

## Keywords

Integrative oral healthcare, dental treatment outcomes, nursing care, nutrition, pharmaceutical interventions

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# An Integrative Approach to Oral Healthcare: The Role of Nursing, Nutrition, Naturopathy, and Pharmaceutical Interventions in Improving Dental Treatment Outcomes

## Abstract

Dental contribution to overall bodily well-being is now becoming evident; the results of dentistry depend on the condition of the body, inflammation, bacterial flora of the mouth, nutrition, drugs, wound healing, and compliance. This comprehensive review examines the role of nursing, nutrition, naturopathy, and pharmaceutical interventions in improving dental treatment outcomes within an integrative oral healthcare framework. The review highlights that nursing contributes through oral assessment, patient education, infection prevention, perioperative support, digital follow-up, and continuity of care. Nutritional strategies support periodontal stability, mucosal integrity, immune function, osseointegration, and surgical recovery. Evidence-based naturopathic approaches, including selected herbal, nutraceutical, probiotic, and anti-inflammatory interventions, may serve as adjuncts when used safely and clinically supervised. Pharmaceutical care remains essential for antimicrobial stewardship, pain control, salivary management, interaction screening, and medication optimization, particularly in medically complex and older patients. Multidisciplinary collaboration among dentists, nurses, nutritionists, pharmacists, and allied healthcare professionals can shift oral healthcare from a procedure-centred model toward preventive, personalized, and patient-centered care. Standardized protocols, better clinical trials, digitalization, interprofessional training, and equal access to care are necessary for future developments. The integrative approach in dentistry is one of the effective ways of increasing treatment predictability, minimizing risks, accelerating recovery, and maintaining oral-systemic health.

Received:27-06-2026

Revised:30-07-2026

Accepted:05-08-2026

Doi:10.1922/ejprd.v34i7s.1715

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## 1. INTRODUCTION

Oral diseases represent one of the most common non-communicable diseases in the world and are a significant public health problem due to their chronic nature and their impact on the quality of life, nutrition, communication and social well-being. Although the field of preventive dentistry, diagnosis and clinical therapies has progressed, oral diseases are still a significant burden to both developed and developing nations. Because many other systemic diseases are associated with dental caries, periodontal disease, tooth loss and oral cancer, oral health cannot be treated as a standalone speciality but must be managed as part of a larger healthcare system [1]. The data from all over the world confirms that oral disorders are a public health problem, impacting billions of people and causing disorders that constitute the leading cause of years lived with disability. While there have been advances in many areas of health, oral disease has not progressed much due to socioeconomic disparities, poor preventive services, and low access to oral healthcare services. The trends suggest that treatment-based interventions are not enough to make oral health outcomes sustainable [2].

Oral health has received a lot of attention internationally as an integral part of universal health coverage. The WHO recommends prevention-based, patient-focused and multidisciplinary approaches to integrate oral health into primary healthcare services. This kind of approach helps to reduce oral and systemic disease risk factors and ensures access to holistic and equitable healthcare services [3]. In recent years, it has been found that oral diseases are still on the rise around the world, despite the advances in technology in dentistry and the increasing number of treatment and care facilities. Population ageing, continuing healthcare accessibility gaps, unhealthy lifestyle habits and the upsurge of chronic diseases remain challenges to current oral healthcare systems. These observations underscore the need for complex models of care that go beyond what is typically considered dental care and include more holistic factors of health in clinical routine [4].

Beyond clinical interventions, other factors, including patient education, behavioral adherence, nutrition, medication management, immune function and wound healing, are increasingly recognized as affecting successful dental treatment. As such, a new paradigm in oral healthcare has emerged, in which interprofessional collaboration facilitates disease prevention, effective treatment and better long-term outcomes for patients [5]. This shift underlines the importance of oral health as a key component of overall health. The co-operation between the various health professionals, such as dentists, nurses, nutritionists, pharmacists and those who practice evidence-based complementary therapy, can enhance the pre-operative preparation, post-operative recovery, empowering the patient to care for themselves, and optimizing the care for medically compromised individuals who require complex dental treatment [6].

Although there is a growing awareness of multidisciplinary healthcare, the current practice of dentistry is mostly procedure-driven with little or no incorporation of nursing care, nutrition support, naturopathic interventions, and medication optimisation.

Furthermore, existing health services remain poorly integrated and are a barrier to the use of coordinated oral health services [7]. The lack of coverage for comprehensive and patient-centered approaches that can enhance treatment outcomes due to policy limitations and challenges in translating preventive strategies into routine clinical practice further limits the uptake of comprehensive, patient-centered approaches [8].

