BULLETIN OF STOMATOLOGY AND MAXILLOFACIAL SURGERY
Volume 21, Issue 5

DOI: 10.58240/1829006X-2025.21.5-226

DRUG-BASED INTERVENTIONS IN DENTISTRY: SUPPORT AND OPTIMIZATION TECHNIQUES

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Received: *May 15. 2025;* ***Accepted:*** *Jun 15, 2025;* ***Published:*** *Jun.30,2025*

ABSTRACT

Background: The introduction of modern approaches in dentistry requires a review of existing patient care strategies. The growing prevalence of non-communicable diseases (NCDs) in the structure of overall morbidity demonstrates the importance of considering comorbidities when planning dental interventions and medication support.

Objective: The study aims to systematise modern approaches to optimising the drug treatment of patients with NCDs in dental practice on the example of non-alcoholic fatty liver disease and its complications.

Methods: The research methodology included an analysis of modern scientific literature, statistical data and clinical studies.

Results: The relationship between oral diseases and non-alcoholic fatty liver disease is analysed. The pathophysiological mechanisms of this relationship and modern approaches to pharmacological support of patients are considered. Particular attention is paid to using herbal remedies and nutraceuticals in dental practice, which helps reduce systemic inflammation and the risk of complications.

Conclusion: The data obtained indicate the importance of an interdisciplinary approach in treating such patients.

***Keywords*:**periodontitis, surgical dentistry, therapeutic dentistry, non-alcoholic fatty liver disease, non-alcoholic steatohepatitis, herbal remedies, nutraceuticals.

1. INTRODUCTION

The modern paradigm of dental care for patients is based on a new understanding of the important role of oral health in maintaining human health and well-being.[1] At the stage of the dental industry transformation, much attention is paid to implementing the latest advances in pathobiology, regenerative medicine, bioengineering, and personalised medicine approaches.[1]

Diagnostics and treatment of oral diseases are among the most relevant areas of surgical dentistry. This area is relevant because of the significant prevalence of pathologies such as caries, periodontal disease, malignant tumours, and others, even in high-income countries.[2] According to Benzian et al.,[3] about 45% of the population, regardless of the region and economic development of the country, suffers from oral pathology, which often requires surgical intervention.

At the same time, the association of oral diseases with chronic non-communicable diseases (NCDs), in particular diseases of the gastrointestinal tract, has been proven[4, 5, 6], which requires the search for not only practical strategies for the treatment of dental diseases but also the development of multidisciplinary approaches to help patients with comorbidities.

The study aimed to systematise modern approaches to optimising the drug treatment of patients with NCDs in dental practice on the example of non-alcoholic fatty liver disease.

Literature review

Adequate pharmacological support in the provision of care to patients in the field of dental surgery is aimed at pain relief, prevention of complications and acceleration of healing processes in various types of pathological processes. It should be noted that, given the increasing proportion of the population with NCDs[7], the planning of pharmacological support for dental interventions should be carried out considering possible comorbidities individually for each patient.[1] In particular, the role of periodontal disease in the development of non-alcoholic fatty liver disease and its complication of non-alcoholic steatohepatitis has been confirmed, which, given the pathophysiological features of the course of this disease and its prevalence in the population, requires special attention to each patient.[6, 8, 9, 10, 11]

Since NCDs are often accompanied by impaired repair processes and immunodeficiency states,[12] and patients are intolerant to many chemicals and pharmacological agents (multiple-chemical sensitivity patients),[13, 14, 15] herbal remedies and probiotics are currently being considered as an alternative or complement to standard therapy.[16, 17, 18, 19]

METHODS

Study Design

This literature review was conducted in accordance with the PRISMA 2020 (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. The purpose of the review was to identify, assess, and synthesise peer-reviewed evidence related to pharmacological support in dental practice, particularly in patients with non-communicable diseases such as non-alcoholic fatty liver disease (NAFLD) and its complications.

Data Sources and Search Strategy

A comprehensive literature search was performed in the following databases: PubMed, Scopus, Web of Science, and Google Scholar, covering the publication period from January 2004 to December 2024. In addition, relevant clinical guidelines and consensus statements from professional medical associations and the World Health Organization (WHO) were reviewed.

The following keywords and their Boolean combinations were used:

[oral microbiome], [periodontitis], [dental pharmacology], [non-alcoholic fatty liver disease], [NAFLD], [steatohepatitis], [cirrhosis], [inflammation], [oxidative stress], [preventing], [oral hygiene practices].

