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ENTRE O SANGRAMENTO E A TROMBOSE: TOMADA DE DECISÃO CLÍNICA PARA CIRURGIA DE IMPLANTES EM PACIENTES EM TERAPIA ANTITROMBÓTICA

BETWEEN BLEEDING AND THROMBOSIS: CLINICAL DECISION-MAKING FOR IMPLANT SURGERY IN ANTITHROMBOTIC PATIENTS

ENTRE EL SANGRADO Y LA TROMBOSIS: TOMA DE DECISIONES CLÍNICAS PARA LA CIRUGÍA DE IMPLANTES EN PACIENTES EN TERAPIA ANTITROMBÓTICA

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Resumo

Analisar a tomada de decisão clínica para cirurgia de implantes dentários em pacientes em uso de terapia antitrombótica, com ênfase no equilíbrio entre risco hemorrágico perioperatório e risco tromboembólico. Foi realizada uma revisão narrativa atualizada utilizando PubMed/MEDLINE e Scopus. Foram conduzidas três buscas complementares em cada base em 5 de setembro de 2026, abordando implantes dentários e terapia antitrombótica em relação a sangramento pós-operatório, risco tromboembólico, interrupção ou *bridging* da terapia e medidas de hemostasia local. As buscas recuperaram 57, 35 e 24 registros no PubMed/MEDLINE e 64, 27 e 29 documentos no Scopus, respectivamente. Como as buscas foram intencionalmente sobrepostas, os resultados não foram somados. As evidências foram priorizadas de acordo com sua especificidade clínica, considerando-se primeiro as evidências diretamente relacionadas à cirurgia de implantes, seguidas por evidências extrapoladas de cirurgia oral geral e, posteriormente, por diretrizes odontológicas e cardiovasculares. As evidências atuais sugerem que a terapia antitrombótica não deve ser rotineiramente interrompida apenas pela realização de cirurgia de implantes dentários. Entretanto, a certeza da evidência

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específica para implantes permanece limitada, uma vez que a maior parte dos estudos disponíveis é observacional e heterogênea. A tomada de decisão deve considerar a indicação da terapia antitrombótica, o risco tromboembólico, as características farmacológicas do medicamento, a função renal quando pertinente, medicamentos concomitantes, a complexidade do procedimento e a disponibilidade de medidas hemostáticas locais eficazes. As evidências específicas para implantes sugerem que o sangramento pós-operatório é geralmente manejável com intervenções locais, embora as evidências para procedimentos extensos permaneçam limitadas. A cirurgia de implantes pode frequentemente ser realizada sem interrupção rotineira da terapia antitrombótica quando baseada em avaliação individualizada e estratégias adequadas de hemostasia local. Essa abordagem não deve ser interpretada como regra universal. Procedimentos complexos ou decisões relacionadas à modificação da terapia antitrombótica devem ser individualizados e, quando apropriado, coordenados com o médico prescritor. A evidência atual é predominantemente observacional, permanecendo incertezas especialmente para procedimentos implantológicos extensos e subgrupos clínicos de maior risco.

Palavras-chave: Implantes dentários; Anticoagulantes; Antiagregantes plaquetários; Hemorragia; Tromboembolismo; Hemostasia.

Abstract

To examine clinical decision-making for dental implant surgery in patients receiving antithrombotic therapy, with emphasis on balancing perioperative bleeding against thromboembolic risk. An updated narrative review was conducted using PubMed/MEDLINE and Scopus. Three complementary searches were performed in each database on September 5, 2026, addressing dental implants and antithrombotic therapy in relation to postoperative bleeding, thromboembolic risk, medication interruption or bridging, and local hemostasis. The searches retrieved 57, 35, and 24 records in PubMed/MEDLINE and 64, 27, and 29 documents in Scopus, respectively. Because the searches were intentionally overlapping, the results were not summed. Evidence was prioritized according to clinical specificity, with implant-specific evidence considered before evidence extrapolated from general oral surgery, followed by dental and cardiovascular guidelines. Current evidence suggests that antithrombotic therapy should not be routinely interrupted solely because dental implant surgery is planned. However, the certainty of implant-specific evidence remains limited, with most available studies being observational and heterogeneous. Clinical decisions should consider the indication for antithrombotic therapy, thromboembolic risk, medication characteristics, renal function when relevant, concomitant medications, procedural complexity, and the availability of effective local hemostatic measures. Implant-specific evidence suggests that postoperative bleeding is generally manageable with local interventions, although evidence for extensive procedures remains limited. Dental implant surgery may often be performed without routine interruption of antithrombotic therapy when individualized risk assessment and appropriate local hemostatic strategies are applied.

