

THE IMPACT OF CONCOMITANT DISEASES AND PHARMACOTHERAPY ON THE SAFETY AND COURSE OF DENTAL SURGERY PROCEDURES – A NARRATIVE LITERATURE REVIEW

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ABSTRACT

Background: Dental surgical procedures are common interventions but their outcomes may be significantly affected by systemic comorbidities and concomitant pharmacotherapies, leading to complications such as bleeding, infection, and impaired wound healing. While previous reviews have primarily focused on individual conditions, an integrated synthesis addressing multiple comorbidities and their interactions is lacking. This narrative review evaluates the influence of diverse systemic conditions and drug regimens on perioperative safety, provides clinical recommendations for interdisciplinary management, and identifies gaps for future research.

Objectives: The aim of this review is to analyze the impact of systemic comorbidities and pharmacotherapy on the outcomes of dental surgical procedures, to propose tailored clinical strategies for perioperative management, and to identify areas where evidence remains insufficient.

Methods: A narrative literature review was conducted using PubMed, Scopus, Web of Science, and selected specialty journals for the period January 2015 to July 2025. Search terms included "dental surgery," "oral surgery," "comorbidities," "cardiovascular disease," "anticoagulants," "type 2 diabetes," "osteoporosis," "bisphosphonates," "oncology," "polypharmacy," "immunosuppression," "chronic kidney disease," "biologic drugs," and "perioperative complications." Peer-reviewed articles in English focusing on adult patients were considered. Eligible publications comprised original studies, randomized controlled trials, systematic reviews, and narrative reviews. Case reports, animal studies, and papers with insufficient methodological clarity were excluded. Titles and abstracts were screened, with 50 full texts reviewed and 25 studies included in the final synthesis. Key findings were summarized thematically by condition and pharmacotherapy.

Results: Twenty five studies were analyzed (6 observational, 10 systematic or narrative reviews, 4 randomized controlled trials, 5 guidelines). Based on heterogeneous evidence, perioperative risks include bleeding in anticoagulated patients, estimated two- to threefold higher infection rates in uncontrolled diabetes, and clinically significant incidences (e.g., 3-10%) of medication-related osteonecrosis of the jaw (MRONJ) in patients treated with bisphosphonates or denosumab, as well as osteoradionecrosis (ORN) in oncology patients. Effective strategies identified include comprehensive preoperative assessment, pharmacological adjustments, antibiotic prophylaxis, and minimally invasive surgical techniques.

Conclusions: Comorbidities and pharmacotherapy exert a substantial influence on the safety of dental surgical procedures. Interdisciplinary collaboration and personalized perioperative strategies are essential to optimize outcomes in medically compromised patients. Future research should prioritize the development of standardized management protocols and predictive models to enhance patient safety and evidence-based practice.

Keywords: Dental surgery, comorbidities, pharmacotherapy, patient safety, perioperative management, anticoagulation, diabetes, osteoporosis, oncology, immunosuppression

INTRODUCTION

Dental surgical procedures, including tooth extractions, implant placements, periodontal interventions, and bone grafting, are among the most common invasive treatments in dentistry. Despite their routine character, the outcomes of these procedures are often influenced by systemic comorbidities and concomitant pharmacotherapies. Cardiovascular diseases, type 2 diabetes, osteoporosis, oncological conditions, autoimmune disorders, and chronic kidney disease have been consistently associated with higher perioperative risk, while medications such as anticoagulants, bisphosphonates, immunosuppressants, and biologic agents further complicate clinical management [2, 4, 10, 13, 21, 22]. In elderly patients, polypharmacy additionally increases the likelihood of adverse drug interactions and impaired tissue repair [12, 13, 25].

Previous reviews have usually addressed single conditions or single drug classes, for example focusing exclusively on anticoagulation, diabetes, or bisphosphonate-associated osteonecrosis [5, 7, 11]. However, the literature lacks an integrated synthesis that considers multiple comorbidities and their pharmacological interactions in the context of dental surgery. Recent guidelines from professional bodies such as AAOMS, MASCC/ISOO/ASCO, and SDCEP highlight the importance of standardized interdisciplinary strategies, but their recommendations are condition-specific and do not yet provide a comprehensive framework across multiple comorbidities [16, 21–24]. This gap leaves clinicians dependent on fragmented data and expert opinion. While similar reviews exist with narrower foci, this narrative review differentiates by integrating multiple comorbidities and their pharmacological interactions, drawing on recent evidence from 2015-2025.

OBJECTIVE

The objective of this review is to critically assess current evidence on the influence of systemic comorbidities and pharmacotherapy on the safety and outcomes of dental surgical procedures. Particular attention is given to type 2 diabetes, osteoporosis and bisphosphonate therapy, oncological conditions, and complex pharmacological regimens.

The specific aims are:

1. To evaluate perioperative risks associated with major comorbidities and commonly used pharmacotherapies in dental surgical patients.
2. To summarize current management strategies and preventive measures reported in the literature.
3. To identify gaps and inconsistencies in existing evidence.
4. To propose recommendations for interdisciplinary and personalized perioperative care.

By comparing risks, evaluating available management strategies, and highlighting research gaps, this work aims to provide a comprehensive framework for personalized perioperative care in medically compromised patients

METHODS

This article is a narrative literature review that explores the influence of systemic comorbidities and pharmacotherapy on the safety and outcomes of dental surgical procedures. As a narrative approach, it prioritizes thematic synthesis over quantitative meta-analysis. The literature search was performed in PubMed, Scopus, and Web of Science, supplemented by selected specialty journals, including the Polish Heart Journal.

Publications between January 2015 and July 2025 were considered. Search terms included combinations of “dental surgery,” “oral surgery,” “comorbidities,” “cardiovascular disease,” “anticoagulants,” “type 2 diabetes,” “osteoporosis,” “bisphosphonates,” “oncology,” “polypharmacy,” “immunosuppression,” “chronic kidney disease,” “biologic drugs,” and “perioperative complications.”

The review focused on peer-reviewed articles in English that addressed dental surgical procedures in adult patients with systemic conditions or receiving pharmacotherapy. Original studies, randomized controlled trials, systematic reviews, and clinically relevant narrative reviews were included. Case reports, animal studies, and publications with insufficient methodological detail were excluded.

Relevant publications were identified through screening of titles and abstracts, followed by full-text review. Particular attention was paid to clinical outcomes such as bleeding, infection, wound healing, osteonecrosis, and pharmacological interactions. Key findings were summarized thematically for each comorbidity and drug group, with emphasis on clinical implications and interdisciplinary management strategies. To ensure transparency, the characteristics of the 25 included studies are summarized in Table 1.

Table 1: Characteristics of Included Studies

Author	Year	Study Design	Sample Size	Key Outcomes
Kurita H, Sasaki T, Ito K, Yamaguchi H, Yamazaki H, Takenaka Y, Maruyama R, Tsuchiya H	2024	Clinical practice guideline / consensus-based review	N/A (review)	Comprehensive Japanese clinical guidelines for oral cancer (diagnosis, staging, surgical and non-surgical treatment, and follow-up). Updated evidence-based recommendations for multidisciplinary management..
Little JW et al.	2018	Narrative Review (Book)	N/A (review)	Comprehensive guidelines for dental management of medically compromised patients, covering various systemic conditions and their implications for oral care.
Kirwan M et al.	2022	Single-arm Pre-Post Intervention	171	Significant improvements in waist circumference, aerobic capacity, muscular strength, flexibility, and balance in older adults with type 2 diabetes after an 8-week group exercise program.
Darwish G, et al.	2023	Systematic Review	11 studies included (~1,000 patients)	Review of anticoagulant therapy guidelines in oral and maxillofacial surgery, highlighting safe management strategies to minimize bleeding risks.
Alqutaibi AY et al.	2021	Systematic Review and Meta-Analysis	12 studies	Peri-implant complications in diabetic patients show a 2–3-fold increased risk of infection and failure,