The full search strategy for each database can be provided upon request.

Inclusion criteria:

– Peer-reviewed articles published between 2004 and 2024.

– Studies examining the relationship between oral health/dental interventions and NAFLD or other non-communicable diseases.

– Articles describing pharmacological or nutraceutical support in dental care.

– Guidelines or consensus documents on pharmacological strategies in dental practice.

– Articles written in English or Ukrainian (with translated versions).

Exclusion criteria:

– Abstracts without access to the full text.

– Case reports, editorials, conference abstracts, or letters to the editor.

– Studies unrelated to pharmacological or therapeutic aspects of dental care.

– Articles lacking clear methodological description or outcome measures.

Screening and Selection Process

The initial search yielded 250 articles. After duplicate removal and title/abstract screening, 72 full-text articles were assessed for eligibility. Of these, 32 articles met the inclusion criteria and were included in the final review. The article selection process is illustrated in the PRISMA flow diagram (Figure 1).

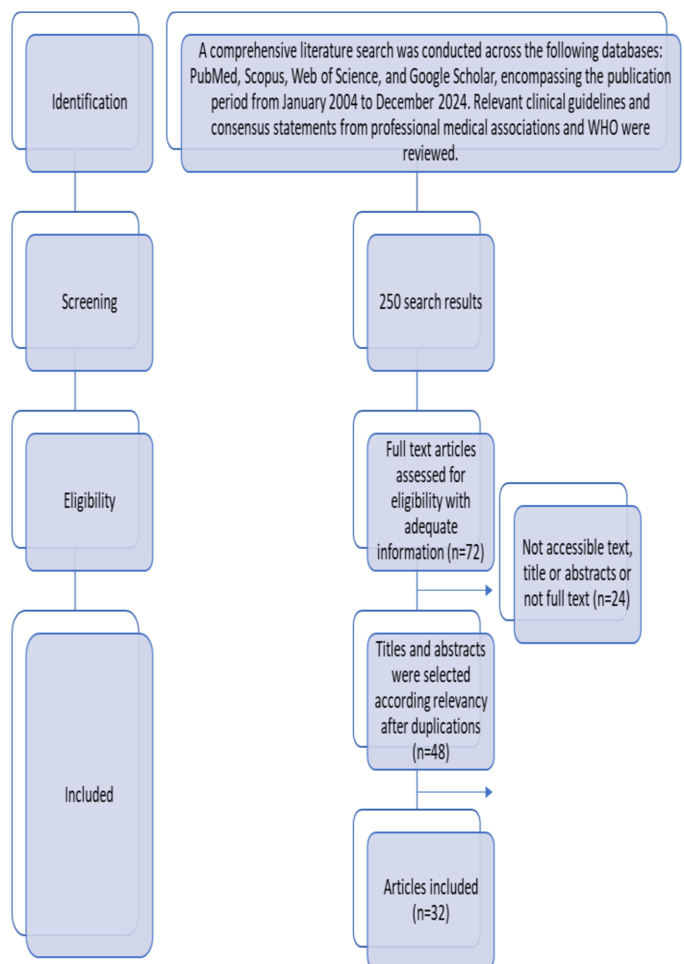

Figure 1. PRISMA 2020 Flow Diagram

Iryna Dvulit, Olena Haioshko, Liudmyla Volokhova, Viktor Kuznetsov, Volodymyr Krasnov. Drug-Based Interventions in Dentistry: Support and Optimization Techniques.Bulletin of Stomatology and Maxillofacial Surgery.2025;226-234 doi: 10.58240/1829006X-2025.21.5-226

Screening and eligibility assessment were performed independently by two reviewers. Discrepancies were resolved through discussion and consensus.

Data Extraction and Synthesis

A structured data extraction form was used to collect the following variables from each included article:

- Author(s) and publication year
- Study design and sample size (if applicable)
- Type of dental intervention
- Type of pharmacological support (e.g., antibiotics, nutraceuticals, herbal therapy)
- Main findings regarding efficacy or safety
- Relevance to NAFLD or comorbid conditions

Data were synthesised narratively due to the heterogeneity of study designs and outcomes. Quantitative synthesis (meta-analysis) was not performed.