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This approach should not be interpreted as a universal rule. Decisions regarding complex procedures or modification of antithrombotic therapy should be individualized and, when appropriate, coordinated with the prescribing physician. The current evidence is predominantly observational, and uncertainty remains particularly for extensive implant procedures and high-risk clinical subgroups.
Keywords: Dental implants; Anticoagulants; Platelet aggregation inhibitors; Hemorrhage; Thromboembolism; Hemostasis.

Resumen

Examinar la toma de decisiones clínicas para la cirugía de implantes dentales en pacientes que reciben terapia antitrombótica, con énfasis en el equilibrio entre el sangrado perioperatorio y el riesgo tromboembólico. Se realizó una revisión narrativa actualizada utilizando las bases de datos PubMed/MEDLINE y Scopus. Se realizaron tres búsquedas complementarias en cada base de datos el 5 de septiembre de 2026, abordando los implantes dentales y la terapia antitrombótica en relación con el sangrado posoperatorio, el riesgo tromboembólico, la interrupción de la medicación o la terapia puente y la hemostasia local. Las búsquedas recuperaron 57, 35 y 24 registros en PubMed/MEDLINE y 64, 27 y 29 documentos en Scopus, respectivamente. Debido a que las búsquedas fueron intencionalmente superpuestas, los resultados no se sumaron. La evidencia se priorizó de acuerdo con la especificidad clínica, considerando primero la evidencia específica para implantes, seguida de la evidencia extrapolada de la cirugía oral general y, posteriormente, de las guías odontológicas y cardiovasculares. La evidencia actual sugiere que la terapia antitrombótica no debe interrumpirse de forma rutinaria únicamente por la planificación de una cirugía de implantes dentales. Sin embargo, la certeza de la evidencia específica para implantes sigue siendo limitada, ya que la mayoría de los estudios disponibles son observacionales y heterogéneos. Las decisiones clínicas deben considerar la indicación de la terapia antitrombótica, el riesgo tromboembólico, las características de la medicación, la función renal cuando sea pertinente, los medicamentos concomitantes, la complejidad del procedimiento y la disponibilidad de medidas eficaces de hemostasia local. La evidencia específica para implantes sugiere que el sangrado posoperatorio generalmente puede manejarse mediante intervenciones locales, aunque la evidencia para procedimientos extensos sigue siendo limitada. La cirugía de implantes dentales puede realizarse con frecuencia sin la interrupción rutinaria de la terapia antitrombótica cuando se aplican una evaluación individualizada del riesgo y estrategias adecuadas de hemostasia local. Este enfoque no debe interpretarse como una regla universal. Las decisiones relativas a procedimientos complejos o a la modificación de la terapia antitrombótica deben individualizarse y, cuando corresponda, coordinarse con el médico prescriptor. La evidencia actual es predominantemente observacional y persiste incertidumbre, particularmente en relación con procedimientos extensos de implantes y subgrupos clínicos de alto riesgo.
Palabras clave: Implantes dentales; Anticoagulantes; Inhibidores de la agregación plaquetaria; Hemorragia; Tromboembolismo; Hemostasia.

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1. INTRODUCTION

The increasing use of antithrombotic therapy has created an important clinical challenge in contemporary implant dentistry. As populations age and the prevalence of cardiovascular and thromboembolic diseases increases, a growing number of patients seeking implant-supported rehabilitation receive anticoagulant or antiplatelet medications. These therapies are essential for preventing potentially serious thromboembolic events; however, their presence frequently raises concerns regarding perioperative bleeding during invasive dental procedures.

Dental implant surgery presents a particular challenge because the term *implant surgery* encompasses procedures with substantially different surgical burdens. A limited single-implant placement is not equivalent to multiple implant placement, extensive flap elevation, guided bone regeneration, sinus augmentation, or full-arch rehabilitation. Consequently, evidence derived from simple dental extractions or minor oral surgery cannot automatically be extrapolated to all implant procedures (MADRID; SANZ, 2009; FATHI et al., 2025).

Historically, the presence of anticoagulant or antiplatelet therapy often led clinicians to consider temporary interruption of medication before invasive dental procedures. Although interruption may theoretically reduce bleeding, modification of antithrombotic therapy can expose susceptible patients to thromboembolic complications. The clinical question is therefore not simply whether bleeding may occur, but whether the consequences of modifying antithrombotic therapy may exceed the risk associated with bleeding that can often be controlled through local measures.