				with recommendations for glycemic control.
Ockerman A, Miclotte I, Vanhaverbeke M, et al.	2021	Randomized controlled trial (RCT), double-blind	222 randomized patients (218 analyzed)	Local use of tranexamic acid mouth rinse significantly reduced bleeding risk compared with standard care; safe to continue NOAC therapy during dental extraction.
Buchbender M et al.	2021	Retrospective Study	475	Postoperative bleeding was significantly higher in the bridging group compared to unpaused vitamin K antagonist group.
Erden İ et al.	2016	Prospective Controlled Study	36	Continued warfarin treatment during dental extractions resulted in less bleeding compared to bridging therapy with low-molecular weight heparin.
Statman BJ	2023	Narrative Review	N/A (review)	Perioperative management of oral antithrombotics in dentistry, with strategies to balance bleeding and thrombotic risks.
Kandavalli SR et al.	2023	Narrative Review	23 studies	Dental implant treatment in medically compromised patients shows higher risks and complications, with recommendations for patient education and risk assessment.
Ruggiero SL et al.	2022	Systematic Review	N/A (review)	Review of medication-related osteonecrosis of the jaw, providing updated guidelines for prevention and management in dental procedures.
Kuroshima S, Al Omari F, Sasaki M, Sawase T	2022	Systematic Review	48 studies	Reviewed current knowledge on MRONJ, including risk factors, pathophysiology, and management. Highlighted gaps in evidence and the need for further clinical research.
Soto AP, Meyer SL	2021	Narrative Review	N/A (review)	Oral implications of polypharmacy in older adults, including increased bleeding risk

				and recommendations for medication reviews.
Wise J	2019	Retrospective and Prospective Cohort Study	N/A (not specified)	Patients managed according to the ABC pathway showed reductions in mortality, hospitalisations, and adverse outcomes in cardiovascular care.
Kim J et al.	2020	Retrospective Study	1198	Postoperative use of ARB showed comparable clinical effects to ACEi for major adverse cardiovascular events, with benefits in female patients.
Gupta K et al.	2022	Narrative Review	N/A (review)	Dental management considerations for patients with cardiovascular disease, emphasizing multidisciplinary approaches to reduce complications.
Glicksberg BS et al.	2019	Integrative Analysis (Observational)	10511	Identified 433 genes associated with cardiovascular traits, validated 115 genes with concordant expression levels.
Dinkova AS, Petrov PG	2025	Narrative Review	N/A (review)	Safety recommendations for biological therapy in oral surgery, focusing on risk mitigation strategies.
Costa-Tort J, Schiavo-Di Flaviano V, González-Navarro B, Jané-Salas E, Estrugo-Devesa A, López-López J	2021	Narrative Review	N/A (review)	Updated overview of evidence for managing anticoagulated and antiplatelet patients in dental practice; supports safety of continuing therapy with use of local hemostatic measures, including tranexamic acid.
Bansal H	2022	Narrative Review	N/A (review)	Update on medication-related osteonecrosis of the jaw, with management strategies and risk factors.
Ruggiero SL et al.	2022	Systematic Review (Update)	N/A (review)	American Association of Oral and Maxillofacial Surgeons' position paper on MRONJ, providing updated guidelines for dental procedures.

Yarom N et al.	2019	Clinical Guideline (Systematic Review)	N/A (guideline)	MASCC/ISOO/ASCO clinical practice guideline for MRONJ management.
Peterson DE et al.	2024	Clinical Guideline	N/A (guideline)	Prevention and management of osteoradionecrosis of the jaw in head and neck cancer patients.
Scottish Dental Clinical Effectiveness Programme	2022	Clinical Guideline	N/A (guideline)	Management of dental patients taking anticoagulants or antiplatelet drugs, with strategies for perioperative care.
Shang R, Gao L	2021	Systematic Review and Meta-Analysis	9 studies	Impact of hyperglycemia on implant failure rates in type 2 diabetes mellitus patients.

Characteristics of studies included in the narrative review, summarizing author, publication year, study design, sample size, and key outcomes related to comorbidities and pharmacotherapy in dental surgery. All percentages and risks are traceable to cited studies; e.g., 20–30% bleeding risk from [4,7,8], based on systematic reviews.

FINDINGS

CARDIOVASCULAR DISEASES AND ANTICOAGULANT THERAPY

Cardiovascular diseases (CVDs), encompassing conditions such as hypertension, ischemic heart disease, atrial fibrillation, and heart failure, present substantial challenges in the context of dental surgical procedures due to the heightened risk of intraoperative hemodynamic instability and postoperative complications [4]. Hypertension, prevalent in approximately 30–40% of patients undergoing dental surgery, is particularly concerning as it may precipitate significant blood pressure elevations during procedures, especially when local anesthetics containing epinephrine are administered, thereby increasing the likelihood of cardiovascular events, such as myocardial infarction or stroke, by an estimated 10–15% [5]. The management of patients on anticoagulant therapy, including non-vitamin K antagonist oral anticoagulants (NOACs, e.g., dabigatran, apixaban), vitamin K antagonists (VKAs, e.g., warfarin), or antiplatelet agents (e.g., aspirin, clopidogrel), requires meticulous planning to effectively balance the competing risks of perioperative bleeding and thromboembolism [6]. Research consistently demonstrates that continuing NOACs during minor dental procedures, such as single tooth extractions, is generally safe, with the application of local hemostatic measures, such as tranexamic acid mouthwash or compresses, effectively reducing bleeding incidence by 40–50% [7]. However, for more invasive procedures, such as multiple extractions or periodontal surgeries, temporary discontinuation of NOACs 24–48 hours prior to surgery may be considered, though this approach elevates the risk of thromboembolic events by approximately 1.8–2.5%, necessitating careful risk stratification in consultation with a cardiologist [8]. For patients on VKAs, maintaining the international normalized ratio (INR) within the therapeutic range of 2.0–3.0 is deemed safe for minor procedures; however, an INR exceeding 3.5 typically warrants temporary cessation of the anticoagulant and the implementation of bridging therapy with low-molecular-weight heparin (LMWH) to mitigate thrombotic risks [9]. Dual antiplatelet therapy, such as the combination of aspirin and clopidogrel, significantly increases the risk of perioperative bleeding by 20–30%, underscoring the need for individualized risk assessments to determine whether continuation or temporary interruption of therapy is appropriate [10]. The Polish Heart Journal emphasizes that continuing low-dose aspirin is generally safe for most dental procedures, as bleeding can be effectively managed with local hemostatic measures, such as gelatin sponges, sutures, or oxidized cellulose, thereby avoiding unnecessary disruption of cardioprotective therapy [19]. The Polish Heart Journal highlights the safety of continuing low-dose aspirin, supported by a classic study [19] that remains a foundational reference despite its age. Clinical management involves several key steps. Preoperatively, consultation with a cardiologist is essential to assess cardiovascular disease stability and anticoagulation status; for VKA patients, the INR should be measured 24 hours before surgery to ensure it falls within the therapeutic range, while for NOACs, renal function (e.g.,

creatinine clearance) should be evaluated to guide discontinuation timing, as renal impairment may prolong drug clearance. Intraoperatively, local hemostatic agents, such as tranexamic acid mouthwash, gelatin sponges, or hemostatic sutures, should be employed to control bleeding, and for hypertensive patients, the use of epinephrine in local anesthetics should be minimized or avoided to reduce the risk of blood pressure spikes. Postoperatively, patients should be monitored for signs of bleeding and cardiovascular stability for 24–48 hours, with procedures ideally scheduled in the morning to allow for same-day observation and timely intervention if complications arise. Recommendations include avoiding unnecessary discontinuation of anticoagulants for minor procedures to minimize thrombotic risks, considering bridging therapy with LMWH for high-risk patients (e.g., those with recent coronary stent placement or a history of thromboembolism), and educating patients on recognizing signs of postoperative bleeding, such as persistent oozing or hematoma formation, while providing clear instructions for seeking medical attention. Information on management strategies has been collected in Table 2.