Risk of Bias Assessment

Given the narrative nature of this review, a formal quantitative risk of bias tool was not applicable. However, methodological quality was assessed based on the following:

- Clarity of research objectives
- Transparency of methodology
- Sample size and design appropriateness
- Relevance of outcomes to the review objective
- Declaration of conflicts of interest and funding sources

Studies judged to have significant methodological limitations or lack of clarity in outcome reporting were excluded during the eligibility screening.

RESULTS

Features of drug treatment of patients with non-communicable chronic diseases in dental practice

The treatment of patients in dental practice involves the use of a variety of medications aimed at reducing symptoms, preventing complications and improving the quality of life of patients. Antibiotics are most often prescribed in dental practice, but according to,[20] as in the practice of family doctors, 80% of prescriptions are not appropriate in terms of both preventive and therapeutic effects.[21] Non-steroidal anti-inflammatory drugs, topical antibacterial drugs, toothpaste and rinses, herbal medicines and nutraceuticals are widely used.[16, 22]

One of the challenges that currently needs to be addressed is the intolerance of drugs and materials used in dental practice by patients with comorbidities. According to Cieplik et al.,[15] one-third of patients have complaints due to reactions associated with taking medications to treat the underlying disease. The most common side effects were detected in patients taking antihypertensive and psychotropic medications. Relevant diagnosed allergy to dental materials was found in 11.9% of patients with comorbidities. This indicates the need for interdisciplinary consultations when providing dental care to patients with comorbidities.

Patients' use of dental care differs for therapeutic and surgical interventions (Figure 2), although the main reasons for visits to a dentist are caries and periodontal disease.[22]

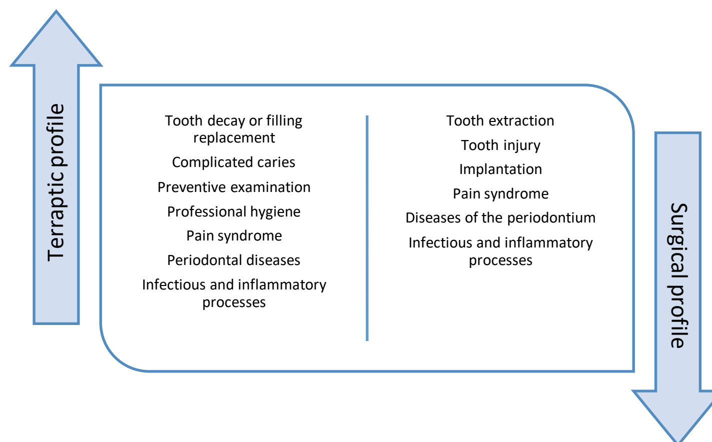

Figure 2. Reasons for seeking dental care in Ukraine, 2021
Source: author's drawing adapted from Mazur et al.[22]

The latest approaches to modern dental care make it possible for patients. In Table 1, we have systematised the main surgical interventions and options for medical support, taking into account modern advances in omics, conventional therapy, and nutraceutical therapy.

Table 1. Medication support after surgical interventions for oral diseases

Surgical intervention	Diseases / indications	Medication support
Tooth extraction	Terminal caries, periodontitis, tooth retention	Antibiotics (amoxicillin, clindamycin), NSAIDs (ibuprofen, ketorolac), probiotics for the prevention of dysbiosis
Atraumatic extraction	Implant planning, minimal tissue trauma	Biomaterials for socket preservation (collagen matrices, PRF-plasma enriched with growth factors), analgesics
Sinus lift	Bone atrophy of the upper jaw before implantation	Biomaterials (hydroxyapatite, β-TCF - beta-tricalcium phosphate), antibiotics, corticosteroids to reduce edema
Augmentation of bone tissue	Insufficient bone volume for implantation	Bioengineered materials (xenografts, bioactive glass, BMPs - bone morphogenetic proteins), antibiotics, analgesics
Dental implantation	Absence of teeth	Antibiotics, PRF (acceleration of osseointegration), probiotics for oral microbiota
Gingivectomy / gingivoplasty	Periodontitis, gingival hyperplasia	Antiseptics (chlorhexidine), regenerative gels with hyaluronic acid, laser therapy
Vestibuloplasty	Soft tissue correction to stabilise prostheses or implants	PRF, regenerative biomaterials, antiseptics
Bone grafting	Bone defects after injuries or tumours	Bioengineered materials (alloplastics, xenografts), PRF, BMP
Treatment of periapical lesions (root apex resection, cystectomy)	Chronic granulomas, cysts	Antibiotics, PRF, antioxidants (vitamin C, curcumin)
Laser surgery	Periodontitis, gingivitis, reduction of biofilm	Antiseptics, probiotics, photodynamic therapy
Mucogingival surgery (gum transplantation)	Gum recession, periodontitis	PRF, antiseptics, regenerative gels
Surgical treatment of peri-implantitis	Inflammation around implants	Bioactive coatings (antibacterial nanoparticles), probiotics, antibiotics