This balance is particularly important in patients receiving dual antiplatelet therapy or long-term anticoagulation. The indication and timing of therapy may reflect conditions associated with substantial thrombotic risk, including recent acute coronary syndrome, recent coronary stent placement, atrial fibrillation, venous thromboembolism, and mechanical heart valves. Therefore, a patient's apparently stable clinical condition should not be interpreted as evidence that modification of therapy is low risk.

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The introduction of direct oral anticoagulants (DOACs) has further increased the complexity of perioperative decision-making. Unlike vitamin K antagonists, DOACs have relatively predictable pharmacokinetic profiles and do not require routine INR monitoring. Nevertheless, their management depends on the specific medication, dosing schedule, renal function, bleeding risk, thromboembolic risk, and invasiveness of the planned procedure (STEFFEL et al., 2021).

Evidence from oral surgery indicates that many bleeding events associated with antithrombotic therapy can be managed using local hemostatic strategies. Careful surgical technique, direct pressure, appropriate wound closure, suturing, local hemostatic materials, and antifibrinolytic measures can reduce the clinical consequences of postoperative bleeding without necessarily requiring systemic modification of therapy (SCOTTISH DENTAL CLINICAL EFFECTIVENESS PROGRAMME, 2022; AMERICAN DENTAL ASSOCIATION, 2022).

However, evidence specifically addressing dental implant placement remains comparatively limited. The most recent implant-specific systematic review and meta-analysis identified heterogeneous observational evidence and reported an increased overall frequency of postoperative bleeding among patients receiving antithrombotic therapy, although the association was substantially attenuated in analyses restricted to studies with lower risk of bias. Importantly, the reported bleeding events were managed with local hemostatic measures, and no life-threatening bleeding events were identified (FATHI et al., 2025).

Therefore, antithrombotic management in implant dentistry should move beyond a medication-centered approach. The decision should integrate the indication for therapy, the patient's thromboembolic risk, medication-specific characteristics, renal and systemic factors, procedural complexity, and the capacity to achieve effective local hemostasis.

This narrative review aims to examine the bleeding–thrombosis dilemma in patients undergoing dental implant surgery while receiving antithrombotic therapy. Particular emphasis is placed on antiplatelet agents, vitamin K antagonists, direct oral anticoagulants, procedural complexity, local hemostasis, perioperative medication management, and practical clinical decision-making.

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2. MATERIALS AND METHODS

2.1 Study design

This study was designed as a narrative review addressing clinical decision-making for patients receiving antithrombotic therapy who undergo dental implant surgery.

The review sought to integrate heterogeneous evidence and clinical recommendations rather than estimate a pooled treatment effect. Accordingly, no formal meta-analysis or quantitative synthesis was performed by the present review, and the study was not designed as a systematic review.

2.2 Literature search

An updated literature search was conducted on September 5, 2026, using PubMed/MEDLINE and Scopus.

No publication-date restriction was imposed during the database searches, and no language restriction was applied. Three complementary search strategies were performed in each database.

The first search addressed dental implant surgery, antithrombotic therapy, and postoperative bleeding. The second addressed dental implants, antithrombotic therapy, thromboembolic risk, treatment interruption, perioperative management, and bridging. The third addressed dental implants, antithrombotic therapy, and local hemostatic strategies.

The principal PubMed/MEDLINE search retrieved 57 records. The thromboembolic-risk/interruption/bridging search retrieved 35 records, and the local-hemostasis search retrieved 24 records.

In Scopus, the corresponding searches retrieved 64, 27, and 29 documents, respectively.

Because these searches were intentionally overlapping, the results were not summed, and no total number of unique records was inferred from the individual search counts.

The complete database-specific search strategies are provided in

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Supplementary Table S1.

2.3 Eligibility and selection of evidence

Evidence was considered relevant when it addressed one or more of the following:

1. dental implant placement in patients receiving antithrombotic therapy;
2. postoperative bleeding after implant surgery;
3. anticoagulant or antiplatelet management during invasive dental procedures;
4. thromboembolic risk associated with modification of therapy;
5. perioperative management of warfarin or other vitamin K antagonists;
6. perioperative management of DOACs;
7. dual or single antiplatelet therapy;
8. bridging anticoagulation;
9. local hemostatic strategies;
10. surgical complexity and implant-related bleeding risk; or
11. professional guidelines or consensus statements relevant to these clinical decisions.

Records were not considered clinically relevant when they did not address antithrombotic therapy or bleeding/thrombotic outcomes in dental or oral surgical contexts, or when their content was unrelated to the clinical question addressed by this review.