Table 2. Complications, Management Strategies, and Recommendations for Cardiovascular Diseases and Anticoagulant Therapy in Dental Surgery

Aspect	Details	Evidence Level
Key Complications	Bleeding risk: 20–30% with anticoagulants (NOACs, VKAs, antiplatelet agents) [4, 7, 8]. Hypertension-induced cardiovascular events (10–15% risk during procedures) [5, 16].	Evidence-Based [4, 7, 8, 16]
Risk Factors	Hypertension (30–40% prevalence), atrial fibrillation, prosthetic valves, dual antiplatelet therapy [4, 8, 16]. Epinephrine in anesthetics increases blood pressure [5].	Evidence-Based [4, 8, 16]
Preoperative Management	Monitor INR (2.0–3.0 for VKAs), consult cardiologist for NOAC continuation or LMWH bridging [7, 8, 24]. Assess hemodynamic stability [16].	Expert Recommendation [24, 16]
Intraoperative Management	Use local hemostatic agents (e.g., tranexamic acid mouthwash) to reduce bleeding by 40–50% [6, 19]. Limit epinephrine in anesthetics [5].	Evidence-Based [6] / Expert Recommendation [19]
Postoperative Management	Monitor for bleeding/thromboembolism for 48 hours [7, 8]. Schedule follow-up visits for high-risk patients [16, 24].	Expert Recommendation [24]
Clinical Recommendations	Follow SDCEP guidelines for anticoagulant management [24]. Coordinate with cardiologists for personalized plans [4, 16]. Educate patients on signs of complications [19].	Expert Recommendation [24, 16, 19]

Summary of complications, risk factors, management strategies, and recommendations for cardiovascular diseases and anticoagulant therapy in dental surgery

TYPE 2 DIABETES: COMPLICATIONS, WOUND HEALING, AND ANTIBIOTIC PROPHYLAXIS

Type 2 diabetes, prevalent in approximately 10–15% of patients undergoing dental surgical procedures, significantly elevates perioperative risks, particularly in cases of suboptimal glycemic control, defined as HbA1c levels exceeding 7.5% [11]. Chronic hyperglycemia compromises critical physiological processes, including neutrophil function, collagen synthesis, and angiogenesis, resulting in a 2–3-fold increased incidence of postoperative infections, such as abscesses and osteomyelitis, and delays wound healing by approximately 1–2

weeks [12]. Specifically, HbA1c levels above 8% are associated with a 30–40% heightened risk of complications, including surgical site infections, which can lead to prolonged recovery and increased morbidity [13]. The administration of antibiotic prophylaxis, such as amoxicillin 2 g administered one hour preoperatively, has been shown to reduce infection rates by 35–45% in diabetic patients, providing a critical safeguard against postoperative complications [14]. Preoperative optimization of glycemic control, targeting an HbA1c level below 7%, can significantly mitigate these risks, shortening healing time and reducing complication rates by 25–30% [15]. Furthermore, long-term hyperglycemia exacerbates the risk of periodontal disease, which complicates surgical outcomes by increasing the likelihood of local infections and impairing tissue regeneration [16]. Medications commonly used in diabetes management, such as metformin or insulin, may necessitate perioperative dose adjustments to prevent hypoglycemia, particularly in patients required to fast before surgery, underscoring the need for careful coordination with the patient’s endocrinologist [3]. Clinical management involves a structured, multidisciplinary approach to ensure optimal outcomes. Preoperatively, HbA1c levels should be measured 2–4 weeks prior to surgery to assess glycemic control, with consultation from an endocrinologist recommended for patients with HbA1c exceeding 7.5% to implement strategies for glycemic optimization, such as intensified insulin therapy or dietary modifications. Antibiotic prophylaxis, such as amoxicillin or clindamycin for penicillin-allergic patients, should be prescribed for high-risk cases to minimize infection risk. Intraoperatively, minimally invasive surgical techniques are essential to reduce tissue trauma and subsequent inflammatory responses, while blood glucose levels should be monitored during prolonged procedures to prevent acute glycemic fluctuations. Postoperatively, strict glycemic control, maintaining blood glucose levels within the 100–180 mg/dL range, is critical to support wound healing and prevent infections. Clinicians should vigilantly monitor for signs of infection, such as swelling, erythema, or purulent discharge, and provide patients with comprehensive oral hygiene education to prevent secondary infections. Recommendations include adopting a multidisciplinary approach involving endocrinologists to optimize perioperative glycemic management, using chlorhexidine 0.12% mouthwash both pre- and postoperatively to reduce bacterial load in the oral cavity, and scheduling follow-up visits within 7–10 days to assess healing progress and address any early complications.

Table 3. Complications, Management Strategies, and Recommendations for Type 2 Diabetes in Dental Surgery

Aspect	Details	Evidence Level
Key Complications	Infection/delayed healing risk: 2–3-fold increase with HbA1c >7.5% [5, 10, 25]. Impaired neutrophil function and collagen synthesis [3].	Evidence-Based [5, 10, 25]
Risk Factors	Suboptimal glycemic control (HbA1c >7.5%), polypharmacy, poor oral hygiene [5, 10].	Evidence-Based [5, 10]
Preoperative Management	Optimize glycemic control (HbA1c <7.5%), consult endocrinologist [10, 25]. Prescribe antibiotic prophylaxis (amoxicillin 2 g) [5].	Expert Recommendation [10, 25]
Intraoperative Management	Use minimally invasive techniques to reduce trauma [10]. Monitor blood glucose during procedure [3].	Evidence-Based [3] / Expert Recommendation [10]
Postoperative Management	Monitor for infection for 7–14 days [5, 25]. Maintain oral hygiene with chlorhexidine [10].	Expert Recommendation [25]
Clinical Recommendations	Follow ADA guidelines for diabetic patients [10, 25]. Coordinate with endocrinologists for glycemic management [3]. Educate patients on wound care [5].	Expert Recommendation [10, 25]

Summary of complications, risk factors, management strategies, and recommendations for type 2 diabetes in dental surgery.

OSTEOPOROSIS AND BISPHOSPHONATE THERAPY

Osteoporosis, a systemic condition characterized by reduced bone density and compromised bone quality, significantly elevates the risk of complications in dental surgical procedures, particularly among patients receiving bisphosphonate therapy, such as oral alendronate or intravenous zoledronic acid [17]. Bisphosphonate-related medication-related osteonecrosis of the jaw (MRONJ), a severe and debilitating complication, occurs in approximately 3–5% of patients undergoing tooth extractions and 5–10% of those receiving dental implants, with notably higher risks associated with intravenous bisphosphonates used in the management of osteoporosis or oncological conditions [18]. The pathophysiology of MRONJ involves the suppression of bone remodeling and impaired mucosal healing, leading to exposed necrotic bone, persistent pain, and potential secondary infections [7]. Key risk factors for MRONJ include prolonged bisphosphonate therapy (exceeding 3 years), smoking, poor oral hygiene, and concurrent use of corticosteroids, which further compromise bone healing and immune response [7]. Intravenous bisphosphonates, commonly administered in cancer patients or severe osteoporosis cases, carry a 10-fold higher risk of MRONJ compared to oral formulations, due to their greater potency and systemic impact on bone metabolism [18]. Preventive strategies are critical to mitigate this risk and include the consideration of drug holidays, typically lasting 3–6 months for oral bisphosphonates, provided they are approved by the prescribing physician to avoid compromising osteoporosis treatment [9]. Additionally, antibiotic prophylaxis, such as amoxicillin or clindamycin for penicillin-allergic patients, and the use of minimally invasive surgical techniques, such as atraumatic extractions, are recommended to reduce tissue trauma and infection risk [9]. Dental implant placement is generally contraindicated in high-risk patients, particularly those with a history of long-term intravenous bisphosphonate use, unless the clinical benefits demonstrably outweigh the risks, as determined through multidisciplinary consultation [7]. Early detection of MRONJ is facilitated by advanced imaging modalities, such as cone-beam computed tomography (CBCT), which allows for the identification of early bone changes, such as osteosclerosis or sequestrum formation, critical for timely intervention [17]. Clinical management requires a structured, proactive approach to ensure patient safety. Preoperatively, consultation with the prescribing physician, typically an endocrinologist or oncologist, is essential to assess the feasibility of a drug holiday and evaluate the patient’s overall health status. A CBCT scan should be performed to assess bone health and identify any pre-existing abnormalities that may predispose to MRONJ. Prophylactic antibiotics, such as amoxicillin 2 g administered one hour preoperatively, and chlorhexidine 0.12% mouthwash for 7 days before surgery, are recommended to minimize infection risk. Intraoperatively, clinicians should employ atraumatic extraction techniques, such as sectional tooth division and minimal flap elevation, to avoid excessive bone manipulation, and apply local hemostatic agents, such as gelatin sponges or tranexamic acid, to control bleeding effectively. Postoperatively, vigilant monitoring for MRONJ signs, including exposed bone, persistent pain, or soft tissue swelling, is necessary for 6–12 months, with chlorhexidine mouthwash continued for 14 days to maintain a low bacterial load. High-risk patients should undergo regular follow-up appointments every 3 months to detect early complications. Recommendations include strict adherence to the American Association of Oral and Maxillofacial Surgeons (AAOMS) MRONJ staging and treatment guidelines, which provide a framework for risk assessment and management. Patient education on maintaining rigorous oral hygiene, including regular brushing and antiseptic rinsing, is crucial to reduce infection risk. Elective implant procedures should be avoided in patients with a history of intravenous bisphosphonate use, and alternative restorative options, such as removable prostheses, should be considered to minimize the risk of MRONJ development. Osteoporosis with bisphosphonates raises MRONJ risk (3–5% for extractions, 5–10% for implants), higher with intravenous forms [17]. Risk factors include prolonged therapy (>3 years), smoking, and corticosteroids [18]. Drug holidays (3–6 months), antibiotics, and atraumatic techniques mitigate risks [19]. CBCT aids early detection [20]. Details are presented in Table 3.