One area of dental care for the population is the treatment of periodontitis, which is the sixth most common disease among adults and is characterised by the destruction of tooth-supporting tissues, including cementum, periodontal ligament, and alveolar bone, due to inflammation.[10] Figure 3 shows the prevalence of severe forms of periodontal disease in the European region that required surgical intervention.

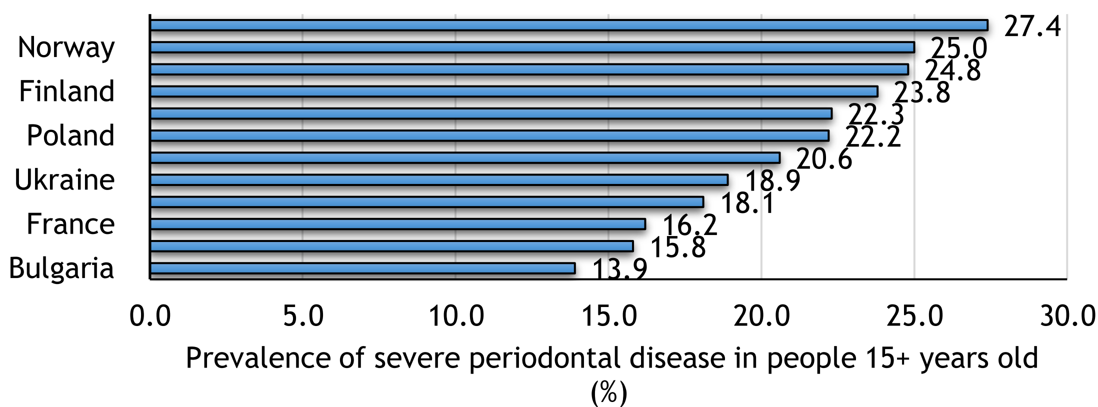

Figure 3. Prevalence of severe periodontal disease in the European region in people over 15 years of age, 2019
Source: author's drawing based on data from the WHO database[23]

Indications for the surgical treatment of periodontitis[16] include deep periodontal pockets that cannot be treated conservatively, destruction of alveolar bone, gingival detachment/gingival recession, granulation tissue and periodontal abscesses, loosening of teeth due to loss of bone support. The main surgical methods of periodontitis treatment include periodontal pocket curettage (closed and open), flap surgery for deep root cleaning and bone regeneration, regenerative surgery, gingivectomy/gingivoplasty, laser surgery – a minimally invasive approach to reduce inflammation and bleeding.

Studies have shown a link between periodontitis and NCDs, the pathophysiological causes of which are associated with metabolic disorders and the development of systemic inflammation,[11] which complicates the provision of dental care. Given the widespread prevalence of such diseases as non-alcoholic fatty liver disease, which occurs both in isolation and as a complication of diseases such as metabolic syndrome and diabetes mellitus, and the association of this disease with periodontitis, let us dwell on this in more detail.

Current understanding of the relationship between oral health and liver disease

Almost one in four people have NAFLD, and several hypotheses link NAFLD and periodontitis through periodontal pathogens, inflammatory mediators and oxidative stress.[11] Studies have demonstrated a statistically significant association between NAFLD and periodontitis, independent of socioeconomic variables, health habits, and the prevalence of metabolic syndrome. It has been established that both liver diseases can affect the state of the oral cavity by reducing local immunity, changing the composition of saliva and contributing to the development of periodontitis, and infectious processes in the oral cavity can contribute to the progression of liver disease by activating and maintaining systemic inflammation. Periodontal disease can negatively affect non-alcoholic fatty liver disease and lead to the development of severe and progressive forms such as non-alcoholic steatohepatitis and cirrhosis.[17]