This comprehensive review critically addresses how nursing, nutrition, naturopathy and pharmaceutical strategies can contribute to an integrative oral healthcare plan that enhances outcomes. It pulls together existing evidence to create a scientific basis for multidisciplinary working, looks at its clinical applications, highlights gaps in knowledge and outlines the further steps that could be taken for the promotion of patient-centred oral health.

## 2. Review Methodology

This thorough review was created using a narrative, guided synthesis of evidence to bring together the findings on integrative oral healthcare and dental treatment outcomes. Peer-reviewed journals, global health reports, clinical reviews, systematic reviews and recent studies were consulted for relevant literature that included topics related to oral-systemic health, nursing care, nutrition and naturopathy, pharmaceutical interventions, multidisciplinary care and future innovations in dentistry. The selection of articles was based on the relevance to the title, scientific validity, clinical relevance, and contribution to an understanding of patient-centred oral healthcare. Evidence was presented in four thematic sections: Biological mechanisms, discipline-specific interventions, integrative care models and research priorities. The studies included were critically analysed, and current knowledge, practical implications, limitations and future directions for the improvement of dental treatment outcomes in a multidisciplinary coordinated approach are identified.

## 3. Biological Basis for Integrative Oral Healthcare

The integrative nature of oral healthcare has a biological basis due to the effects of oral disease on systemic health and the effects of systemic disease on oral health. Oral tissues are constantly exposed to systemic physiological conditions, and oral diseases may be involved in the initiation or exacerbation of systemic disease, via inflammatory, microbial and immune-mediated mechanisms. The prevalence of oral diseases, especially periodontal disease, has been linked to cardiovascular disease, diabetes mellitus, adverse pregnancy outcomes, respiratory diseases and autoimmune diseases, and shows that oral health is not a standalone clinical condition, but is inextricably intertwined with systemic diseases [9]. Additional evidence in support of the concept of oral-systemic interdependence has emerged in the literature that demonstrates the interplay between chronic oral inflammation and systemic immune responses and metabolic homeostasis. Oral infections and slow healing after dental interventions, however, result from impaired function of the salivary glands, integrity of oral tissues, immune competence and wound healing caused by systemic diseases. The reciprocal interactions require

healthcare strategies that take into account both oral and systemic aspects in order to achieve the best patient results [10]. The dental biofilm is a key biological mediator between oral and systemic health. Oral biofilms are highly organized communities of microorganisms that, when healthy, maintain a physiological balance, but when there are environmental and host-related changes, the biofilm is dysbiosis. Dysbiotic biofilms can contribute to systemic dissemination of pathogenic microorganisms and inflammatory mediators, chronic inflammation and tissue destruction of the periodontal tissues, which can lead to chronic disease processes beyond the oral cavity [11].

Recent microbiome studies have discovered that one of the most diverse microbial ecosystems in the human body is the oral cavity. The oral microbiome is composed, spatially organised and functionally related to the host immunity, the maintenance of the mucosa and the ability to resist pathogens. In addition to an increased risk for dental caries and periodontal diseases, disruption of microbial homeostasis also has systemic health implications due to complex host-microbe interactions and the importance of maintaining the balance of the microbes during oral care interventions [12]. Another important biological pathway that links oral and systemic diseases is through inflammation. Continuous stimulation of inflammatory pathways in periodontal tissues leads to the release of cytokines, chemokines and other inflammatory mediators, which further intensify the destruction of the periodontal tissues and lead to a systemic inflammatory burden. These are all interrelated inflammatory networks, and this is why good control of oral inflammation could have benefits beyond the mouth and further illustrates the need for multi-disciplinary approaches to dealing with these conditions [13]. The nutritional status is a key determinant of the maintenance of the homeostasis of oral tissues and the regulation of immune function. Protein, vitamins, minerals, antioxidants, and essential fatty acids are all important for the integrity of the epithelia, collagen synthesis, immune competence and resistance to infection. Conversely, poor nutrition and nutrient inadequacies can adversely affect

periodontal disease, dental caries, oral mucosal disease and wound healing, reinforcing the role of nutrition as a biological factor that affects the successful treatment of dental disease [14].