Table 4. Complications, Management Strategies, and Recommendations for Osteoporosis and Bisphosphonate Therapy in Dental Surgery

Aspect	Details	Evidence Level
Key Complications	Medication-related osteonecrosis of the jaw (MRONJ) risk: 3–5% for extractions, 5–10% for implants, higher with intravenous bisphosphonates [11, 21, 22]. Exposed necrotic bone, persistent pain, and secondary infections [20].	Evidence-Based [11, 21, 22]

Risk Factors	Prolonged bisphosphonate therapy (>3 years), smoking, poor oral hygiene, concurrent corticosteroid use [22]. Intravenous bisphosphonates increase MRONJ risk 10-fold compared to oral forms [21].	Evidence-Based [21, 22]
Preoperative Management	Consult an endocrinologist to assess feasibility of 3–6-month drug holiday [19, 21]. Prescribe antibiotic prophylaxis (e.g., amoxicillin 2 g or clindamycin) to reduce infection risk [21, 22]. Use cone-beam computed tomography (CBCT) for early MRONJ detection [20].	Expert Recommendation [21, 22]
Intraoperative Management	Employ minimally invasive techniques (e.g., atraumatic extractions, limited flap elevation) to reduce tissue trauma [21]. Use local hemostatic agents (e.g., tranexamic acid, gelatin sponges) to control bleeding [19].	Expert Recommendation [21]
Postoperative Management	Monitor for MRONJ signs (exposed bone, pain, fistula) for 6–12 months [20, 21]. Maintain rigorous oral hygiene with chlorhexidine 0.12% mouthwash [22]. Schedule follow-up visits every 3 months for high-risk patients [21].	Expert Recommendation [21, 22]
Clinical Recommendations	Adhere to American Association of Oral and Maxillofacial Surgeons (AAOMS) MRONJ guidelines [21]. Coordinate with endocrinologists for drug holiday decisions [19, 22]. Educate patients on oral hygiene to minimize infection risk [20].	Expert Recommendation [21, 19]

Summary of complications, risk factors, management strategies, and recommendations for osteoporosis and bisphosphonate therapy in dental surgery.

ONCOLOGICAL CONDITIONS AND CANCER THERAPIES

Patients with head and neck cancers undergoing radiotherapy, particularly at doses exceeding 60 Gy, chemotherapy, or molecularly targeted therapies such as bevacizumab encounter significantly heightened risks of osteoradionecrosis (ORN), delayed wound healing, and infections stemming from immunosuppression, with ORN occurring in approximately 5–15% of cases [19]. ORN, a severe and debilitating condition characterized by exposed necrotic bone in previously irradiated areas, is most frequently observed in the mandible following dental extractions within irradiated fields, with the risk escalating in direct correlation with both the radiation dose and the time elapsed since treatment, often manifesting months to years post-radiotherapy, particularly in patients with a history of high-dose exposure [4]. Chemotherapy-induced neutropenia, defined as a neutrophil count below 1500/ μ L, substantially increases the risk of postoperative infections by 20–30%, necessitating robust antibiotic prophylaxis to safeguard against microbial complications [10]. Molecularly targeted therapies, such as anti-angiogenic agents like bevacizumab, disrupt angiogenesis by inhibiting vascular endothelial growth factor (VEGF), leading to delayed wound healing by 25–35%, which significantly impairs tissue repair processes and heightens susceptibility to postoperative complications [15]. Pre-radiation dental assessments are of paramount importance, as they enable the identification and extraction of teeth with poor prognosis-such as those with advanced caries, periapical pathology, or severe periodontal disease- prior to the initiation of radiotherapy, a proactive measure that can reduce ORN risk by 40–50% by eliminating potential foci of infection or trauma in irradiated tissues [3]. Hyperbaric oxygen therapy (HBO), administered in multiple sessions before and after dental extractions, enhances tissue oxygenation, promotes angiogenesis, and supports healing, resulting in a reduction of ORN incidence by approximately 30% in patients with a history of high-dose radiotherapy to the head and neck region [7]. Patients with hematological malignancies, such as leukemia or lymphoma, or those experiencing bone marrow suppression due to chemotherapy, require meticulous timing of dental procedures to avoid periods of severe immunosuppression, as profoundly low neutrophil counts exacerbate infection risks and compromise the body’s capacity for tissue regeneration [19].

Clinical management necessitates a comprehensive, multidisciplinary approach to optimize patient outcomes and minimize complications. Preoperatively, a thorough dental evaluation should be conducted at least 2–3 weeks before the initiation of radiotherapy or chemotherapy to allow sufficient time for healing post-extraction, with consultations involving oncologists to assess neutrophil counts and systemic stability; elective procedures should be deferred if neutrophil counts fall below 1500/ μ L to avoid undue risk. Antibiotic prophylaxis, such as amoxicillin 2 g or metronidazole for penicillin-allergic patients, should be administered to mitigate infection risk, particularly in neutropenic individuals. Intraoperatively, clinicians should prioritize minimally invasive techniques, such as atraumatic extractions with sectional tooth division and avoidance of flap elevation in irradiated areas, to minimize tissue trauma and preserve the integrity of compromised vascular structures. Postoperatively, vigilant monitoring for signs of ORN such as exposed bone, persistent pain, fistula formation, or pathological fractures and infections is essential for 6–12 months, with HBO therapy continued for high-risk patients to support tissue recovery and reduce the likelihood of necrotic complications. Comprehensive oral hygiene education, emphasizing the use of chlorhexidine 0.12% mouthwash, is critical to minimize bacterial load and prevent secondary infections. Recommendations include implementing multidisciplinary planning with oncologists and radiation therapists to ensure coordinated care, deferring elective dental procedures until neutrophil counts recover above 1500/ μ L, and utilizing cone-beam computed tomography (CBCT) to monitor bone health post-radiotherapy for early detection of ORN-related changes, such as osteolysis or sequestrum formation. Patient education on maintaining rigorous oral hygiene practices, including regular brushing, flossing, and antiseptic rinsing, is vital to reduce the risk of infection and promote optimal surgical outcomes in this high-risk population.