There is evidence that oral dysbiosis alters the gut microbiota through the oral-intestinal axis, contributing to endotoxaemia and liver fibrosis.[11, 17] At the same time, it is known that the activation of fibrosis in the liver is also promoted by such oral pathogenic bacteria as P. gingivalis, T. denticola, and F. nucleatum, which are paradontal pathogens. In addition, patients with severe liver disease, such as non-alcoholic steatohepatitis and cirrhosis, have oral dysbiosis and pathological reproduction of flora that is opportunistic in people without such diseases, which complicates the treatment of such patients.[24]

The reason for this phenomenon is immune system dysfunction, which is the development of the underlying disease, which must be considered at the time of treatment. Although oral dysbiosis has been shown to influence the gut microbiome,[18] it increases the gut microbiome's permeability, and this leads to a complication of NAFLD, non-alcoholic steatohepatitis.

Hence, the modern approaches to treating patients with NCDs and primarily liver injury are planned to be combined with natural ingredients drugs.[25, 26] In the following subsection, we discuss how such drugs are prescribed.

Application of natural ingredient-based preparations in dental care

Often, after dental procedures, it is necessary to prescribe drugs to shorten the patient's recovery.[20] Due to the severe course of periodontal diseases in patients with NAFLD, especially non–alcoholic steatohepatitis and directly related pathogenesis of the intestine dysbiosis processes, it is necessary to use drugs that positively affect the main links of the pathological process and enhance tissue repair after surgical interventions.

With NCDs formed by the oral intestinal axis, considerable attention has been paid to the contribution of oral-based medicines to their treatment in the last few years.[18, 19]

This is a group of drugs based on the requirements of specific patients, including herbal medicines and pre-and probiotics.[19, 27] Table 2 systematises the primary drugs used in patients' current stage of dental care.

Table 2. Integrative approaches utilising phytopreparations, probiotics, and vitamins in dental patient care

Substance name	Effect	Diseases or surgical interventions
Phytopreparations		
Chamomile recutita (Chamomilla recutita)	Anti-inflammatory, antiseptic, soothing	Gingivitis, stomatitis, post-extraction period
Medicinal sage (Salvia officinalis)	Antiseptic, anti-inflammatory	Periodontitis, gingivitis, alveolitis
Calendula officinalis	Anti-inflammatory, wound healing	Stomatitis, postoperative wound healing
Oak bark (Quercus cortex)	Astringent, antiseptic, haemostatic	Gingivitis, periodontitis, bleeding gums
Propolis	Antibacterial, anti-inflammatory, immunostimulating	Periodontal disease, stomatitis, alveolitis, healing after tooth extraction
Aloe vera	Regeneration, anti-inflammatory	Mucosal burns, ulcerative stomatitis, postoperative recovery
Green tea extract (Camellia sinensis)	Antioxidant, anti-inflammatory, antibacterial	Prevention of caries, gingivitis, periodontitis
Vitamins		
Vitamin C (ascorbic acid)	Antioxidant, vascular strengthening	Periodontitis, bleeding gums, postoperative period
Vitamin D	Regulation of bone mineralisation	Osteoporosis, periodontal disease, dental implants
Vitamin A	Mucosal regeneration, antioxidant	Ulcerative stomatitis, healing after surgery
Vitamin E	Antioxidant, regenerating	Periodontal disease, dry mucous membrane
B vitamins (B1, B6, B12)	Neurotrophic effect, improved regeneration	Glossitis, stomatitis, facial nerve neuralgia
Rutin (vitamin P)	Strengthening of capillaries, anti-inflammatory	Bleeding gums, periodontitis, postoperative healing
Probiotics		
Lactobacillus reuteri	Antibacterial restoration of microflora	Prevention of caries, gingivitis, periodontitis
Bifidobacterium spp.	Anti-inflammatory, normalisation of the microbiota	Stomatitis, candidiasis, periodontitis
Streptococcus salivarius K12	Antibacterial protection against pathogenic microorganisms	Prevention of caries, periodontitis, stomatitis
Lactobacillus acidophilus	Restoring the balance of microflora, inhibiting the growth of pathogens	Oral dysbiosis, candidiasis, periodontitis

Using nutraceuticals, probiotics, and phytopreparat ions aims to immunomodulate by fighting the systematic inflammatory process stemming from infectious pathogenicity.[27] For example, administering nutraceuticals in non-alcoholic fatty liver disease decreases mitochondrial dysfunction, prevents oxidative stress development, and averts the progression of this disease to steatohepatitis.[25]

These are not traditional dental procedures or medical support, but they can be big assets in improving oral health and rehabilitation after surgery. They are also suggested as complementary or alternative approaches for patients who prefer such therapies and as part of a complete oral hygiene regimen.

