Between Systemic Health and Disease. *Microorganisms.* 9. 496. 10.3390/microorganisms9030496.
4. Li Xinyi , Liu Yanmei , Yang Xingyou , Li Chengwen , Song Zhangyong The Oral Microbiota: Community Composition, Influencing Factors, Pathogenesis, and Interventions *Frontiers in Microbiology* Vol. 13 2022. DOI=10.3389/fmicb.2022.895537, ISSN=1664-302X
5. Serena Altamura, Rita Del Pinto, Davide Pietropaoli, Claudio Ferri, Oral health as a modifiable risk factor for cardiovascular diseases, *Trends in Cardiovascular Medicine*, 2023, ISSN 1050-1738, <https://doi.org/10.1016/j.tcm.2023.03.003>.
6. Dubey, Pragati & Mittal, Neelam. (2020). Periodontal diseases- A brief review. *International Journal of Oral Health Dentistry.* 6. 177-187. 10.18231/j.ijohd.2020.038.
7. Kotronia E, Brown H, Papacosta AO, Lennon LT, Weyant RJ, Whincup PH, Wannamethee SG, Ramsay SE. Oral health and all-cause, cardiovascular disease, and respiratory mortality in older people in the UK and USA. *Sci Rep.* 2021 Aug 12;11(1):16452. doi: 10.1038/s41598-021-95865-z. PMID: 34385519; PMCID: PMC8361186.
8. Meurman JH, Sanz M, Janket S-J. Oral Health, Atherosclerosis, and Cardiovascular Disease. *Critical Reviews in Oral Biology & Medicine.* 2004;15(6):403-413. doi:10.1177/154411130401500606
9. Mathews, M.J., Mathews, E.H. & Mathews, G.E. Oral health and coronary heart disease. *BMC Oral Health* 16, 122 (2016). <https://doi.org/10.1186/s12903-016-0316-7>
10. Ghanem AS, Németh O, Móre M, Nagy AC. Role of oral health in heart and vascular health: A population-based study. *PLoS One.* 2024 Apr 18;19(4):e0301466. doi: 10.1371/journal.pone.0301466. PMID: 38635852; PMCID: PMC11025934.
11. Sanchez, P., Everett, B., Salamonson, Y. et al. The oral health status, behaviours and knowledge of patients with cardiovascular disease in Sydney Australia: a cross-sectional survey. *BMC Oral Health* 19, 12 (2019). <https://doi.org/10.1186/s12903-018-0697-x>
12. Sedghi Lea M., Bacino Margot, Kapila Yvonne Lorraine, Periodontal Disease: The Good, The Bad, and The Unknown , *Frontiers in Cellular and Infection Microbiology* Vol. 11 2021 DOI=10.3389/fcimb.2021.766944. ISSN=2235-2988
13. Saraç F, Derelioğlu SŞ, Şengül F, Laloğlu F, Ceviz N. The Evaluation of Oral Health Condition and Oral and Dental Care in Children with Congenital Heart Disease. *Journal of Clinical Medicine.* 2023; 12(11):3674. <https://doi.org/10.3390/jcm12113674>
14. Benjamin RM. Oral health: the silent epidemic. *Public Health Rep.* 2010 Mar-Apr;125(2):158-9. doi: 10.1177/003335491012500202. PMID: 20297740; PMCID: PMC2821841.
15. Rughwani, Roshan & Cholan, Priyanka & Victor, Dhayanand. (2022). Congenital Heart Diseases and Periodontal Diseases—Is There a Link?. *Frontiers in Cardiovascular Medicine.* 9. 10.3389/fcvm.2022.937480.
16. Silva Steffens, Nora & Abusleme, Loreto & Bravo, Denisse & Dutzan, Nicolas & Garcia-Sesnich, Jocelyn & Vernal, Rolando & Hernández, Marcela & Gamonal, Jorge. (2015). Host response mechanisms in periodontal diseases. *Journal of applied oral science : revista FOB.* 23. 329-55. 10.1590/1678-775720140259.
17. Bourgeois, D.; Inquimbert, C.; Ottolenghi, L.; Carrouel, F. Periodontal Pathogens as Risk Factors of Cardiovascular Diseases, Diabetes, Rheumatoid Arthritis, Cancer, and Chronic Obstructive Pulmonary

- Disease—Is There Cause for Consideration? *Microorganisms* 2019, 7, 424. <https://doi.org/10.3390/microorganisms7100424>
18. El Kholly, Karim & Genco, Robert & Van Dyke, Thomas. (2015). Oral infections and cardiovascular disease. *Trends in endocrinology and metabolism: TEM*. 11. 10.1016/j.tem.2015.03.001.