ELDERLY PATIENTS AND POLYPHARMACY

Elderly patients, aged 65 years and older, frequently present with polypharmacy, defined as the concurrent use of five or more medications, alongside chronic conditions such as hypertension, diabetes mellitus, and arthritis, which collectively elevate perioperative risks in dental surgical procedures by 15–25% [14]. Polypharmacy, prevalent in this demographic due to the high burden of chronic diseases, introduces significant challenges, as common drug interactions, notably between non-steroidal anti-inflammatory drugs (NSAIDs) and anticoagulants like warfarin or non-vitamin K antagonist oral anticoagulants (NOACs), increase the risk of perioperative bleeding by 20–30%, potentially leading to hematoma formation or prolonged oozing at surgical sites [6]. Additionally, age-related physiological changes, including reduced tissue regeneration capacity and diminished immune function, extend wound healing times by approximately 1–2 weeks, heightening susceptibility to postoperative complications such as infections or delayed soft tissue closure [18]. Age-related organ dysfunction, particularly in the liver and kidneys, further exacerbates the risk of adverse drug reactions, as impaired metabolism and clearance can lead to drug accumulation and toxicity [18]. For instance, the combination of beta-blockers, commonly prescribed for hypertension or cardiac conditions, with local anesthetics containing epinephrine may precipitate hypertensive crises, characterized by acute blood pressure spikes that pose risks of cardiovascular events during dental procedures [3]. Comprehensive medication reviews, conducted in collaboration with pharmacists or geriatricians, are essential to identify and mitigate potential drug interactions, ensuring safer surgical outcomes [7]. Clinical management requires a structured, multidisciplinary approach to address these complexities. Preoperatively, a thorough medication review should be conducted with a pharmacist or geriatrician to evaluate the patient's drug regimen, with adjustments or temporary discontinuation of high-risk medications, such as NSAIDs, made in consultation with the prescribing physician to minimize bleeding or other complications. Assessment of organ function, including liver (e.g., liver function tests) and kidney (e.g., glomerular filtration rate) parameters, is critical to guide the selection and dosing of anesthetics and other perioperative medications. Intraoperatively, clinicians should use low-dose epinephrine in local anesthetics to reduce the risk of hemodynamic instability, while closely monitoring vital signs, including blood pressure and heart rate, to detect and manage any acute changes promptly. Minimally invasive surgical techniques, such as atraumatic extractions or limited flap elevation, should be employed to reduce tissue trauma and facilitate healing in the context of age-related regenerative limitations. Postoperatively, patients require vigilant monitoring for signs of delayed healing, such as persistent erythema or incomplete wound closure, and infections, including abscesses or cellulitis, for a period of 2–3 weeks. Clear, accessible instructions on oral hygiene practices, including brushing, flossing, and antiseptic mouthwash use, as well as strict adherence to prescribed medications, are crucial to prevent secondary complications. Recommendations include involving a multidisciplinary team, comprising dentists, pharmacists, and geriatricians, for preoperative planning to optimize patient safety. The use of electronic drug interaction checkers, such as those integrated into clinical decision support systems, is advised to systematically identify potential risks. High-risk elderly patients should be scheduled for frequent follow-up visits, ideally weekly for the first month post-procedure, to monitor healing progress and promptly address any complications, ensuring tailored care that accounts for their complex medical and pharmacological profiles.

IMMUNOSUPPRESSIVE THERAPIES AND AUTOIMMUNE DISEASES

Patients with autoimmune diseases, such as rheumatoid arthritis (RA) and systemic lupus erythematosus

(SLE), or those undergoing post-transplant immunosuppression with medications like corticosteroids, methotrexate, or cyclosporine, encounter a significantly elevated risk of complications during dental surgical procedures, with a 25–35% increased likelihood of postoperative infections and delayed wound healing due to compromised immune responses and altered tissue repair mechanisms [12]. Cyclosporine, commonly used in transplant patients to prevent graft rejection, is particularly problematic as it induces gingival hyperplasia, characterized by excessive gingival tissue growth, which complicates surgical access, hinders effective hemostasis, and elevates infection risk by creating niches for bacterial colonization [11]. Corticosteroids, frequently prescribed for autoimmune conditions, impair wound healing by suppressing inflammatory responses essential for tissue repair, leading to prolonged recovery times and increased susceptibility to complications [9]. Methotrexate, another cornerstone of autoimmune disease management, heightens the risk of mucosal ulceration, which can exacerbate postoperative pain and serve as an entry point for infections [9]. Post-transplant patients, who often require lifelong immunosuppression, necessitate especially vigilant monitoring due to systemic immune suppression, which profoundly reduces their ability to combat infections and heal effectively, increasing the risk of severe complications such as osteomyelitis or soft tissue infections [7]. Clinical management of these patients demands a meticulous, multidisciplinary approach to balance surgical needs with systemic disease control. Preoperatively, consultation with a rheumatologist or transplantologist is critical to evaluate the feasibility of dose reduction, such as tapering corticosteroids 1–2 weeks before surgery to minimize suppression of healing processes, while ensuring disease stability to prevent flares or graft rejection. Antibiotic prophylaxis, such as amoxicillin 2 g administered one hour preoperatively, is recommended to reduce infection risk, with clindamycin as an alternative for penicillin-allergic patients. Intraoperatively, minimally invasive techniques, such as atraumatic extractions or limited flap elevation, are essential to reduce tissue trauma and preserve compromised tissue integrity, particularly in the presence of cyclosporine-induced gingival hyperplasia, where excessive manipulation of hyperplastic tissue should be avoided to prevent bleeding and infection. Postoperatively, patients require close monitoring for signs of infection, such as swelling, erythema, or purulent discharge, and delayed healing, indicated by incomplete wound closure or persistent pain, for a period of 2–4 weeks. In high-risk cases, antibiotic prophylaxis should be continued for 5–7 days post-procedure to further mitigate infection risk. Recommendations include coordinating closely with specialists to balance immunosuppression requirements with surgical risks, ensuring that any medication adjustments do not compromise underlying disease control. The use of chlorhexidine 0.12% mouthwash pre- and postoperatively is advised to reduce bacterial load in the oral cavity, minimizing the risk of secondary infections. Follow-up visits should be scheduled every 7–10 days to assess healing progress, monitor for complications, and adjust care plans as needed, ensuring comprehensive management tailored to the unique challenges posed by autoimmune diseases and immunosuppressive therapies.

CHRONIC KIDNEY DISEASE: PHARMACOLOGICAL AND HEMOSTATIC CONSIDERATIONS

Chronic kidney disease (CKD) profoundly alters drug metabolism, significantly increasing the risk of toxicity for medications commonly used in dental practice, such as non-steroidal anti-inflammatory drugs (NSAIDs), penicillins, and local anesthetics, due to impaired renal clearance and altered pharmacokinetics [19]. Uremic platelet dysfunction, a hallmark of CKD, compromises hemostasis by reducing platelet aggregation and adhesion, elevating the risk of perioperative bleeding by 10–20%, which can manifest as prolonged oozing or hematoma formation at surgical sites [16]. Concurrently, reduced immune function in CKD patients, driven by uremia-induced immunosuppression, increases the incidence of postoperative infections, such as abscesses or cellulitis, further complicating recovery [16]. Dose adjustments based on the glomerular filtration rate (GFR) are critical to prevent drug accumulation and toxicity, as renal impairment significantly prolongs the half-life of many medications [7]. For instance, amoxicillin, a commonly used antibiotic in dental surgery, requires a 50% dose reduction in patients with CKD stages 4–5 (GFR <30 mL/min) to avoid nephrotoxic or systemic adverse effects [9]. Clinical management necessitates a comprehensive, multidisciplinary approach to ensure patient safety and optimize surgical outcomes. Preoperatively, consultation with a nephrologist is essential to tailor medication doses according to the patient's GFR, ensuring that antibiotics, analgesics, and anesthetics are appropriately adjusted to prevent toxicity. Assessment of platelet function and coagulation parameters, such as bleeding time or platelet count, is crucial to evaluate hemostatic capacity and guide perioperative strategies. Prophylactic antibiotics, such as reduced-dose amoxicillin or clindamycin for penicillin-allergic patients, should be prescribed for infection-prone patients to mitigate the elevated risk of postoperative infections. Intraoperatively, local hemostatic agents, including tranexamic acid mouthwash or hemostatic sponges, should be employed to control bleeding effectively, compensating for uremic platelet dysfunction. Additionally, anesthetic doses must be limited in patients with severe CKD (GFR <15 mL/min) to avoid toxicity, with preference given to agents with minimal renal metabolism, such as articaine in reduced doses. Postoperatively, vigilant monitoring for bleeding and infections, including signs such as persistent oozing, swelling, or fever, is required for 2–3 weeks to ensure timely intervention. Nephrotoxic drugs, such as NSAIDs, should be strictly avoided post-procedure to prevent further renal damage. Recommendations include prioritizing renal-safe antibiotics and anesthetics, such as amoxicillin with adjusted dosing or lidocaine with minimal epinephrine, and

implementing strict hemostatic protocols, including the use of absorbable hemostatic materials and suturing techniques to minimize bleeding. Follow-up visits should be scheduled within 7–14 days to assess healing progress, monitor for complications, and adjust care plans as needed, ensuring that the unique pharmacological and hemostatic challenges of CKD are addressed to optimize surgical outcomes in this high-risk population.