Quertulin is used for the prevention and treatment of periodontal disease in patients with non-alcoholic steatohepatitis[28, 29] and has proven clinical efficacy.[28]

The results of the clinical trials based on the reduction of treatment time and dynamics were the indicators of the effectiveness of the proposed dosage forms of Quertulin as the therapeutic and prophylactic agent in the context of the treatment and prevention of initial and first forms of periodontitis on the background of non-alcoholic steatohepatitis. The drug is justified in clinical practice as a highly effective hepatoprotector with a broad angiotensin effect in treatment.[27, 28, 29]

DISCUSSION

The growing number of NCDs in morbidity structure suggests that as a response, dental interventions and medical support should be planned based on the possible comorbidities of patients.[23] Considering the relationship between oral diseases and NCDs, mainly non-alcoholic fatty liver disease and its complications, good oral care at an early stage can reduce the general development of complications or its severe course.[6, 9, 10, 28]. This is because of that between chronic inflammatory processes in the oral cavity (such as periodontitis and caries) and systemic inflammation that has a positive influence on the pathogenesis of NAFLD and steatohepatitis.[6, 9, 10]

Proven are the penetration of systemic bloodstream by oral bacteria and their metabolites and consequent induction of immune response disorders and elevated oxidative stress in the liver.[10] In particular, disruption of the oral microbiome can increase blood endotoxins such that the presence of metabolic syndrome or isolated, non-alcoholic fatty liver disease (NAFLD) results in steatohepatitis and cirrhosis.[17]

These relationships should be considered by the pharmacological support in the dental practice so that new therapeutic approaches emerge. For instance, the oral microbiome can be corrected by using anti-inflammatory drugs or probiotics to reduce peripheral and systemic inflammation, decreasing the chances of complications of NAFLD.[17] Additional promise implies using antioxidant drugs to lower the level of oxidative stress or immunomodulatory agents that can enhance the immune system's balance. Combined strategies involving the topical application of antimicrobials during dental care and general management for correcting metabolic disorders may be a more efficient approach for treating patients with concomitant dental diseases of other systems and organs.

Indeed, many questions are still open to further research. In particular, it is necessary to study in more detail the mechanisms of transporting oral bacteria to the liver, determine the optimal dental treatment methods for patients with NAFLD and evaluate the effectiveness of pharmacological interventions in preventing systemic complications. It is also important to develop interdisciplinary approaches to managing such patients, which involves close cooperation between dentists, gastroenterologists and hepatologists.[10, 11]

Current discussions also focus on the question of what is a greater risk for severe NCDs: oral diseases, metabolic disorders, lifestyle choices or socioeconomic factors[30, 31, 32]. Much attention is paid to heredity and genetic regulation of metabolic processes and susceptibility to infectious factors, as well as the integration of modern omics advances into dental education.[1, 30, 31, 32]

Summarising the above, it should be noted that drug support for dental patients at all stages of care should be comprehensive, considering the potential positive and negative systemic effects on the underlying disease and comorbidities.[16]

CONCLUSION

When providing dental care to patients, possible concomitant pathology and possible intolerance to pharmacological substances, especially when taking antihypertensive and psychotropic drugs, must be considered. Given the rise in antibiotic resistance, antibiotic prescriptions must be regularly monitored. Introducing integrated approaches to drug support based on natural remedies into clinical practice will help improve treatment effectiveness and reduce the risk of complications. Further research in this area promises to optimise treatment and reduce the risk of developing non-communicable chronic diseases associated with oral pathology.

DECLARATIONS

Financial support

This research did not receive any financial support.

Data Availability

All the data available upon request.

Ethics approval and consent to participate

This research did not involve human participants, animal subjects, or any material that requires ethical approval.

Conflict of Interest

The authors declare that there are no conflicts of interest regarding the publication of this article.

