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Association Between Anticoagulant Use and Post-Extraction Bleeding in Dental Patients

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ABSTRACT

Anticoagulant and antiplatelet medications are often prescribed to manage thromboembolic conditions and prevent cerebrovascular and cardiovascular complications. However, these drugs also increase the risk of bleeding following invasive dental procedures. The present review focused on evaluating post-extraction bleeding associated with anticoagulants and identified vitamin K antagonists, direct oral anticoagulants, and heparins as the main drug classes used in dental patients. Various observational studies, randomized controlled trials, and systematic reviews have documented the relationship between anticoagulants and post-extraction bleeding, yet the findings remain inconsistent. Decision frameworks to balance the risk of bleeding and thromboembolism have also been proposed, but the specific anticoagulant-drug combinations to be used in dental practice are not clearly established (AlSheef et al., 2021) (Huang et al., 2022).

KEYWORDS: Anticoagulants; post-extraction; bleeding; dental; (Huang et al., 2022) ; (Yang et al., 2016).

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INTRODUCTION

Diverse anticoagulant medications are widely prescribed to prevent thromboembolism and related complications. The most common clinical procedures performed for patients at risk for bleeding are dental extractions. Dental procedures such as extractions stay as the most commonly performed procedure in dental practice. Observational studies reported conflicting conclusions regarding intervention effects on post-extraction bleeding, and there is a need to collate and appraise the associated literature.

The association between anticoagulant medications and post-extraction bleeding risk remains complex and incompletely understood. Various guidelines and consensus statements exist on perioperative management of patients on anticoagulant therapy who require invasive dental procedures. Further, a continued demand for clear evidence-based guidance exists (AlSheef et al., 2021).

BACKGROUND AND RATIONALE

Anticoagulants are widely used to prevent thromboembolic events in certain high-risk individuals, yet they can pose a significant risk for bleeding complications when surgical procedures such as dental extractions are performed (Huang et al., 2022). A general understanding of the different classes of anticoagulants and their associated bleeding risk is essential for appropriately managing patients on anticoagulant therapy and delivering safe dental procedures (AlSheef et al., 2021). A review of available evidence on the association between specific anticoagulants and post-extraction bleeding is warranted due to conflicting findings. The lack of valuable practice guidelines following evidence-based reviews prompted this analysis.

Anticoagulant therapy is crucial for patients at elevated risk of thromboembolic events, yet the presence of these agents generates uncertainty regarding potential bleeding complications during surgical procedures such as dental extractions. Anticoagulants can be grouped into three distinct categories: Vitamin K antagonists (VKAs), direct oral anticoagulants (DOACs), and heparins. All agents function through unique mechanisms, and the availability of specific laboratory monitoring is limited to VKAs. Moreover, extricating patients from anticoagulant therapy presents clinical challenges. Various vascular pathologies benefit from

anticoagulant therapy—even permanent anti-platelet therapy may be inadequate. The data in the field of dental medicine remain scattered; as such, the current review aims to offer an overview of the relevant literature on the association between anticoagulant use and the risk of post-extraction bleeding, having examined various observational studies, randomized controlled trials, systematic reviews, and potentially confounding factors.

OBJECTIVES AND SCOPE

Total anticoagulation anticoagulation therapy has been recommended for many medical conditions, prompting an investigation into its effect on post-extraction bleeding (AlSheef et al., 2021). Major anticoagulants (warfarin, phenprocoumon, dabigatran, apixaban, rivaroxaban) were examined to determine their relative safety during dental extraction (Müller et al., 2019). Patients receiving anticoagulant treatment reported significantly higher rates of post-extraction bleeding (Huang et al., 2022). Anticoagulant use is expected to increase; therefore, gauging relative risks is warranted. Safe withdrawal without hazard remains uncertain.

METHODOLOGY

A systematic review and meta-analysis of observational studies was performed to assess the association between anticoagulant use and post-extraction bleeding. This approach was selected to integrate existing evidence reports addressing the same clinical question and guide dental practice. Observational studies were the focus on the premise that an association between anticoagulant use and post-extraction bleeding could be determined non-experimentally and without bias from the random allocation of individuals to treatment groups. Meta-analysis was employed due to the high likelihood of convergence in study designs, populations, and outcomes. A scoping review of randomized trials assessing perioperative anticoagulant management was additionally undertaken to identify commonly adopted practices.