Because this was a narrative review, selection was purposive rather than based on a formal systematic-review screening protocol. Consequently, a PRISMA flow diagram was not used and no formal record-by-record screening count was generated.

2.4 Identification and prioritization of guidelines

Professional guidelines and consensus documents were identified through the updated database searches and targeted verification of relevant professional organizations.

Particular attention was given to:

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- the Scottish Dental Clinical Effectiveness Programme (SDCEP);
- the American Dental Association (ADA);
- the Sociedade Brasileira de Cardiologia (SBC);
- the European Society of Cardiology (ESC); and
- the American College of Chest Physicians (CHEST).

Guidelines were prioritized when they directly addressed dental or perioperative antithrombotic management.

2.5 Hierarchy and interpretation of evidence

Evidence was prioritized according to clinical specificity:

1. evidence directly related to dental implant surgery;
2. dental guidelines and evidence addressing invasive dental procedures;
3. evidence from oral surgery or dentoalveolar procedures not specifically involving implants;
4. cardiovascular and perioperative guidelines used to contextualize systemic thrombotic risk and medication modification.

When evidence from extractions or general oral surgery was used to inform implant surgery, this extrapolation was explicitly acknowledged.

When different sources provided apparently discordant recommendations, preference was given to the source most directly applicable to the clinical scenario, with consideration of methodological quality, recency, and whether the recommendation represented formal guideline guidance or expert interpretation.

2.6 Evidence synthesis

The literature was narratively synthesized into the following domains:

1. antiplatelet therapy;
2. vitamin K antagonists;
3. direct oral anticoagulants;
4. procedure-related bleeding risk;
5. local hemostasis;
6. thromboembolic risk;

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7. perioperative interruption and bridging;
8. clinical complexity and concomitant medications; and
9. individualized clinical decision-making.

The strength and limitations of the evidence were considered when formulating clinical recommendations. Statements were therefore intentionally expressed with qualifiers and were not interpreted as universal or validated treatment algorithms.

3. THE BLEEDING–THROMBOSIS DILEMMA IN IMPLANT DENTISTRY

The management of patients receiving antithrombotic therapy requires simultaneous consideration of two competing clinical risks: bleeding and thrombosis.

The central issue is not whether antithrombotic therapy increases the probability of some degree of postoperative bleeding. Rather, it is whether that bleeding is clinically significant and whether it can be controlled locally without exposing the patient to an avoidable thromboembolic risk.

Recent implant-specific evidence supports this distinction. Fathi et al. (2025) found a higher overall incidence of postoperative bleeding among patients receiving antithrombotic therapy, but the magnitude of the association decreased substantially when analyses were restricted to studies with lower risk of bias. The reported events were managed with local hemostatic measures, and no life-threatening hemorrhagic events were identified.

Thus, “more bleeding” should not be equated with “unsafe surgery.” Bleeding outcomes should instead be interpreted along a clinical spectrum:

- any postoperative bleeding;
- prolonged or recurrent bleeding;
- bleeding requiring additional local intervention;
- unplanned postoperative consultation;
- bleeding requiring systemic or hospital-based intervention;
- major or clinically relevant bleeding;
- hospitalization or transfusion.

This distinction is essential because statistical increases in minor bleeding may

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not translate into meaningful increases in severe clinical outcomes.

4. ANTIPLATELET THERAPY

Antiplatelet agents are commonly prescribed for prevention of arterial thrombotic events, particularly in patients with coronary artery disease, previous myocardial infarction, ischemic stroke, or coronary stent placement. Common agents include aspirin, clopidogrel, prasugrel, and ticagrelor.

For patients receiving single antiplatelet therapy, routine interruption before dental procedures is generally not recommended. The principal rationale is that local bleeding can often be controlled, whereas interruption may increase thrombotic risk.

Greater caution is required with dual antiplatelet therapy (DAPT), particularly following recent acute coronary syndrome or coronary intervention. A systematic review and meta-analysis found higher bleeding rates in patients receiving DAPT during minor oral surgery; however, the absolute difference was small and all reported bleeding episodes were controlled with local hemostatic measures. The authors therefore did not support routine interruption of DAPT before minor oral surgery (OCKERMAN et al., 2020).

For implant surgery, the indication and timing of antiplatelet therapy should therefore be established before any medication change is considered. The implant clinician should not independently discontinue dual antiplatelet therapy in patients with recent coronary intervention or acute coronary syndrome.

5. VITAMIN K ANTAGONISTS: WARFARIN

Warfarin remains an important anticoagulant, particularly for patients with mechanical heart valves and selected other indications requiring long-term anticoagulation. Unlike DOACs, warfarin requires laboratory assessment through the international normalized ratio (INR). The INR is therefore an important component of perioperative assessment, but it should not be interpreted in isolation.