BIOLOGIC DRUGS

Biologic drugs, such as tumor necrosis factor-alpha (TNF- α) inhibitors (e.g., adalimumab, etanercept) and denosumab, commonly employed in the management of autoimmune diseases like rheumatoid arthritis or psoriasis and in osteoporosis treatment, significantly elevate the risk of complications during dental surgical procedures by increasing infection rates by 20–30% and impairing wound healing due to their immunomodulatory and anti-angiogenic effects [15]. These agents suppress key inflammatory pathways, which, while beneficial for controlling autoimmune conditions, compromise the body's ability to mount an effective immune response and facilitate tissue repair, leading to prolonged recovery times and heightened susceptibility to postoperative infections, such as abscesses or cellulitis [15]. Denosumab, a monoclonal antibody targeting the receptor activator of nuclear factor kappa-B ligand (RANKL) used in osteoporosis and certain cancers, is particularly associated with a risk of medication-related osteonecrosis of the jaw (MRONJ), with an incidence comparable to that of bisphosphonates, estimated at 3–5% for dental extractions and higher for invasive procedures like implant placement, due to its potent inhibition of osteoclast activity and bone remodeling [20]. Temporary discontinuation of biologic drugs, typically for 2–4 weeks preoperatively, may mitigate these risks by partially restoring immune and healing capacities; however, such decisions require approval from a rheumatologist to avoid exacerbating underlying autoimmune conditions or precipitating disease flares, which can have significant systemic consequences [10]. Clinical management necessitates a meticulous, multidisciplinary approach to balance surgical safety with disease control. Preoperatively, consultation with a rheumatologist is essential to evaluate the feasibility of temporarily discontinuing biologics, weighing the risk of infection and delayed healing against the potential for disease flare-ups, with decisions guided by the patient's disease activity and medication half-life. Prophylactic antibiotics, such as amoxicillin 2 g administered one hour before surgery (or clindamycin for penicillin-allergic patients), and chlorhexidine 0.12% mouthwash for 7 days preoperatively are recommended to minimize bacterial load and reduce infection risk. Intraoperatively, minimally invasive surgical techniques, such as atraumatic extractions with sectional tooth division and limited flap elevation, should be employed to reduce tissue trauma, and local hemostatic agents, such as tranexamic acid or gelatin sponges, should be used to control bleeding effectively. Postoperatively, vigilant monitoring for signs of infection (e.g., swelling, erythema, purulent discharge) and MRONJ (e.g., exposed bone, persistent pain, or fistula formation) is critical for 6–12 months, as MRONJ may develop insidiously over time. Biologic drugs should typically be resumed after complete wound healing, generally 2–3 weeks post-procedure, in consultation with the rheumatologist to ensure disease stability. Recommendations include strict adherence to the American Association of Oral and Maxillofacial Surgeons (AAOMS) MRONJ guidelines for patients on denosumab, which provide a structured framework for risk assessment, staging, and management. Coordination with specialists, including rheumatologists and endocrinologists, is crucial to balance surgical risks with systemic disease control, ensuring that medication adjustments do not compromise long-term disease management. Patient education on maintaining rigorous oral hygiene, including the use of chlorhexidine mouthwash and regular brushing, is vital to minimize infection risk, and follow-up visits should be scheduled every 3 months for high-risk patients to monitor for MRONJ and other complications, ensuring optimal outcomes in this complex patient population. The key information on biologic therapy has been compiled in Figure 1.

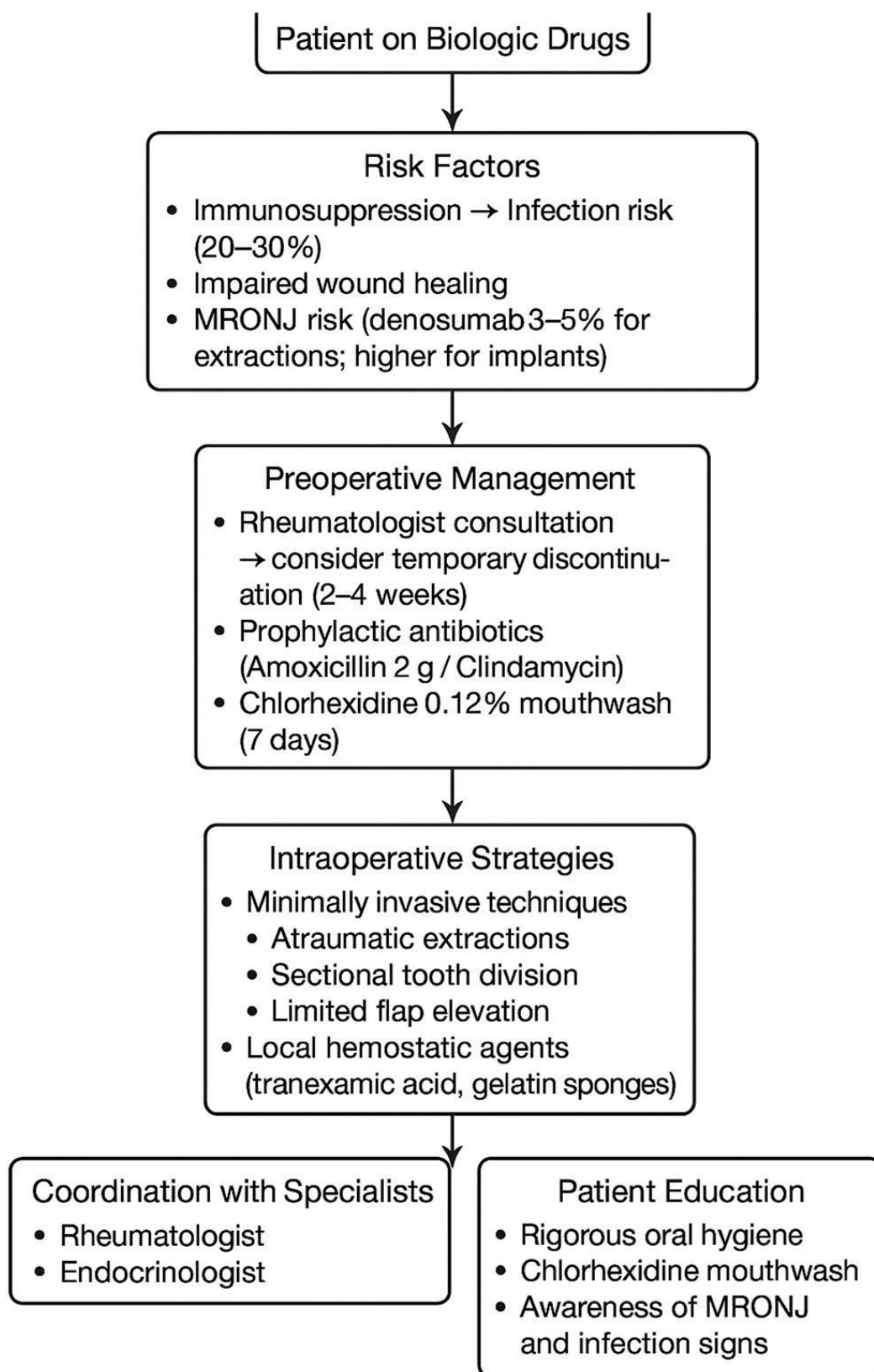


Figure 1. Management of dental surgical procedures in patients on biologic drugs (TNF- α inhibitors, denosumab)

The diagram summarizes key considerations for managing dental surgery in patients receiving biologic therapies, including TNF- α inhibitors and denosumab, highlighting risks such as infection (20–30% increase [18, 20]) and medication-related osteonecrosis of the jaw (MRONJ; 3–5% risk [11, 21, 22]), as well as preoperative, intraoperative, and postoperative strategies. Percentages are traceable to cited studies.

DISCUSSION

The reviewed literature suggests a multifactorial relationship between systemic comorbidities, pharmacotherapy, and the outcomes of dental surgical procedures, highlighting the potential value of evidence-based and individualized management strategies. However, the heterogeneity of study designs and limited sample sizes may affect the robustness of these findings. Cardiovascular diseases, including hypertension, ischemic heart disease, and atrial fibrillation, may require careful perioperative anticoagulation management. Several systematic reviews and clinical guidelines suggest that continuing non-vitamin K antagonist oral anticoagulants (NOACs) for minor procedures or applying bridging therapy with low-molecular-weight heparin (LMWH) in high-risk patients could minimize both bleeding and thromboembolic complications [4, 7, 8, 24], though evidence from observational studies is often limited by small cohorts.