Recent findings also suggest that oral mucosal and periodontium integrity is directly linked to the nutritional status, which affects oxidative stress, inflammatory reactions and host defense mechanisms. Personalized nutrition plans can thus be used in conjunction with traditional dental treatments and enhance the stability of the periodontal tissues, lower inflammation and aid in the recovery process after dental procedures, especially for vulnerable and/or medically compromised individuals [15]. The coordination of the inflammatory, proliferative and remodeling phases is essential for successful healing after dental procedures and involves the immune cells, growth factors, extracellular matrix components, and angiogenesis. Disruption of these biological processes due to systemic diseases, poor nutrition, microbial dysbiosis, or drugs may lead to a failure of tissue regeneration and clinical outcomes. This knowledge lays the scientific foundation for the development of nutritional optimization, pharmaceutical management and supportive nursing care as part of everyday dental care [16]. These biological interactions encompass a multidisciplinary approach to oral healthcare in which dentists work with other healthcare providers (nurses, nutritionists, pharmacists, and others) to address the multiple factors that can impact oral health and the success of treatment. This will allow for the possibility of personalized evidence-based care that will aim to address microbial, inflammatory, nutritional and systemic factors that contribute to disease progression and recovery [17]. The mechanisms connecting oral and systemic health illustrate that oral healthcare interventions have a broader impact than just on the local level. Combining the various sciences of nursing, nutrition, pharmaceuticals, and complementary medicine with traditional dentistry gives a scientifically based approach to better healing, reducing disease load and ensuring long-term systemic and oral health. The important biological reasons for the integrative approach to oral care are shown in Table 1.

**Table 1. Biological mechanisms supporting integrative oral healthcare**

| Biological mechanism       | Oral relevance                                          | Systemic relevance                                          | Integrative implication                                            |
|----------------------------|---------------------------------------------------------|-------------------------------------------------------------|--------------------------------------------------------------------|
| Oral-systemic inflammation | Periodontal tissue destruction and mucosal inflammation | Increased systemic inflammatory burden                      | Requires dental, medical, nursing, and pharmaceutical coordination |
| Oral microbiome dysbiosis  | Caries, periodontitis, peri-implant disease             | Microbial and inflammatory spillover beyond the oral cavity | Supports microbiome-sensitive prevention and adjunctive care       |
| Nutritional insufficiency  | Impaired mucosa, gingival bleeding, poor tissue repair  | Reduced immunity and delayed recovery                       | Justifies dietary screening and nutritional optimization           |
| Biofilm persistence        | Treatment failure and recurrent disease                 | Chronic inflammatory activation                             | Requires hygiene reinforcement and structured maintenance          |
| Impaired wound healing     | Delayed postsurgical recovery                           | Higher complication risk in systemic disease                | Supports perioperative care and medication review                  |

#### 4. Nursing Contributions to Optimizing Dental Treatment Outcomes

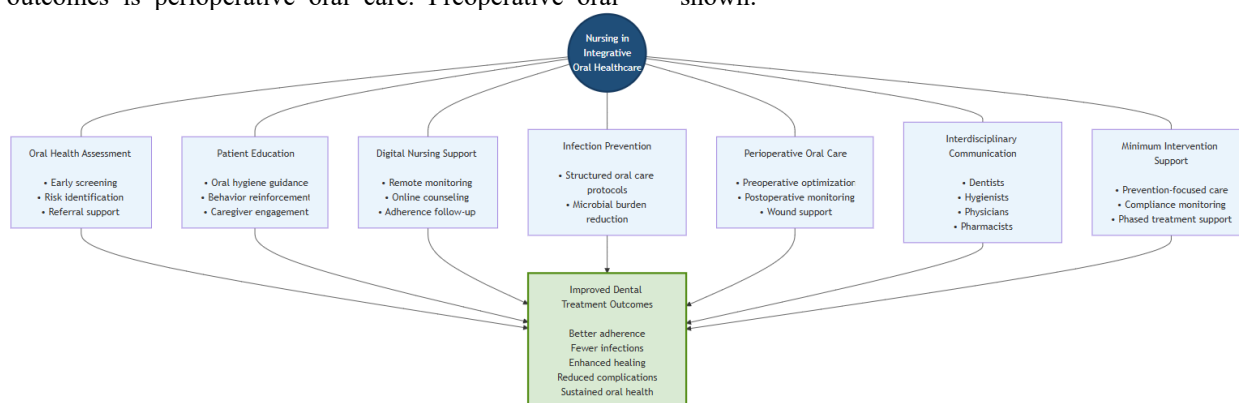
Through the integration of assessment, prevention, education and continuity of care, nursing has become an essential part of integrative oral healthcare, going beyond