 19. Dumitriu Buzia O, Păduraru AM, Stefan CS, Dinu M, Cocoș DI, Nwabudike LC, Tatu AL. Strategies for Improving Transdermal Administration: New Approaches to Controlled Drug Release. *Pharmaceutics*. 2023; 15(4):1183. <https://doi.org/10.3390/pharmaceutics15041183>
 20. Feier R, Sireteanu Cucui RM, Ratiu RF, Baciuc D, Galea C, Sachelarie L, Nistor C, Cocos D, Hurjui LL, Cernei ER. Comparative Study of Ozonated Olive Oil and Extra Virgin Olive Oil Effects on Oral Hygiene. *Applied Sciences*. 2023; 13(5):2831. <https://doi.org/10.3390/app13052831>
 21. Cocoș DI, Dumitriu Buzia O, Tatu AL, Dinu M, Nwabudike LC, Stefan CS, Earar K, Galea C. Challenges in Optimizing Nanoplatforms Used for Local and Systemic Delivery in the Oral Cavity. *Pharmaceutics*. 2024; 16(5):626. <https://doi.org/10.3390/pharmaceutics16050626>
 22. Dinu M, Tatu AL, Cocoș DI, Nwabudike LC, Chirilov AM, Stefan CS, Earar K, Dumitriu Buzia O. Natural Sources of Therapeutic Agents Used in Skin Conditions. *Life*. 2024; 14(4):492. <https://doi.org/10.3390/life14040492>
 23. Cocoș DI, Earar K, Dinu M, Lungu I, Bazbanelă C, Galea C. PERSPECTIVES ON THE USE OF GERANIUM ESSENTIAL OIL: PELARGONIUM GRAVEOLENS AND PELARGONIUM ROSEUM, IN DENTAL MEDICINE. *Romanian Journal of Medical and Dental Education* Vol. 12, No. 2, March-April 2023
 24. Bejan A, Baciuc D, Cocoș DI, Dimofte AR. CONCEPTS ON THE RESISTANCE OF ACRYLIC TEETH, PMMA. *MEDICINE AND MATERIALS* Volume 3, Issue 1, 2023: 43-47 | ISSN: 2784 – 1499 & e-ISSN: 2784 – 1537 DOI: 10.36868/MEDMATER.2023.03.01.043
 25. Cocoș DI, Bucur SM, Coman TM, Păcurar M. Observational study on the frequency of anchorage auxiliaries in fixed orthodontics, *Romanian Journal of Oral Rehabilitation* vol. 13, nr. 3,(iulie-septembrie) anul 2021.
 26. Bucur SM, Popa R, Cocoș DI, Tunyogi AB, Istrate P. Presence of candida albicans in hawley plate wearers: a pilot study *Romanian Journal of Oral Rehabilitation* Vol. 14, No. 1, January - March 2022. ISSN2066-7000 ISSN-L 2601-4661
 27. Cocoș DI, Earar K, Bucur SM, Păcurar M, Mariș M, Cocoș ID, Galea C. FREQUENCY OF THIRD MOLAR PATHOLOGY: INNOVATIVE CAUSES, SYMPTOMS AND TREATMENT OPTIONS. *Romanian Journal of Oral Rehabilitation* Vol. 15, No.4 October-December 2023
 28. Coman TM, Mănărașan AD, Cîrstea AS, Cocoș DI. The multidisciplinary approach of a patient with Sjögren's Syndrome in the dental office – case report, *Acta Stomatologica Marisiensis* 2019 ;2(2)235-240 <https://asmj.ro/tag/hypertension/>
 29. Bucur SM, Bud A, Gligor A, Vlăsa A, Cocoș DI, Bud ES. Observational Study Regarding Two Bonding Systems and the Challenges of Their Use in Orthodontics: An In Vitro Evaluation. *Applied Sciences*. 2021; 11(15):7091. <https://doi.org/10.3390/app11157091>
 30. Cocoș DI, Păcurar M, Nistor AC, Moaleș D, Cocoș ID, Earar K. THE ROLE OF CBCT IN ASSESSING THE SEVERITY OF WISDOM TEETH INCLUSION COMPARED TO CONVENTIONAL RADIOLOGICAL TECHNIQUES. *Romanian Journal of Oral Rehabilitation* Vol. 16, No.2 April-June 2024. DOI : 10.6261/RJOR.2024.2.16.51
 31. Budacu CC, Agop Forna D, Dimofte AR, Miulescu M. OMF versus migraine pain: similarities, differences, and realization of laser treatment. *MEDICINE AND MATERIALS* Volume 4, Issue 1, 2024: 17-24 | ISSN: 2784 – 1499 & e-ISSN: 2784 – 1537 DOI: 10.36868/MEDMATER.2024.04.01.017.