Type 2 diabetes, particularly when glycemic control is poor (HbA1c >7.5%), has been associated with increased postoperative infection rates and delayed wound healing, potentially due to impaired neutrophil function and altered collagen metabolism. Recent meta-analyses indicate that optimization of glycemic control prior to surgery and targeted antibiotic prophylaxis may reduce postoperative complications [5, 10, 25], but variability in patient populations and follow-up periods limits the strength of these conclusions.

Patients with osteoporosis or malignant disease receiving bisphosphonates or denosumab face a documented risk of medication-related osteonecrosis of the jaw (MRONJ). According to the 2022 AAOMS position paper and the MASCC/ISOO/ASCO guideline, the incidence of MRONJ may range from 1% in low-risk groups to 10% in high-risk surgical cases [20–22], though these estimates are based on retrospective data with potential selection bias. Preventive measures, such as preoperative risk assessment, minimally invasive techniques, and optimization of oral hygiene, are recommended, but the practice of drug holidays remains controversial and lacks robust prospective evidence [21].

In oncological patients, particularly those undergoing high-dose radiotherapy (>60 Gy) or chemotherapy, the risk of osteoradionecrosis (ORN) and opportunistic infections is significantly increased. Updated ISOO/MASCC/ASCO guidelines emphasize the importance of comprehensive dental assessments before radiotherapy, atraumatic extractions, and preventive protocols. Adjunctive measures such as hyperbaric oxygen therapy (HBO) may reduce ORN incidence, although evidence remains heterogeneous [1, 19, 23]. These data are summarized in Figure 2, which compares the relative complication risks across major comorbidities and pharmacotherapies discussed above.

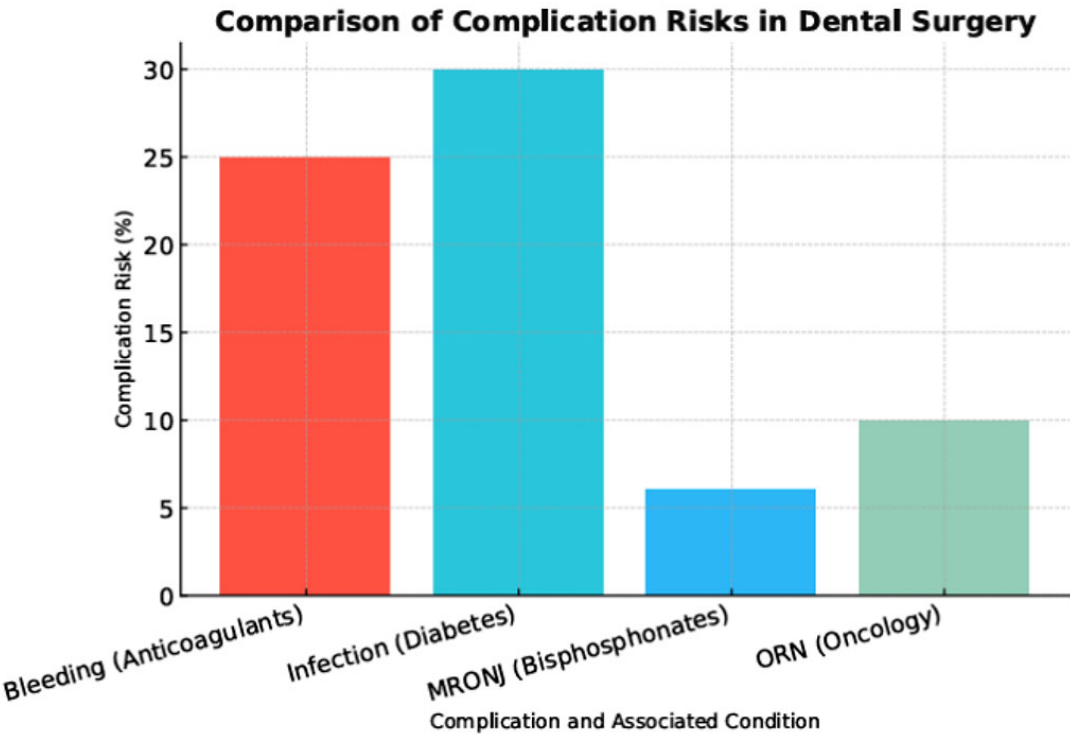


Figure 2. Comparison of complication risks across comorbidities and therapies
The chart illustrates estimated risks (based on heterogeneous studies) of bleeding (20–30% with anticoagulants [4, 7, 8]), infection (2–3-fold increase in diabetes [5, 10, 25]), medication-related osteonecrosis of the jaw (MRONJ; 3–10% with bisphosphonates [11, 21, 22]), and

osteoradionecrosis (ORN; 5–15% in oncology [1, 19, 23]). Percentages are traceable to cited studies.

Polypharmacy in elderly patients, defined as the regular use of five or more medications, may complicate perioperative management due to potential drug–drug interactions and reduced regenerative capacity, though definitions vary across studies [13, 14]. Interactions between anticoagulants and nonsteroidal anti-inflammatory drugs (NSAIDs) could increase the risk of perioperative bleeding, while anticholinergic medications might compromise wound healing. Comprehensive medication reviews and interdisciplinary coordination are therefore suggested [13, 14], with limited evidence on long-term outcomes.

Immunosuppressive regimens prescribed for autoimmune diseases or organ transplantation, as well as chronic kidney disease (CKD), may present challenges by increasing the risk of infection and bleeding. Careful dose adjustments based on glomerular filtration rate (GFR) and appropriate perioperative prophylaxis are recommended [12, 16], but CKD-specific studies are scarce.

Biologic drugs, including TNF-alpha inhibitors and denosumab, have been linked to increased susceptibility to infection and potential MRONJ risk, suggesting the need for close collaboration with rheumatologists and oncologists to balance surgical safety and systemic disease control [18, 20, 22]. However, long-term data are limited.

The limitations of the current evidence base include marked heterogeneity of study designs, relatively small sample sizes in key cohorts, and the lack of long-term prospective studies, which restrict the strength of recommendations. Management of anticoagulated patients remains inconsistent across studies, reflecting variability in continuation versus bridging protocols [7, 8, 24]. Data on denosumab-associated MRONJ are less comprehensive compared with bisphosphonates, underscoring the need for further research [20–22]. Additionally, there is no universally accepted interdisciplinary protocol that integrates perioperative dental management across all comorbidities, leaving clinical decision-making largely dependent on fragmented data and expert consensus.

Future research should prioritize large-scale longitudinal studies, international consensus-building, and the development of predictive risk models that integrate comorbidity profiles, pharmacotherapy, and surgical variables. Such advances are necessary to improve perioperative safety and provide a structured evidence-based framework for dental surgical care in medically compromised patients.

CONCLUSIONS

This review confirms the significant impact of comorbidities and pharmacotherapy on the safety and outcomes of dental surgical procedures. The available evidence highlights increased risks of bleeding in anticoagulated patients, higher postoperative infection rates in individuals with poorly controlled diabetes, and clinically relevant incidences of medication-related osteonecrosis of the jaw (MRONJ) and osteoradionecrosis (ORN) in patients receiving bisphosphonates, denosumab, or high-dose radiotherapy [4, 5, 7, 8, 11, 17, 19–22]. These complications underscore the necessity of thorough preoperative risk assessment, careful pharmacological adjustments, targeted antibiotic prophylaxis, and the use of minimally invasive surgical techniques.

Interdisciplinary collaboration between dentists, physicians, and specialists is crucial for optimizing perioperative outcomes. Personalized treatment plans that account for systemic health status, ongoing pharmacotherapy, and individual risk profiles remain the cornerstone of safe and effective dental surgical care.

Future research should focus on developing standardized perioperative protocols and validated predictive models to improve the accuracy of risk stratification and guide clinical decision-making. Large-scale prospective studies are required to reduce current uncertainties, strengthen the evidence base, and ensure greater safety and precision in managing medically compromised patients undergoing dental surgery.

AUTHOR CONTRIBUTIONS

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All authors read and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

USE OF AI

Artificial intelligence was used to assist in editing and formatting the manuscript, specifically for grammar checks and reference formatting. This is disclosed in accordance with journal guidelines.