typical dental care. Oral health is often the first area of concern identified by a nurse when performing routine clinical exams and is an opportunity for early referral and intervention, before disease progression negatively impacts treatment outcomes. Their role is vital in these patient groups: hospitalized patients, medically compromised patients, and patients undergoing complex dental and/or surgical procedures, in which the comprehensive care of the mouth plays an integral part in the maintenance of oral and systemic health [18]. Educating patients about oral health continues to be one of the more profound nursing roles in the outcomes of oral health. Within primary healthcare, nursing-led behavioral interventions have been shown to have a positive impact on oral hygiene practices, engagement of the caregiver and compliance with oral preventive practices. Oral health promotion through individualized counseling, reinforcement of self-care behaviors and regular follow-up can help to achieve long-term oral health improvements and reduce the prevalence of preventable oral diseases, which negatively impact dental care outcomes [19]. As more of these digital health technologies are adopted, nursing has become even more integral in the field of oral health. Internet-based nursing interventions offer 24-hour patient support via remote education, symptom monitoring, individualized guidance and behavioral reinforcement. These interventions have been effective in improving adherence to periodontal therapy, self-management ability, and implementation of periodontal care outside the dental office setting, and have the potential to improve the effectiveness of therapy and make it more available to a broad patient population [20]. Structured oral care protocols are also an important part of nursing interventions for infection prevention. Simply implementing oral hygiene practices that have been proven in the scientific literature will reduce the number of microorganisms in the oral cavity and, as a result, the risk of aspiration infection and the other HAPs. The nurse-driven oral care protocols have been shown to have a substantial impact on hospital-acquired pneumonia and illustrate how routine oral care can support systemic health and overall clinical outcomes [21].

Another dimension of oral care that is a crucial area for nursing collaboration to enhance dental and surgical outcomes is perioperative oral care. Preoperative oral

assessment, optimization of oral hygiene, and postoperative management help to minimize the microbial burden prior to the introduction of invasive procedures and to optimize healing following therapy. Oral care that is structured and coordinated around the time of surgery has been shown to reduce postoperative infections, especially those involved with cancer surgeries, and highlights the critical role of the multidisciplinary approach from the treatment initiation period through to discharge [22]. Assessment of the oral health status is a key step in effective nursing practice. Using standardized assessment tools can help identify oral complications early, document the assessment in a uniform way and enhance the communication between the nursing and dental professions. Some difficulties were found in achieving a full consensus between a nurse and a dental hygienist when evaluating the oral cavity; however, structured training and validated oral assessment tools may improve the ability to make a consensus diagnosis and improve collaboration between the oral healthcare professionals and their patients in clinical practice [23]. Modern dentistry follows a preventive philosophy that is very similar to the nursing philosophy of intervention at an early age and the reduction of risk. Nursing professionals can help promote the concept of minimum intervention oral care by reinforcing the importance of preventive behaviors, encouraging consistent oral hygiene care, ensuring adherence of patients to therapy, and aiding in the phased treatment planning of patients at high caries risk and/or with complex oral healthcare needs. This co-operative approach increases patient involvement and helps to ensure the effectiveness and sustainability of dental care [24].

As dental treatment outcomes are continuous, nursing can help in continuous assessment, preventive education, infection control, perioperative support and patient-centred follow-up. Embedding nursing skills in routine dental care fosters teamwork across the disciplines and provides a more integrated framework that could enhance the care and outcomes of oral and systemic health. In Figure 1, the principal components of a nursing-led integrative oral healthcare model and how they contribute to the delivery of better dental treatment outcomes are shown.



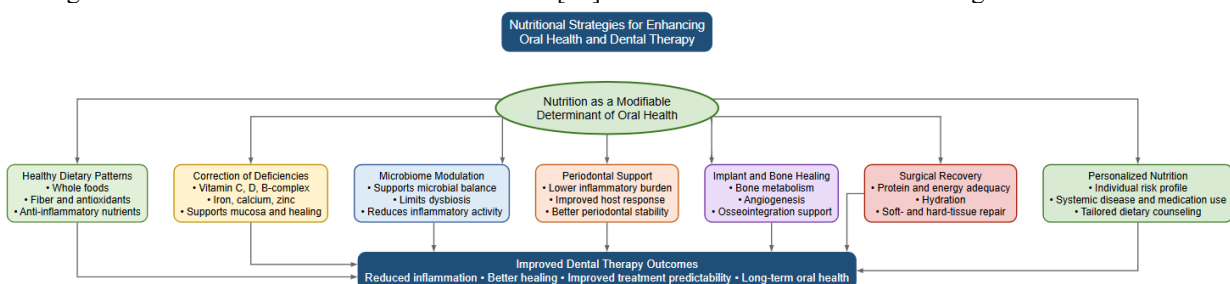
**Figure 1. Nursing contributions to integrative oral healthcare and their impact on dental treatment outcomes**