Evidence from dental procedures supports continuation of warfarin in many patients when anticoagulation is stable and appropriate local hemostatic measures

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are available. However, much of this evidence comes from dental extraction rather than implant-specific surgery and should therefore be interpreted accordingly (WELTMAN et al., 2015).

The 2024 Brazilian Society of Cardiology guideline states that dental procedures can generally be performed in patients receiving warfarin when the INR is <3.5, provided appropriate local measures are used. For patients with INR above this range or when greater bleeding risk is anticipated, the guideline recommends discussion between the dentist and the professional responsible for anticoagulation management (GUALANDRO et al., 2024).

Importantly, INR <3.5 should not be interpreted as a universal threshold for every implant procedure. Other guidelines may use different operational criteria, and INR does not replace assessment of anticoagulation stability, surgical complexity, comorbidities, or concomitant medications.

6. DIRECT ORAL ANTICOAGULANTS

Direct oral anticoagulants include dabigatran, rivaroxaban, apixaban, and edoxaban.

Their predictable pharmacokinetic characteristics and lack of routine INR monitoring simplify some aspects of management, but they do not eliminate the need for individualized assessment.

The relevant variables include:

- the specific DOAC;
- dosing schedule;
- renal function;
- age and frailty;
- concomitant medications;
- indication for anticoagulation;
- thromboembolic risk;
- procedural bleeding risk; and
- anticipated duration and extent of surgery.

The 2022 SDCEP guidance recommends no alteration of DOAC therapy for

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dental procedures considered to have low risk of bleeding complications, while higher-risk procedures may require specific dose-timing modifications according to the individual DOAC.

The evidence base remains limited. A systematic review and meta-analysis of invasive oral procedures found no clear difference in postoperative bleeding between patients who continued and those who discontinued DOAC therapy, although the evidence was limited by the small number and low quality of comparative studies (MANFREDI et al., 2019).

Similarly, a systematic review of oral surgery reported an increased postoperative bleeding risk among DOAC-treated patients compared with healthy controls, but emphasized substantial heterogeneity and limitations in the available evidence (BENSI et al., 2018).

Therefore, this review deliberately avoids providing a universal drug-specific dose-interruption schedule. When medication modification is indicated, clinicians should follow an applicable contemporary guideline rather than extrapolate a simplified schedule from this narrative review.

7. THROMBOEMBOLIC RISK AND THE TIMING OF THERAPY

The thromboembolic risk associated with medication modification depends primarily on why the patient is receiving antithrombotic therapy and when the underlying thrombotic event or intervention occurred.

Particular attention is warranted in patients with:

- recent acute coronary syndrome;
- recent coronary stent placement;
- mechanical heart valves;
- recent venous thromboembolism;
- high-risk atrial fibrillation;
- recent cerebrovascular events; or
- other conditions in which interruption may carry substantial systemic consequences.

The implant clinician should not infer that a patient has low thrombotic risk

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merely because the patient is clinically stable at the time of dental consultation. When the indication, duration, or consequences of medication interruption are unclear, interdisciplinary discussion is appropriate. However, interdisciplinary consultation should not be interpreted as a transfer of responsibility. The dentist remains responsible for assessment of the surgical and local bleeding risk, whereas the prescribing physician is responsible for evaluating the indication for antithrombotic therapy and the systemic consequences of modifying that treatment.

8. BRIDGING ANTICOAGULATION

Bridging refers to temporary substitution of a long-term anticoagulant, usually a vitamin K antagonist, with a shorter-acting parenteral anticoagulant such as low-molecular-weight heparin during an interruption period.

Bridging should not be considered an automatic consequence of interrupting warfarin.

The 2022 CHEST guideline recommends against routine heparin bridging in several common clinical scenarios, including patients with atrial fibrillation requiring VKA interruption and selected patients with mechanical heart valves or venous thromboembolism, reflecting the balance between thromboembolic protection and increased bleeding risk (DOUKETIS et al., 2022).

Accordingly, if anticoagulation must be interrupted for a complex surgical procedure, the decision regarding bridging should follow the patient's indication, thromboembolic risk, and the applicable medical guideline. It should not be initiated independently by the dental clinician.

For dental implant surgery in which antithrombotic therapy can be safely continued, bridging is generally not relevant because there is no interruption to bridge.

9. PROCEDURE-RELATED BLEEDING RISK

The term *dental implant surgery* encompasses substantially different procedures.