 32. Tiutiuca C, Ceban E, Solomon O. Anatomy and pathology of the optic nerve. *MEDICINE AND MATERIALS* Volume 4, Issue 1, 2024: 25-32 | ISSN: 2784 – 1499 & e-ISSN: 2784 – 1537 DOI: 10.36868/MEDMATER.2024.04.01.025.
 33. Salcianu IA, Bratu AM, Bratu IC, Parvu S. Biomaterials used in heart valve substitution. *MEDICINE AND MATERIALS* Volume 4, Issue 1, 2024: 43-50 | ISSN: 2784 – 1499 & e-ISSN: 2784 – 1537 DOI: 10.36868/MEDMATER.2024.04.01.043.

34. Anghel M, Marina V, Moscu CA, Dragomir L, Anghel AD, Lescai AM , Emotional Distress in a Patients Following Polytrauma, JOURNAL OF MULTIDISCIPLINARY HEALTHCARE, Vol.16, pp.1161-1170
35. Moscu CA, Marina V, Anghel M, Anghel AD, Dragomir L Did Personality Type Influence Burn Out Syndrome Manifestations During Covid-19 Pandemic? .Int J Gen Med. 2022 Jun 7;15:5487-5498. doi: 10.2147/IJGM.S353405. eCollection 2022.PMID:
36. Dragomir L, Marina V, Moscu CA, Anghel M The Patient Hides the Truth, but the Computer Tomography Examination Restores It! .Diagnostics (Basel). 2022 Mar 31;12(4):876. doi: 10.3390/diagnostics12040876.PMID: 35453924
37. Marina V, Popa F. An unusual case of leg wound made by a Sea Shell (*Scapharca inaequivalis*).Int J Surg Case Rep. 2020;67:127-129. doi: 10.1016/j.ijscr.2020.01.039. Epub 2020 Feb 6.PMID: 32062116
38. Duceac LD, Calin G, Eva L, Marcu C, Bogdan Goroftei ER, Dabija MG, Mitrea G, Luca AC, Hanganu E, Gutu C, Stafie L, Banu EA, Grierosu, Iordache AC, Third-generation cephalosporin-loaded chitosan used to limit microorganisms resistance, Materials 2020, 13(21), 4792;
39. Ichim DL, Duceac LD, , Marcu C, Iordache AC, Ciomaga IC, Luca AC, Mitrea G, Bogdan Goroftei ER, Stafie L: Synthesis and Characterization of Colistin Intercalated Nanoparticles Used to Combat Multi-Drug Resistant Microorganisms, Rev Chimie.2019;70(10):3734-3737.
40. Forna N.C., Dascalu C. , Forna D. , Antohe M.E. , Incidence and prevalence of dental - periodontal conditions and edentation in Moldavia, Medical-Surgical Journal-Revista Medico-Chirurgicala , 2013,117 (1) , pp.205-211
41. Bolat, M; Antohe, M and Forna, NC, Clinical aspects of therapeutical solutions involved in oral rehabilitation of partially edentulous patients, 2013, Romanian journal of oral rehabilitation 5 (4) , pp.75-81
42. Duceac LD, Stafie L, Păvăleanu I, Mitrea G, Baciuc G, Banu EA, Romila L, Luca AC: Sepsis in paediatrics – a special form of infection associated to medical assistance, International Journal of Medical Dentistry (IJMD), vol.22, nr.3, 2018, pp 229-235
43. Mîndru DE, Stănescu RS, Matei Calipsoana M, Duceac LD, Rugină A, Temneanu OR, Ungureanu M, Florescu L, Stress in pediatric patients – the effect of prolonged hospitalization, Revista Medico Chirurgicală, Iași, 2016, Vol. 120, nr. 2, pp.417-423,
44. Antohe, M.E.; Madarati, M. and Forna, N.C., Clinical-technological requirements in the rehabilitation of partially extended edentulousness complications, Romanian journal of oral rehabilitation, 2021, 13 (4) , pp.194-200
45. Murariu, A., Hanganu, C., Bobu, L., Vasluianu, R. , Geletu, G. , Baciuc, R. , Stafie, C.S. , Forna, N.C. , Comparative study of oral health systems in Europe, Romanian journal of oral rehabilitation, 2020, 12 (4) , pp.11-17
46. Nemtoi, A., Nemtoi, A. ,Fochi, A., Sirghe, A.E. , Preda, C. , Earar, K. , Beznea, A. , Onisor, C. , Iorgulescu, G. , Haba, D., CBCT Evaluation of the Mandibular Bone Quality in Relation to Skeletal Status After Treatment with Strontium Renelate in Diabetic Patients, Revista de chimie, 2019, 70 (11) , pp.4113-4118
47. Forna, N.C. and Pepi, P., Non-invasive methods of paraclinical evaluation involved in oral rehabilitation, Romanian journal of oral rehabilitation, 2009, 1 (2) , pp.11-19
48. Forna N, Damir D, Duceac LD, Dabija MG, Calin G, Ichim DL, Gutu C, Grierosu C, Eva L, Ciuhodaru MI, et al. Nano-Architectonics of Antibiotic-Loaded Polymer Particles as Vehicles for Active Molecules. Applied Sciences. 2022; 12(4):1998
49. Duceac M (Covrig), Eva L, Dabija MG, Stoica MG, Druguș D, Duceac LD, Voinescu DC. Does oral health affect your bone loss? The link between periodontitis disease and osteoporosis – an epidemiological approach to lumbar disc herniation in a neurosurgery hospital in the northeastern region of Romania, Romanian Journal of Oral Rehab.2023;2:44-53 ;

50. Luchian N, Eva L, Dabija MG, Druguş D, Duceac M, Mitrea G, Marcu C, Popescu MR, Duceac LD. Health – associated infections in hospital in the North-East region of Romania – a multidisciplinary approach, *Romanian Journal of Oral Rehab* 2023; 2:219-229.