REFERENCES

1. Kabbashi S, Roomaney IA, Chetty M. Bridging the gap between omics research and dental practice. *BDJ O pen*. 2024;10(1):16. doi: 10.1038/s41405-024-00199-3
2. Global oral health status report: towards universal health coverage for oral health by 2030. *World Health Organisation*, 2022;120. https://iris.who.int/bitstream/handle/10665/364538/9789240061484-eng.pdf?sequence=1
3. Benzian H, Daar A, Naidoo S. Redefining the non-communicable disease framework to a 6 × 6 approach: incorporating oral diseases and sugars. *The Lancet. Public health*. 2023;8(11):e899-e904. doi: 10.1016/S2468-2667(23)

4. Seitz MW, Listl S, Bartols A, Schubert I, et al. Current Knowledge on Correlations Between Highly Prevalent Dental Conditions and Chronic Diseases: An Umbrella Review. *Preventing chronic disease*. 2019;16:E132. doi: 10.5888/pcd16.180641
5. Wolf TG, Cagetti MG, Fisher JM, Seeberger GK, et al. Non-communicable Diseases and Oral Health: An Overview. *Frontiers in oral health*. 2021;2:725460. doi: 10.3389/froh.2021.725460
6. Yilmaz Y. Brushing your teeth may be good for your liver: Linking oral health to non-alcoholic fatty liver disease. *Annals of hepatologyю* 2023;28(6):101159. doi: 10.1016/j.aohep.2023.101159
7. GBD 2021 Antimicrobial Resistance Collaborators. Global burden of bacterial antimicrobial resistance 1990-2021: a systematic analysis with projections to 2050. *Lancet*. 2024a;404(10459):1199-1226. doi: 10.1016/S0140-6736(24)01867-1
8. Dvulit I. Prevention and treatment of periodontal complications in patients with non-alcoholic steatohepatitis. *International Scientific and Practical Conference "Medicines-People. Modern problems of pharmacotherapy and drug prescription",* Kharkiv, March 12-13, 2020;217-219. https://library.dmed.org.ua/index.php?newsid=2475
9. Wijarnpreecha K, Panjawatanan P, Cheungpasitporn W, Lukens FJ, et al. The Association between Periodontitis and Non-alcoholic Fatty Liver Disease: A Systematic Review and Meta-analysis. *Journal of gastrointestinal and liver diseases: JGLD*. 2020;29(2):211-217. doi: 10.15403/jgld-841
10. Ram D, Wilensky A, Zur D, Almoznino G. The Triangle of Non-alcoholic Fatty Liver Disease, Metabolic Dysfunction, and Periodontitis: Analysis of the Dental, Oral, Medical and Epidemiological (DOME) Records-Based Nationwide Research. *Metabolites*. 2022;12(12):1212. doi: 10.3390/metabo12121212
11. Åberg F, Helenius-Hietala J. Oral Health and Liver Disease: Bidirectional Associations-A Narrative Review. *Dentistry journal*. 2022;10(2):16. doi: 10.3390/dj10020016
12. Piovani D, Nikolopoulos GK, Bonovas S. Non-Communicable Diseases: The Invisible Epidemic. *Journal of clinical medicine*. 2022;11(19):5939. doi: 10.3390/jcm11195939
13. Suzuki J, Nikko H, Kaiho F, Yamaguchi K, et al. The problems of multiple-chemical sensitivity patients in using medicinal drugs. *Yakugaku zasshi: Journal of the Pharmaceutical Society of Japan*. 2004;124(8):561-570. doi: 10.1248/yakushi.124.561
14. Molot J, Sears M, Anisman H. Multiple chemical sensitivity: It's time to catch up with the science. *Neuroscience and biobehavioural reviews*. 2023;151:105227. doi: 10.1016/j.neubiorev.2023.105227
15. Cieplik F, Hiller KA, Scholz KJ, Schmalz G, Buchalla W, Mittermuller P. General diseases and medications in 687 patients reporting on adverse effects from dental materials. *Clinical oral investigations*. 2023;27(8):4447-4457. doi: 10.1007/s00784-023-05064-5
16. Sanz M, Herrera D, Kebschull M, Chapple I, et al. Treatment of stage I-III periodontitis-The EFP S3 level clinical practice guideline. *Journal of clinical periodontology*. 2020;47(Suppl 22):4-60. doi: 10.1111/jcpe.13290
17. Kuraji R, Sekino S, Kapila Y, Numabe Y. Periodontal disease-related non-alcoholic fatty liver disease and non-alcoholic steatohepatitis: An emerging concept of oral-liver axis. *Periodontology 2000*. 2021;87(1):204-240. doi: 10.1111/prd.12387
18. Kumar A, Sakhare K, Bhattacharya D, Chattopadhyay R, et al. Communication in non-communicable diseases (NCDs) and role of immunomodulatory nutraceuticals in their management. *Frontiers in nutrition*. 2022;9:966152. doi: 10.3389/fnut.2022.966152
19. Leo M, D'Angeli F, Genovese C, Spila A, et al. Oral Health and Nutraceutical Agents. *International journal of molecular sciences*, *25*(17):9733. doi: 10.3390/ijms25179733
20. Teoh L, McCullough MJ, Moses G. 2022; Preventing medication errors in dental practice: An Australian perspective. *Journal of dentistry*. 2024;119:104086. doi: 10.1016/j.jdent.2022.104086
21. GBD 2021 Diseases and Injuries Collaborators. Global incidence, prevalence, years lived with disability (YLDs):disability-adjusted life-years (DALYs):and healthy life expectancy (HALE) for 371 diseases and injuries in 204 countries and territories and 811 subnational locations, 1990-2021: a systematic analysis for the Global Burden of Disease Study 2021. *Lancet*. 2024b;403(10440):2133-2161. doi: 10.1016/S0140-6736(24)00757-8
22. Mazur IP, Levchenko A-OY, Stadnyk MB. Pharmacotherapy in dentistry: analysis of the use of drugs in dentistry in 2021. *Oral and General Health*. 2021;2(2):21-28 doi: 10.22141/ogh.2.2.2021.237654