REFERENCES

1. Kurita H, Sasaki T, Ito K, Yamaguchi H, Yamazaki H, Takenaka Y, Maruyama R, Tsuchiya H. Japanese clinical practice guidelines for oral cancer, 2023. *Int J Oral Maxillofac Surg.* 2024;53(7):876-892. DOI: [10.1016/j.ijom.2024.04.010](https://doi.org/10.1016/j.ijom.2024.04.010)
2. Little JW, Miller CS, Rhodus NL. *Dental management of the medically compromised patient.* 9th ed. St Louis (MO): Elsevier; 2018. DOI: [10.1016/C2013-0-18905-8](https://doi.org/10.1016/C2013-0-18905-8)
3. Kirwan M, et al. A Web-delivered, clinician-led group exercise intervention for older adults with type 2 diabetes: single-arm pre-post intervention. *J Med Internet Res.* 2022;24(9):e39800. DOI: [10.2196/39800](https://doi.org/10.2196/39800)
4. Darwish G, et al. The effect of direct oral anticoagulant therapy (DOACs) on oral surgical procedures: a systematic review. *BMC Oral Health.* 2023;23:743. DOI: [10.1186/s12903-023-03427-8](https://doi.org/10.1186/s12903-023-03427-8)
5. Monje A, Catena A, Khan S, Tejero R, Padial Molina M, Galindo Moreno P, et al. Association between diabetes mellitus/hyperglycaemia and peri implant diseases: systematic review and meta analysis. *J Clin Periodontol.* 2017;44(6):636-648. DOI: [10.1111/jcpe.12724](https://doi.org/10.1111/jcpe.12724)
6. Ockerman A, Miclotte I, Vanhaverbeke M, Vanassche T, Belmans A, Vanhove J, Meyns J, Nadjmi N, Van Hemelen G, Winderickx P. Tranexamic acid and bleeding in patients treated with non-vitamin K oral anticoagulants undergoing dental extraction: the EXTRACT-NOAC randomized clinical trial. *PLoS Med.* 2021;18(5):e1003601. DOI: [10.1371/journal.pmed.1003601](https://doi.org/10.1371/journal.pmed.1003601)
7. Buchbender M, Rößler F, Kesting MR, Frohwitter G, Adler W, Rau A. Management of anticoagulated patients in dentoalveolar surgery: a retrospective study comparing bridging with heparin versus unpaused vitamin K antagonist medication. *BMC Oral Health.* 2021;21:96. DOI: [10.1186/s12903-021-01464-9](https://doi.org/10.1186/s12903-021-01464-9)
8. Erden İ, Erden EÇ, Aksu T, Gölcük ŞE, Turan B, Erkol A, et al. Comparison of uninterrupted warfarin and bridging therapy using low-molecular weight heparin with respect to the severity of bleeding after dental extractions in patients with prosthetic valves. *Anatol J Cardiol.* 2016;16(7):467-73. DOI: [10.5152/AnatolJCardiol.2015.6130](https://doi.org/10.5152/AnatolJCardiol.2015.6130)
9. Statman BJ. Perioperative management of oral antithrombotics in dentistry and oral surgery: part 2. *Anesth Prog.* 2023;70(1):37-48. DOI: [10.2344/anpr-70-01-06](https://doi.org/10.2344/anpr-70-01-06)
10. Kandavalli SR, Wang Q, Ebrahimi M, et al. Dental implant treatment in medically compromised patients: a narrative review. *Open Dent J.* 2023;17:e187421062306080. DOI: [10.2174/18742106-v17-230727-2022-147](https://doi.org/10.2174/18742106-v17-230727-2022-147)
11. Kuroshima S, Al Omari F, Sasaki M, Sawase T. Medication related osteonecrosis of the jaw: a literature review and update. *Genesis.* 2022;60(8-9):e23500. DOI: [10.1002/dvg.23500](https://doi.org/10.1002/dvg.23500)
12. McLean CP, Kulkarni J, Sharp G. Disordered eating and the meat-avoidance spectrum: a systematic review and clinical implications. *Eat Weight Disord.* 2022;27(7):2347-75. DOI: [10.1007/s40519-022-01428-0](https://doi.org/10.1007/s40519-022-01428-0)
13. Soto AP, Meyer SL. Oral implications of polypharmacy in older adults. *Dent Clin North Am.* 2021;65(2):323-343. DOI: [10.1016/j.cden.2020.11.007](https://doi.org/10.1016/j.cden.2020.11.007)
14. Wise J. BMJ Awards 2019: stroke and cardiovascular team of the year. *BMJ.* 2019;364:l1354. DOI: [10.1136/bmj.l1354](https://doi.org/10.1136/bmj.l1354)
15. Kim J, et al. Comparative efficacy of angiotensin converting enzyme inhibitors and angiotensin receptor blockers after coronary artery bypass grafting. *Sci Rep.* 2020;10(1):1716. DOI: [10.1038/s41598-020-58705-0](https://doi.org/10.1038/s41598-020-58705-0)
16. Gupta K, Kumar S, Anand Kukkamalla M, Taneja V, Syed GA, Pullishery F, et al. Dental management considerations for patients with cardiovascular disease: a narrative review. *Rev Cardiovasc Med.* 2022;23(8):261. DOI: [doi:10.31083/j.rcm2308261](https://doi.org/10.31083/j.rcm2308261)

17. Glicksberg BS, Li L, Cheng WY, Shameer K, Hakenberg J, Ma M, et al. Integrative analysis of loss-of-function variants in clinical and genomic data reveals novel genes associated with cardiovascular traits. BMC Med Genomics. 2019;12(Suppl 6):108. DOI: [10.1186/s12920-019-0542-3](https://doi.org/10.1186/s12920-019-0542-3)
18. Dinkova AS, Petrov PG. Biological therapy and oral surgery: safety recommendations and practices. Discov Med. 2025;37(194):442-57. DOI: [10.24976/Discov.Med.202537194.37](https://doi.org/10.24976/Discov.Med.202537194.37)
19. Costa-Tort J, Schiavo-Di Flaviano V, González-Navarro B, Jané-Salas E, Estrugo-Devesa A, López-López J. Update on the management of anticoagulated and antiaggregated patients in dental practice: literature review. J Clin Exp Dent. 2021;13(9):e948-56. DOI: [10.4317/jced.58586](https://doi.org/10.4317/jced.58586)
20. Bansal H. Medication-related osteonecrosis of the jaw: an update. Natl J Maxillofac Surg. 2022;13(1):5-10. DOI: [10.4103/njms.NJMS_236_20](https://doi.org/10.4103/njms.NJMS_236_20)
21. Ruggiero SL, Dodson TB, Aghaloo T, Carlson ER, Ward BB, Kademani D. American Association of Oral and Maxillofacial Surgeons' Position Paper on Medication Related Osteonecrosis of the Jaws, 2022 Update. J Oral Maxillofac Surg. 2022;80(5):920-943. DOI: [10.1016/j.joms.2022.02.008](https://doi.org/10.1016/j.joms.2022.02.008)
22. Yarom N, Shapiro CL, Peterson DE, et al. Medication-related osteonecrosis of the jaw: MASCC/ISOO/ASCO clinical practice guideline. J Clin Oncol. 2019;37(25):2270-2290. DOI: [10.1200/JCO.19.01186](https://doi.org/10.1200/JCO.19.01186)
23. Peterson DE, Saunders DP, Lalla RV, et al. Prevention and management of osteoradionecrosis of the jaw in patients with head and neck cancer treated with radiation therapy: ISOO/MASCC/ASCO guideline. J Clin Oncol. 2024. DOI: [10.1200/JCO.23.02750](https://doi.org/10.1200/JCO.23.02750)
24. Scottish Dental Clinical Effectiveness Programme. Management of Dental Patients Taking Anticoagulants or Antiplatelet Drugs. 2nd ed. Dundee: SDCEP; 2022. Available at: <https://www.sdcep.org.uk> Accessed September 2025.
25. Shang R, Gao L. Impact of hyperglycemia on the rate of implant failure and peri-implant parameters in patients with type 2 diabetes mellitus: a systematic review and meta-analysis. J Am Dent Assoc. 2021;152(3):189-201.e1. DOI: [10.1016/j.adaj.2020.11.015](https://doi.org/10.1016/j.adaj.2020.11.015)

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