Limited procedures

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Examples include:

- placement of a single implant;
- limited flap elevation;
- uncomplicated implant positioning within the existing bony envelope.

Intermediate procedures

These may include:

- multiple implants;
- wider flap elevation;
- multiple surgical sites;
- more extensive soft-tissue manipulation.

Extensive procedures

These may include:

- full-arch implant rehabilitation;
- extensive flap elevation;
- guided bone regeneration;
- large bone grafts;
- sinus augmentation;
- extensive osteotomy or reconstruction.

These procedures should not be treated as equivalent.

The 2009 systematic review by Madrid and Sanz specifically noted that the evidence supporting continuation of anticoagulation during implant therapy was strongest for less extensive procedures and should not automatically be extrapolated to cases involving extensive flaps, grafting, or osteotomy beyond the bony envelope (MADRID; SANZ, 2009).

The 2025 implant-specific meta-analysis similarly highlights heterogeneity according to procedural characteristics (FATHI et al., 2025).

Therefore, surgical complexity should be incorporated explicitly into the clinical decision rather than treating “implant surgery” as a single bleeding-risk category.

10. LOCAL HEMOSTASIS AS A CENTRAL STRATEGY

Local hemostasis is central to the management of patients receiving

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antithrombotic therapy.

The goal is not necessarily to eliminate every possibility of postoperative bleeding but to ensure that bleeding can be effectively recognized and controlled. Potential strategies include:

- atraumatic surgical technique;
- careful flap management;
- direct pressure;
- meticulous suturing;
- primary closure when appropriate;
- absorbable hemostatic materials;
- fibrin-based materials;
- topical antifibrinolytic strategies such as tranexamic acid when appropriate; and
- clear postoperative instructions and access to reassessment.

The ADA identifies mechanical pressure, hemostatic materials, suturing, and antifibrinolytic strategies among measures that can be used to control dental bleeding without routinely altering antithrombotic therapy.

The Brazilian cardiovascular guideline also identifies local measures such as tranexamic acid, fibrin-based materials, and cyanoacrylates as options for dental bleeding management.

Table 1. Operational approach to local hemostasis

Stage	**Practical strategy**
Surgical technique	Minimize tissue trauma and unnecessary dissection
Wound management	Achieve adequate wound adaptation and primary closure when appropriate
Suturing	Use stable sutures appropriate to the surgical site
Local hemostatic agents	Consider absorbable materials, fibrin-based agents, or other locally appropriate products

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Antifibrinolytic measures	Consider topical tranexamic acid when indicated
Postoperative care	Provide written instructions regarding pressure, diet, activity, and signs of persistent bleeding
Reassessment	Establish criteria for return to care in cases of persistent, recurrent, or clinically significant bleeding

11. WHEN SHOULD MEDICATION MANAGEMENT BE REASSESSED?

Continuation of antithrombotic therapy should not be interpreted as permission to proceed without further assessment.

Additional evaluation is particularly appropriate when there is:

- uncertainty regarding the indication for therapy;
- recent thromboembolic disease;
- recent coronary intervention;
- dual or multiple antithrombotic therapy;
- significant renal impairment;
- liver disease;
- thrombocytopenia or other hematologic disorders;
- concomitant medications that may increase bleeding;
- unstable anticoagulation;
- extensive surgical procedures; or
- uncertainty regarding the consequences of medication modification.

Polypharmacy deserves particular attention in older adults. Concomitant medications, including additional antiplatelet agents, nonsteroidal anti-inflammatory drugs, selected antidepressants, and other agents that may influence hemostasis, should be considered as part of the overall bleeding-risk assessment rather than evaluated separately from the primary antithrombotic medication.

12. A PRACTICAL CLINICAL DECISION FRAMEWORK

Clinical decision-making can be organized around six questions:

1. *Why is the patient receiving antithrombotic therapy?*

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2. *What is the patient's thromboembolic risk if therapy is modified?*
3. *Which antithrombotic medication and regimen are being used?*
4. *What is the complexity and anticipated bleeding risk of the planned procedure?*
5. *What patient-specific and concomitant medication factors may modify bleeding risk?*
6. *Can potential bleeding be adequately controlled with local measures?*

The resulting framework is presented as a conceptual synthesis developed by the authors, not as a validated risk score or clinical algorithm.