23. Oral health prevalence of oral diseases. *World Health Organisation,* 2023. https://www.who.int/data/gho/data/indicators/indicator-details/GHO/prevalence-of-severe-periodontal-disease-in-people-15--years
24. Jensen A, Ladegaard Grønkjær L, Holmstrup P, Vilstrup H, Kilian M. Unique subgingival microbiota associated with periodontitis in cirrhosis patients. *Scientific Reports*. 2018;8(1):10718. doi: 10.1038/s41598-018-28905-w
25. Dall M, Hassing AS, Treebak JT. NAD$^+$ and NAFLD - caution, causality and cautious optimism. *The Journal of Physiology*. 2022;600(5):1135-1154. doi: 10.1113/JP280908
26. Varada VV, Kumar S, Balaga S, Thanippilly AJ, et al. Oral delivery of electrohydrodynamically encapsulated *Lactiplantibacillus plantarum* CRD7 modulates gut health, antioxidant activity, and cytokine-related inflammation and immunity in mice. *Food function*. 2024;15(21):10761-10781. doi: 10.1039/d4fo02732a
27. Dvulit IP. Relevance of the application of herbal remedies as therapeutic and profilactic agents in periodontal patients. *Clinical Dentistry*. 2016;2:8-13. doi: 10.11603/2311-9624.2016.2.6714
28. Dvulit I, Pasichnyk M, Nogachevska I, Yarychkivska N. Evaluation of the effectiveness of using different forms of the drug “Quertuline” for the treatment and prevention of periodontal diseases. *International Scientific and Practical Conference “Innovative Technologies in Modern Dentistry”,* Ivano-Frankivsk, March 11-13 2020;29-32. https://library.dmed.org.ua/index.php?newsid=2476
29. Dvulit I. Evaluation of the clinical efficacy of the drug “Quertuline” in the treatment of generalised periodontitis in patients with non-alcoholic steatohepatitis. *International Scientific and Practical Congress “Modern Technologies and Innovations in Dentistry”,* September 26-27 2024;98-199. https://library.dmed.org.ua/index.php?newsid=2476
30. Chiappelli F. Evidence-Based Dentistry: Two Decades and Beyond. *The Journal of Evidence-Based Dental Practice*. 2019;19(1):7-16. doi: 10.1016/j.jebdp.2018.05.001
31. Budreviciute A, Damiati S, Sabir DK, Onder K, Schuller-Goetzburg P, Plakys G, Katileviciute A, Khoja S, Kodzius R. Management and Prevention Strategies for Non-communicable Diseases (NCDs) and \Their Risk Factors. Front Public Health. 2020 Nov 26;8:574111. doi: 10.3389/fpubh.2020.574111
32. Wang J, Jing J, Zhou C, Fan Y. Emerging roles of exosomes in oral diseases progression. Int J Oral Sci. 2024 Jan 15;16(1):4. doi: 10.1038/s41368-023-00274-9