## 5. Nutritional Strategies for Enhancing Oral Health and Dental Therapy

Nutrition is one of the key modifiable factors that affect oral health due to its effect on inflammation, immunity,

microbial balance, tissue repair, and predisposition to chronic illness. There are various common pathways regarding risk factors for periodontitis and systemic disease, such as oxidative stress, metabolic disorders and low-grade inflammation, which make nutritional strategies relevant from a clinical perspective in both oral and systemic health. A whole-foods diet and foods high in antioxidants, fiber, and anti-inflammatory nutrients can be helpful in maintaining periodontal stability, while too much sugar, refined carbohydrates, and poor dietary quality can lead to caries and periodontal inflammation, and the teeth may not respond well to treatment [25]. Malnutrition also affects oral health through its effects on host defenses, inadequate salivary protection, mucosal integrity, and tissue repair. PEM and insufficient nutrition predispose to oral infections, lesions and periodontal breakdown and to poor postoperative healing. Plaque control and clinical procedures are not the only aspects of preventive oral healthcare that need attention, however. Dietary adequacy is also an important consideration, particularly in children, the elderly, hospitalized and medically compromised patients [26]. There are certain nutrients which, when deficient, can have direct effects on the tissues of the mouth that are clinically relevant. Vitamin C, vitamin D, B-complex vitamins, iron, calcium, zinc and other micronutrient deficiencies can present as gingival bleeding, impaired wound healing, loss of enamel, altered taste, glossitis and increased periodontal sensitivity. The identification and correction of these deficiencies can lead to better biological preparedness for dental therapy and minimize complications in preventive, restorative, periodontal, and surgical therapy [27]. Additionally, the effects that dietary patterns have on periodontal disease progression are related to changes in the composition of plaque, inflammatory load, and host immune response. The cariogenic and dysbiotic effects of diets rich in fermentable carbohydrates and the anti-inflammatory benefits from nutrient-dense diets with adequate amounts of omega-3 fatty acids, vitamins, minerals, and phytochemicals might be opposing effects. This helps to make the dietary assessment and counseling part of periodontal treatment instead of nutrition being a lifestyle matter [28]. The mechanisms behind the interplay between diet and oral microbiome suggest a mechanism for nutritional interventions in oral healthcare. Microbiological diversity and composition of the biofilm, immune signaling and inflammatory response during periodontitis may be influenced by nutrients. Balanced nutrition can then maintain the oral microbial homeostasis, while sub-optimal nutrition can promote dysbiosis and the inflammatory process of the tissue, limiting the success of traditional dental care [29].

Another field where dietary nutrients are relevant is dental implant surgery, where bone metabolism, angiogenesis, immune regulation and tissue regeneration are all a crucial part of the success of dental implants. Some evidence indicates a possible beneficial effect on the healing process of the bone and integration of implants with vitamin D, calcium, omega-3 fatty acids, antioxidants and other bioactive compounds; however, clinical protocols are not sufficiently standardized for these supplements and nutraceuticals. Therefore, the principles of nutritional optimization alone should not be used to replace the evidence-based principles of surgery and prosthetics [30]. In oral and maxillofacial surgery, sufficient energy intake, availability of protein, hydration, micronutrient availability and metabolic stability are necessary for surgical healing to occur. An inadequate nutrient status can negatively affect the risk of postoperative infection, collagen synthesis, angiogenesis and soft- and hard-tissue repair. Dietary planning and nutritional screening before and after extraction, periodontal surgery, dental implants, and reconstructive surgery can then help strengthen recovery pathways and improve recovery following these types of surgeries [31]. Diet and its potential to pose a risk is of great importance in dentistry because of the importance of factors such as age, systemic disease, composition of the oral microbiome, medication usage, cultural practices, socioeconomic status, and the person's treatment goals. With more personalized dietary counseling, clinicians can go beyond the generic information and create a strategy for each patient to help prevent cavities, manage periodontal disease, improve mucosal health and recovery from surgery [32]. Dental practitioners are increasingly realizing that personalized nutritional counseling is an important aspect of oral health management. Long-term prevention can be enhanced through the use of structured dietary assessment, tailored counselling and interprofessional referral to engage patients. There is a need for more training and standardisation of protocols and the integration of nutrition professionals into routine dental practice to make personalised nutrition a reality [33]. Nutritional interventions augment dental care, making it more effective in several ways: increasing host resistance, regulating inflammation, maintaining the balance of the mouth's microorganisms, and facilitating tissue repair. A nutrition component that incorporates dietary screening and screening for deficiencies, along with perioperative nutritional planning and counseling for individuals, can enhance the predictability of dental care and long-term oral health. The key nutritional pathways that have an impact on oral health, tissue repair and overall dental outcomes are reviewed in Figure 2.