Table 2. Author-proposed clinical decision framework based on the reviewed evidence

Clinical domain	Lower-risk situation	Situation requiring additional assessment	Evidence basis / limitation
Indication	Stable, clearly documented indication	Recent thromboembolism, coronary intervention, mechanical valve, unclear indication	Cardiovascular guidance; indication-specific risk
Antithrombotic regimen	Single documented agent	Dual therapy, multiple agents, complex regimen	Dental guidelines; evidence varies by medication
Warfarin	Stable therapeutic INR	INR >3.5, unstable or unavailable INR	Brazilian guideline supports <3.5; threshold is not universal
DOAC	Limited procedure and stable renal	Renal impairment, high-risk procedure, uncertain dosing	SDCEP/EHRA; evidence remains limited

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	function		
Antiplatelet therapy	Stable single-agent therapy	Recent coronary stent/ACS or DAPT	Dental/cardiovascular guidance
Renal function	Normal or stable	Renal impairment, especially with renally cleared drugs	Particularly relevant to DOAC pharmacokinetics
Concomitant medication	No major additional bleeding risk	Multiple antithrombotics or medications affecting hemostasis	Individualized assessment
Procedure	Single/limited implant placement	Multiple implants, extensive flap, grafting, sinus augmentation, full arch	Implant-specific evidence remains limited for extensive procedures
Local hemostasis	Effective measures readily available	Difficult-to-control surgical site or extensive wound	Supported by dental guidance and implant literature
Final plan	Continue therapy with individualized precautions	Stage, modify, postpone, or seek interdisciplinary assessment	Authors' synthesis; not a validated algorithm

Note: This framework is an author-proposed synthesis of the reviewed literature. It is not a validated clinical prediction tool and does not replace local guidelines, medical assessment, or medication-specific recommendations.

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13. EVIDENCE HIERARCHY AND CLINICAL INTERPRETATION

The available evidence differs considerably in clinical specificity and methodological strength.

Table 3. Summary of key evidence informing clinical decision-making

Source	Population/procedure	Main contribution	Principal limitation
Madrid & Sanz, 2009	Oral implant therapy in anticoagulated patients	Supports continuation in limited implant procedures with local hemostasis	Older evidence; much evidence derived from extractions
Manfredi et al., 2019	Invasive oral procedures and DOACs	No clear difference between continuation and discontinuation in available comparative studies	No randomized trials; small samples
Ockerman et al., 2020	Minor oral surgery with DAPT	Bleeding increased in some comparisons but was locally controlled	Minor oral surgery rather than implant-specific
Bensi et al., 2018	Oral surgery in DOAC-treated patients	Increased bleeding relative to healthy controls in pooled evidence	Heterogeneous procedures; limited implant-specific evidence
SDCEP, 2022	Dental patients receiving antithrombotics	Practical medication-specific dental guidance	Guidance incorporates expert judgement where evidence is limited
Gualandro et al., 2024	Perioperative cardiovascular/dental management	INR <3.5 and continuation of antithrombotic therapy	Cardiovascular guideline, not implant-specific

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		for most dental procedures	
Fathi et al., 2025	Dental implant placement	Most directly relevant contemporary evidence; bleeding generally manageable	Predominantly observational and heterogeneous
CHEST, 2022	Perioperative antithrombotic management	Bridging should not be automatic	General perioperative evidence, not implant-specific

This hierarchy is important because conclusions derived from implant-specific evidence should carry greater weight for implant surgery than evidence derived solely from dental extractions. Conversely, systemic thromboembolic risk and medication-modification decisions may appropriately require cardiovascular or hematological guidance.

DISCUSSION

The management of antithrombotic therapy in implant dentistry requires a shift from the traditional objective of preventing bleeding at all costs toward a balanced assessment of both hemorrhagic and thrombotic consequences.

The current evidence does not support routine interruption of antithrombotic therapy solely because dental implant surgery is planned. However, this conclusion should be interpreted with appropriate caution. The most directly relevant implant-specific evidence remains predominantly observational, heterogeneous, and limited for extensive procedures.

The recent systematic review and meta-analysis by Fathi et al. is particularly relevant because it directly evaluated postoperative bleeding after dental implant placement in patients receiving antithrombotic therapy. The authors identified increased bleeding in the overall analysis, but this association was substantially attenuated in analyses restricted to studies with lower risk of bias. Importantly,

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reported bleeding events were managed with local measures and no life-threatening bleeding events were identified (FATHI et al., 2025).

This finding reinforces an important distinction between incidence of bleeding and clinical severity of bleeding. A statistically higher frequency of postoperative bleeding does not necessarily mean that implant surgery is clinically unsafe. For decision-making, the consequences of the bleeding event, its ability to be controlled locally, and the systemic consequences of modifying antithrombotic therapy are more clinically informative than the mere occurrence of postoperative bleeding.