51. Antohe, M.E. , Stamatina, O., Paval, D., Tibeica, A., Cretu, C. , Forna, N.C., Clinical-technological interactions of treatment in partially extended edentulousness,2022, *Romanian journal of oral rehabilitation* 14 (1) , pp.195-204
52. Luca, E., Iordache, C., Tanculescu, O., Surlari, Z. , Virvescu, D. , Checherita, L. , Ciocan-Pendefunda, A. , Beldiman, M., A., Aspects of aesthetic rehabilitation using digital smile design, *Romanian journal of oral rehabilitation*, 2019, 11 (2) , pp.119-123
53. Forna, N.C. and Sader, R., Oral rehabilitation on small substance loss cases,2009,*Romanian Journal Of Oral Rehabilitation*, 1 (4) , pp.15-20
54. Botnariu G., Forna N., Popa A.,Popescu R. , Onofriescu A. ,Ciocla D., Lacatusu C. , Mihai B. ,Correlation of Glycemic Control Parameters in Non-Diabetic Persons with Cardiovascular Risk Scores - Results from a Cross-Sectional Study,*Revista De Chimie* , 2017, 68 (1) , pp.108-110
55. Moscalu, M., Moscalu, R., Dascalu, C.G., Tarca, V. , Cojocaru, E. , Costin, I.M. , Tarca, E., Serban, I.L., Histopathological Images Analysis and Predictive Modeling Implemented in Digital Pathology-Current Affairs and Perspectives,*Diagnostics*,2023, 13 (14)
56. Hizanu M, Bogdan Goroftei ER, Popa F, Duceac M, Marcu C , Ciuhodaru MI , Drugus D, Duceac LD, Dental disease in children diagnosed with life-limiting diseases. Retrospective study, *Romanian Journal of Oral Rehab* 2023;3:160-172
57. Simionescu N, Nemezc M, Petrovici AR, Nechifor IS, Buga RC, Dabija MG, Eva L, Georgescu A. "Microvesicles and Microvesicle-Associated microRNAs Reflect Glioblastoma Regression: Microvesicle-Associated miR-625-5p Has Biomarker Potential" *International Journal of Molecular Sciences* 2022, nr. 15: 8398.
58. Marciuc EA, Dobrovăţ BI, Popescu RM, Dobrin N, Chiriac A, Marciuc D, Eva L, Haba D, 3D Printed Models—A Useful Tool in Endovascular Treatment of Intracranial Aneurysms. *Brain Sciences*. 2021, 11(5), 598.
59. Luca, L., Ciubara, A.B., Antohe, M.E., Peterson, I., Ciubara, A., Social media addiction in adolescents and young adults - psychoeducational aspects, *ARCHIV EUROMEDICA*, 2022, 12.
60. Cristea, I. , Agop-Forna, D., Martu, M.A. ,Dascalu, C. ,Topoliceanu, C. ,Török, R., Török, B. , Bardis, D., Bardi, P.M. ,Forna, N. , Oral and Periodontal Risk Factors of Prosthetic Success for 3-Unit Natural Tooth-Supported Bridges versus Implant-Supported Fixed Dental Prostheses,*DIAGNOSTIC*, 2023 13 (5)
61. Branisteanu, D.E., Nicolescu, A.C., Branisteanu, D.C., Branisteanu, C.I., Dragoi, A.C., Bogdanici, C.M. ... Porumb, E.A. (2022). Cardiovascular comorbidities in psoriasis (Review). *Experimental and Therapeutic Medicine*, 23, 152. <https://doi.org/10.3892/etm.2021.11075>