**Figure 2. Nutritional strategies supporting oral health and enhancing dental treatment outcomes**

## 6. Naturopathic and Pharmaceutical Interventions in Integrative Oral Care

As the name implies, naturopathic and pharmaceutical approaches are part of integrative oral care and address issues of microbial control, inflammation, pain, tissue repair, medication safety and patient centered supportive management. Natural oral care products have become increasingly under the scientific spotlight, since numerous substances found in plant extracts display antimicrobial, antioxidant, anti-inflammatory, analgesic and wound-healing effects that are pertinent to a variety of oral diseases. They are most useful when added to standard dental treatment using evidence-based information and when not used as a replacement for diagnosis, operative care, infection control and/or pharmacological treatment when clinically required [34]. Chronic orofacial pain is a good example of the need for a multimodal approach to treating pain. While the use of conventional pharmacological treatment is still significant for symptom control, many holistic methods like naturopathy and yoga can help modulate pain, reduce stress, improve function and help the patient cope. When pain has some behavioural, neuromuscular, inflammatory or psychosocial elements, there is evidence for integrative treatment to be beneficial, although it is supervised and clinically individualised [35]. Natural agents have demonstrated beneficial effects on oral and periodontal health by the inhibition of pathogenic microorganisms, modulation of inflammatory mediators, reduction of oxidative stress and promotion of tissue homeostasis. Other bioactive compounds, such as phytochemicals, probiotics, polyphenols, essential oils, and others, can also be used to complement the use of periodontal therapy to enhance the host response and microbial balance. However, because of inter-variability of formulations, doses, and bioavailability, as well as clinical endpoints, it is not possible to directly translate to standard oral protocols [36].

The use of nutraceuticals is another pathway that can be used in oral and periodontal health as an adjunct. Immunomodulatory, antioxidant and anti-inflammatory effects of such compounds can support periodontal stability, ensure protection of the mucosa and promote healing reactions. They are clinically useful if they are the right patient, the right product, the right dose and the right drug interactions, especially when the patient is taking multiple medicines or suffers from a systemic disease [37]. Herbal remedies have been studied for their various oral health uses such as dental plaque control, gingivitis, oral ulcers, halitosis, dentin hypersensitivity and microbial infections. Often, they contain antimicrobial properties against oral microorganisms, anti-inflammatory properties, the ability to neutralize free-radicals and properties that promote the regeneration of local tissues. Although these are encouraging mechanisms, more robust clinical trials are required to establish efficacy and safety, best delivery systems and outcomes of these programs in the long term [38].

Pharmaceutical interventions are still crucial in integrative oral care, as numerous oral diseases are associated with systemic diseases where there is a need for coordinated medical and dental care. A list of medications that directly affect the control and treatment of oral disease includes antimicrobials, analgesics and anti-inflammatory medications, salivary substitutes, antifungals, fluoride therapies and systemic diseases. When working together, dentists and pharmacists can make the best selections of medications, minimize adverse effects, increase adherence, and enable safe management of diabetes, cardiovascular disease, immunosuppression, and medications prescribed for more than one condition (polypharmacy) [39].

The medicinal plants and their bioactive compounds are still being investigated for novel therapies in the dental area. Phytochemicals have a variety of pharmacological mechanisms that could be involved in caries prevention, periodontal therapy, endodontic disinfection, management of mucosal lesions, and wound healing. They should be carefully evaluated for their pharmacodynamics, toxicity, standardization, and compatibility with existing dental materials and therapies for their integration into oral care [40]. Drug–nutrient interactions are particularly important in older patients who are likely to be taking multiple drugs (polypharmacy), to have nutritional deficiencies, xerostomia, changes in taste and be more susceptible to dental caries. Medications can affect the production of saliva, impact nutrition choices, impact micronutrient status, and/or raise the risk of caries, while nutrients and supplements can affect drug absorption or metabolism. The review of medications, an evaluation of nutrition and implementation of preventive measures in ageing and medically complex patients are therefore part and parcel of integrative oral care [41]. This is expanded by modern nursing with their ability to assess, follow protocols, educate patients, keep track of adverse reactions, and communicate with other disciplines in the implementation of naturopathic and pharmaceutical oral care. Oral care in institutional, perioperative, geriatric and medically compromised groups is especially helpful as nursing-led supportive care can minimize complications and enhance oral hygiene in these groups of patients [42].

When applied in conjunction with mainstream dental treatment and evidence-based, safety-screened by a licensed naturopath, and practitioner-specific, naturopathic and pharmaceutical interventions can enhance outcomes of dental treatment. Their primary benefit is their ability to assist with microbial control, reducing inflammation, managing pain, healing tissues and optimizing medications in an integrated multidisciplinary approach. Table 2 shows the contributions made to each discipline by the integrative oral care.