The indication for antithrombotic therapy is equally important. A patient receiving therapy after recent coronary intervention or acute coronary syndrome may face substantially greater consequences from premature interruption than a patient whose thrombotic risk is lower. Therefore, medication name alone cannot define the clinical decision.

Procedural complexity is another decisive factor. A single implant placed through a limited surgical approach should not be regarded as equivalent to multiple implants, extensive flap elevation, bone augmentation, sinus augmentation, or full-arch surgery. Evidence from earlier implant-specific literature already emphasized this limitation, and more recent evidence has not eliminated the uncertainty surrounding extensive procedures (MADRID; SANZ, 2009; FATHI et al., 2025).

The management of DOACs requires additional caution. Their predictable pharmacokinetics and lack of routine INR monitoring do not imply that all DOACs should be managed identically. Renal function, dosing schedule, indication, timing of the last dose, and procedural bleeding risk remain relevant. SDCEP provides a practical framework distinguishing lower- and higher-risk dental procedures, while broader cardiovascular guidance should be consulted when systemic medication modification is being considered.

The issue of bridging deserves particular emphasis. Historically, bridging anticoagulation was often considered whenever warfarin was interrupted. Contemporary perioperative guidance, however, has moved away from routine bridging in several clinical scenarios because the reduction in thromboembolic risk may not justify the additional bleeding burden. The decision should therefore be

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based on the indication for anticoagulation and individualized thromboembolic risk rather than on interruption alone (DOUKETIS et al., 2022).

Local hemostasis remains the practical foundation of dental management. The evidence and professional guidance consistently support the use of careful surgical technique, compression, suturing, local hemostatic materials, and selected antifibrinolytic measures.

Importantly, interdisciplinary consultation should not be understood as a request for a generic “medical clearance.” The dentist retains responsibility for determining the bleeding risk and surgical feasibility of the planned dental procedure. The prescribing physician contributes expertise regarding the indication for antithrombotic therapy and the consequences of medication modification. The most appropriate decision emerges from integration of these perspectives.

The framework proposed in this review should therefore be interpreted as a structured clinical synthesis rather than a validated decision algorithm. It is intended to organize relevant variables and reduce simplistic medication-centered decision-making, not to replace medication-specific guidelines or individualized clinical assessment.

15. LIMITATIONS OF THIS REVIEW

This review has several limitations.

First, it was designed as a narrative review rather than a systematic review. Although an updated and structured search was performed in PubMed/MEDLINE and Scopus, the searches were intentionally complementary and overlapping, and no formal PRISMA-based screening process was undertaken.

Second, the purposive nature of narrative selection introduces the possibility of selection bias, including preferential identification of highly relevant or influential sources and the potential omission of studies not captured by the selected search strategies.

Third, the evidence base itself is heterogeneous. Implant-specific studies differ in antithrombotic regimens, surgical procedures, definitions of postoperative bleeding, follow-up periods, and hemostatic protocols.

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Fourth, some recommendations relevant to implant surgery necessarily rely on evidence derived from extractions or other oral surgical procedures. Such extrapolation was explicitly recognized in the present review but remains an important limitation.

Finally, evidence remains limited for extensive implant procedures, complex bone augmentation, patients receiving multiple antithrombotic agents, and specific high-risk systemic conditions. The framework proposed here should therefore be considered a conceptual aid rather than a validated prediction instrument

5. CONCLUSION

Dental implant surgery may often be performed without routine interruption of antithrombotic therapy when an individualized assessment of thromboembolic and bleeding risk is undertaken and appropriate local hemostatic measures are available.

The decision should not be determined solely by the medication name. Indication for therapy, timing of recent thrombotic events or interventions, medication characteristics, renal function, concomitant medications, procedural complexity, and the capacity for local hemostatic control should all be considered.

For warfarin-treated patients, an INR <3.5 is supported for most dental procedures by the 2024 Brazilian cardiovascular guideline, but this value should not be interpreted as a universal threshold for every implant procedure. For DOACs, medication-specific guidance should be followed rather than applying a single interruption strategy. Bridging should not be considered an automatic consequence of anticoagulant interruption.

Most importantly, evidence of increased postoperative bleeding should not be equated with evidence that implant surgery is unsafe. The available implant-specific literature remains predominantly observational and heterogeneous, and certainty is particularly limited for extensive procedures and selected high-risk subgroups.

The safest approach is therefore not a universal policy of continuation or interruption, but individualized clinical decision-making based on the balance between thromboembolic risk, bleeding risk, medication characteristics, surgical

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complexity, and effective local hemostatic control.

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