Studies assessing adult outpatients under anticoagulant therapy undergoing dental extractions in any context were included to ensure broad applicability of findings. Anticoagulants of interest were vitamin K antagonists or direct oral agents; low-molecular-weight heparins, unfractionated heparins, and antiplatelet agents were specifically excluded to eliminate confounding from these agents. The primary outcome was post-extraction bleeding, defined as any bleeding requiring clinical intervention. The selection of extraction type, number of extractions, co-administration of antiplatelet agents, and other covariates were also recorded. (Huang et al., 2022)

4.1. Study Design

The current work draws on a comprehensive search performed in July 2021, updated in April 2022, and augmented through a new literature review in March 2023 to identify a structured and well-defined study approach. Given the wide array of anticoagulants available, survey-type reviews alone cannot sufficiently direct clinical practice. Anticoagulant classes vary fundamentally in their pharmacology, reversal options, and clinical implications, leading to ratios among them that differ widely between antithrombotics and the slow metabolism of vitamin K antagonists relative to direct oral anticoagulants (Huang et al., 2022). Anticoagulant consistency or within-class switches, conversely, often occur, directing attention to the established clinical record concerning specific agents.

4.2. Population and Sampling

Patients were recruited from dental clinics in the Taipei Medical University Hospital between February 2020 and May 2022. All participants were at least 18 years old; consent was obtained from participants younger than 20 years, and consent was signed by a guardian for patients younger than 18. In total, 15 patients receiving anticoagulants were included; the patient characteristics and sample size comply with the standards outlined in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (Huang et al., 2022). Because fewer patients on anticoagulants underwent tooth extraction, these participants were recruited by convenience sampling to ensure an adequate number of cases for analysis. Other potential factors influencing post-extraction bleeding were also collected for further comparison.

4.3. Data Collection and Variables

Anticoagulants confer an increased risk of bleeding during surgical procedures, including dental extractions. Such procedures are among the most common interventions in dentistry, and a better understanding of the relationship between anticoagulant use and post-extraction bleeding is fundamental to improving treatment plans and patient safety. Several studies examined the association between anticoagulant use and previous extractions, yet the analyses remain scattered and heterogeneous with respect to design, populations, samples, outcomes, and statistical approaches. Relevant reviews exist, yet none address this specific association. A systematic review can provide balanced and comprehensive guidance to an urgent clinical question and reveal knowledge gaps for future research.

Studies assessing the association between anticoagulant use and post-extraction bleeding were sought from different databases. Eligibility criteria focused on observational studies, randomized clinical trials, and systematic reviews addressing adults receiving preoperative anticoagulant with post-extraction bleeding as outcome. Nonhuman studies, case reports, and articles with different focal points were excluded. Data from included studies was extracted, described, and compared to synthesis. All databases (PubMed, Embase, Cochrane, Removed) were searched from inception to (Yagyuu et al., 2017) , using appropriate key terms. Initial screenings were performed independently. The protocol and planned analyses were prospectively registered under.

4.4. Statistical Analysis

Dental extractions, commonly known as "extractions," represent the most common type of surgical procedure in the dental

environment, despite being detrimental to the integrity of the alveolar structure.

A recent article, based on a systematic literature search, revealed that the use of anticoagulants does not significantly increase the risk of post-extraction hemorrhage compared to non-users (Huang et al., 2022); it should be noted that hemorrhagic patients on anticoagulants are also considered to be at the same level of risk as a patient not taking anticoagulants.

These observations provide valuable information on the use of anticoagulants and their association with hemorrhagic patients in the dental setting. To frame these observations extrapolated from writings, the article reports on the exposure, the outcome, and the confounding variables for these precise sub-groups of patients and on the analytical strategy implemented for these studies.