**Table 2. Contributions of nursing, nutrition, naturopathy, and pharmaceutical care to dental outcomes**

| Discipline          | Main intervention area                        | Clinical contribution                                                  | Expected treatment benefit                                              |
|---------------------|-----------------------------------------------|------------------------------------------------------------------------|-------------------------------------------------------------------------|
| Nursing             | Assessment, education, and perioperative care | Oral screening, hygiene reinforcement, infection prevention            | Better adherence, fewer complications, improved continuity of care      |
| Nutrition           | Dietary assessment and nutrient correction    | Supports immunity, mucosal integrity, bone metabolism, and healing     | Improved periodontal stability and surgical recovery                    |
| Naturopathy         | Evidence-based adjunctive natural therapies   | Herbal, nutraceutical, probiotic, and anti-inflammatory support        | Symptom relief and adjunctive microbial/inflammatory control            |
| Pharmaceutical care | Medication optimization and safety            | Analgesics, antimicrobials, salivary agents, and interaction screening | Safer prescribing, fewer adverse effects, improved therapeutic response |
| Dentistry           | Diagnosis and definitive treatment            | Preventive, restorative, periodontal, surgical, and implant care       | Disease control and functional rehabilitation                           |

## 7. Multidisciplinary Integration: Building Patient-Centered Oral Healthcare Models

In patient-centered oral care, it is essential to work together in a coordinated way between different health-related professions, such as dentistry, nursing, nutrition and pharmacy. Interprofessional education and training are crucial, as oral disease is influenced by factors, including behaviour, nutrition, systemic (e.g. systemic disease), pharmacological (e.g. medications) and social factors, which are beyond the dental profession's ability to solve. Greater collaboration on common areas of expertise in nutrition education, medication awareness, prevention and patient counseling can enhance clinical decision making and facilitate the care continuum throughout the healthcare system [43]. In the case of peri-implant diseases, where the success is dependent on the quality of the surgical preparation, the maintenance of a good level of plaque control, systemically managing risk factors and patient compliance, clinical integration is especially relevant. Implementing evidence-based guidelines highlights the importance of coordinated professional involvement and long-term follow-up, as well as structured diagnosis, risk assessment and staged treatment planning, which illustrates that successful implant therapy is more of a process than merely a series of procedures [44]. The tools of digital transformation can be used to put into practice multidisciplinary models of oral healthcare. The use of teledentistry, EHRs, AI, digital imaging, remote monitoring, and mobile health platforms can help to facilitate communication between practitioners, improve early detection, allow for patient education, and expand access to preventive health services. When implemented in a patient-centered system, these technologies can be especially beneficial when combined with other medical and supportive technologies and services that involve the oral health system [45]. The scope of dentistry in global health is shifting from providing healthcare to preventing it, from focusing on service delivery to systems integration and from service delivery to research-based public health action. Shared

risk factors need addressing in oral healthcare models, as do links between primary and oral care, and evidence must be produced that will enable interventions to be scaled up and equitable. The paradigm shift demands greater involvement of dentistry with medicine, nursing, nutrition, pharmacy and public health to address the challenges to the individual and population levels [46]. There is a significant challenge regarding access inequities for oral healthcare. Socioeconomic, racial/ethnic, geographic, health insurance, disability, age and health literacy remain important factors influencing access to timely preventive and therapeutic dental care. Oral health promotion can close some of these gaps by integrating oral health into primary care, community health programmes, school-based programmes, long-term care and chronic disease management [47].

Therefore, integration at three levels is necessary to build models of oral healthcare for the patient: clinical, educational and systems-based. In the clinical context, the nursing assessment, nutritional counselling, the review of the pharmacotherapy and individual prevention of dental disease should support dental treatment. Educationally, a common training of health professionals is needed where they are able to identify the link between oral and systemic disease and work in collaboration with each other. From a systems perspective, digital infrastructure, public health policy and equitable service delivery need to be aligned to enable seamless care-out-of-the-dental-chair. Multidisciplinary integration is a change in oral healthcare that shifts from "what procedure to do" to a comprehensive, preventative and whole-person approach. The best models use evidence-based dental diagnosis and nursing care, optimize nutrition, prescribe dental medicines safely, ensure effective communication with digital tools, and ensure equitable access. A proposal is presented in Table 3 for a practical approach to implementing integrative oral healthcare, which is patient-centred.

**Table 3. Proposed framework for patient-centered integrative oral healthcare**

| Care phase                 | Core actions                                                                   | Responsible professionals                   | Outcome focus                                |
|----------------------------|--------------------------------------------------------------------------------|---------------------------------------------|----------------------------------------------|
| Risk assessment            | Oral-systemic history, diet review, medication review, oral screening          | Dentist, nurse, pharmacist, nutritionist    | Early identification of modifiable risks     |
| Pre-treatment optimization | Plaque control, nutritional correction, systemic stabilization                 | Dentist, nurse, physician, nutritionist     | Improved readiness for dental therapy        |
| Active treatment           | Evidence-based dental care with supportive adjuncts                            | Dentist, pharmacist, nurse                  | Safe and effective clinical intervention     |
| Post-treatment recovery    | Wound care, pain control, dietary guidance, adverse-effect monitoring          | Nurse, dentist, pharmacist, nutritionist    | Faster healing and fewer complications       |
| Long-term maintenance      | Recall care, behavior reinforcement, digital monitoring, preventive counseling | Dental team and allied health professionals | Reduced recurrence and sustained oral health |

## 8. Future Perspectives and Research Priorities

Precision Dentistry, AI, Robotics, Microbiome research and better research designs will dictate the future of Integrative Oral healthcare. Precision based dental care can take clinical decision making beyond the "one size fits all" approach by integrating patient-specific factors such as biological, behavioral, systemic, nutritional, pharmacological, and genomic factors. When coupled with the use of robotics and sophisticated digital workflows, this combination could enhance the accuracy of diagnosis, planning of the procedure, precision of surgery and personalized rehabilitation, especially for complex restorative, periodontal, implant, and maxillofacial surgeries [48]. AI is expected to be more and more utilized in the fields of diagnosis, risk prediction, treatment plan and clinical monitoring. Some of the radiographic interpretation, caries diagnosis, periodontal evaluation, orthodontic diagnosis, oral cancer detection, and treatment effectiveness prediction are among the areas where AI tools can be helpful. It could be especially helpful in integrative care, as it enables a more comprehensive review of the patient's dental history and systemic health status, medication, and other patient behaviors and habits to guide earlier intervention and better-tailored treatment routes [49]. Another promising area for oral health therapy is microbiota-based. In addition to the above, new adjunctive approaches for caries prevention, periodontal therapy, the management of halitosis, the health and integrity of the mucosa, and the control of peri-implant disease may include the use of probiotics, prebiotics, synbiotics, postbiotics, microbial replacement strategies, and targeted modulation of dysbiotic biofilms. Further research is needed to determine the species/strains specificity, delivery systems, dosing regimens, long-term safety, and interactions with other dental therapies, pharmaceuticals, food and host immunity [50].

Research priorities should also include the production of quality clinical evidence of integrative oral healthcare. Measuring the measurable effects of various nursing, nutritional, naturopathic, pharmaceutical, and dental methods in combination in large randomized controlled trials, pragmatic clinical studies, longitudinal cohorts, implementation research, and cost-effectiveness analyses would be beneficial to determine the optimal methods to improve treatment outcomes. Clinical endpoints, patient-reported outcomes, quality of life, adherence, adverse events, oral-systemic biomarkers, health equity indicators

are all elements that should be incorporated in standardized outcomes measures. Other issues such as translational barriers will also need to be considered in future models. Effective implementation of integrative oral care calls for evidence-based clinical guidelines, cross-disciplinary training, transparency of regulations, interoperability between digital tools, ethical governance of AI technologies and access to new technologies. If these protections were lacking, precision dentistry and microbiome-based therapies could exacerbate existing inequalities, not only in population oral health but also in the benefits that can be gained from these interventions. Rather than just technological innovation, future developments in oral care ought to take into account the ways in which innovations are connected with safe, equitable, and patient-centered systems. The next steps in research are to determine which multidisciplinary interventions are effective, for which patients, under what circumstances and how they can be scaled up in routine dental practice in a responsible manner.

## 9. Conclusion

This review indicates that the treatment outcomes in dentistry are influenced by the interplay of biological, behavioral, nutritional, pharmacological and systemic factors, rather than by clinical procedures per se. Inflammation in the oral cavity, the dysbiosis of oral bacteria or biofilm, impaired wound healing, malnutrition, medication-related risks and burden of systemic diseases all impact upon prevention, responses to therapy, and long-term oral stability. Incorporating dentistry into nursing care, optimizing nutrition, evidence-based naturopathic support and pharmaceutical management can contribute to a stronger patient education, better adherence, decreased complications, healing and better continuity of care in an integrative model. Nursing contributes in the areas of assessment, infection prevention, perioperative care and behavioral reinforcement, and nutrition contributes to host resistance, periodontal stability, tissue healing and surgical recovery. In a safe, evidence-based approach and with practitioner supervision, naturopathic and pharmaceutical treatments can be used as adjuncts. Therefore, there is a need for multidisciplinary integration to move from a procedure-centred approach in oral healthcare to a preventive, personalized and whole-person approach. Standards of practice, more rigorous clinical

research, digital integration, interprofessional education, and access to coordinated care, which is equitably implemented, are critical to future progress. Integrative oral healthcare should be encouraged as a clinically relevant, evidence-based approach that will enhance the effects of dental care and oral wellness.

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