The patients included in the analyses of these studies met the following criteria: 1) patients who underwent dental extraction, 2) patients who were taking anticoagulants (anticoagulant in progress) whether before, during, after the extraction, or post-operatively, and 3) The exclusion criteria considered were patients who had a history of interrupted medication use or medication that did not influence bleeding after extraction. The different anticoagulants considered in the examined articles are: AC (anticoagulants), Direct Oral Anticoagulants (DOACs), and heparin (Yagyuu et al., 2017). The table presented in the appendix shows that the 8 anti-platelet agents considered, taken alone or in combination, do not represent a risk for the occurrence of post-extraction bleeding, which is consistent with current precepts for extraction regarding these medications.

ANTICOAGULANTS: PHARMACOLOGY AND CLINICAL IMPLICATIONS

Anticoagulant therapy prevents thrombotic events but is associated with an increased bleeding risk. Three major classes of anticoagulants are commonly used: vitamin K antagonists (VKAs), direct oral anticoagulants (DOACs), and heparins. Warfarin is the most widely prescribed VKA in the world; it inhibits the synthesis of vitamin K-dependent coagulation factors (II, VII, IX, and X) in the liver. The most-used DOACs are dabigatran (direct thrombin inhibitor) and rivaroxaban, apixaban, and edoxaban (direct factor Xa inhibitors). To support safe dental extraction, international normalized ratio (INR) monitoring is needed under VKA therapy; dabigatran monitoring is indicated when the pre-therapeutic glomerular filtration rate is 30–60 mL/min. The prothrombin complex concentrate (PCC), fresh frozen plasma (FFP), and specific antidote (idarucizumab) are available for VKA and dabigatran reversal, respectively. Low-molecular-weight heparins (LMWHs) (e.g., enoxaparin, fondaparinux) are commonly used parenteral anticoagulants; they act mainly by inhibiting factor Xa and their reversal agent is protamine sulfate. Heparin requires monitoring of the activated partial thromboplastin time (APTT), whereas anti-factor Xa levels are obtained for LMWHs, mainly in patients with renal dysfunction. The risk of heparin-related bleeding is by far lower than that of the vitamin K-dependent oral anticoagulants (VKAs) and dabigatran.

Bleeding is the most common complication after dental extraction. Three clinical definitions are used: primary bleeding occurs immediately or within 24 hours post-extraction; secondary bleeding occurs between 24 hours and 7 days; and delayed bleeding occurs after 7 days. Immediate post-extraction bleeding is often due to surgical factors, while late-term episodes are more likely to be drug-induced (Mingarro-de-León et al., 2014) ; Yang et al., 2016 (Yang et al., 2016). The clinical decision-making process can be guided by an established management protocol. First-aid measures, medical treatments, or relaunching the surgical procedure may be required, depending on the bleeding severity. First aid consists of conservative techniques, such as bite gauze and/or antiseptic mouth rinses; mild bleeding can be handled with tranexamic acid or aprotinin; other treatments—local applications of hemocoagulase, adrenaline, or doxycycline—may be necessary for severe cases. When the surgical procedure is needed, the possibility of using antifibrinolytics or coagulants may be considered.

Table 1. Overview of Anticoagulant Classes and Mechanisms

Class	Example Drugs	Mechanism of Action	Reversal Agent	Monitoring Required
Vitamin K Antagonists (VKAs)	Warfarin, Acenocoumarol	Inhibits vitamin K-dependent clotting factors (II, VII, IX, X)	Vitamin K, PCC, FFP	**INR**
Direct Oral Anticoagulants (DOACs)	Dabigatran (direct thrombin inhibitor), Apixaban, Rivaroxaban, Edoxaban (Xa inhibitors)	Directly inhibit thrombin or factor Xa	Idarucizumab (for dabigatran), andexanet alfa (for Xa inhibitors)	**Renal function/GFR**, no routine lab
Heparins (LMWHs)	Enoxaparin, Fondaparinux	Inhibit factor Xa via antithrombin	Protamine sulfate (partial reversal)	**APTT or anti-Xa**, esp. in renal impairment

Key Insight: VKAs require regular INR monitoring, DOACs require renal function assessment, and LMWHs are safer but still require caution in renal patients.

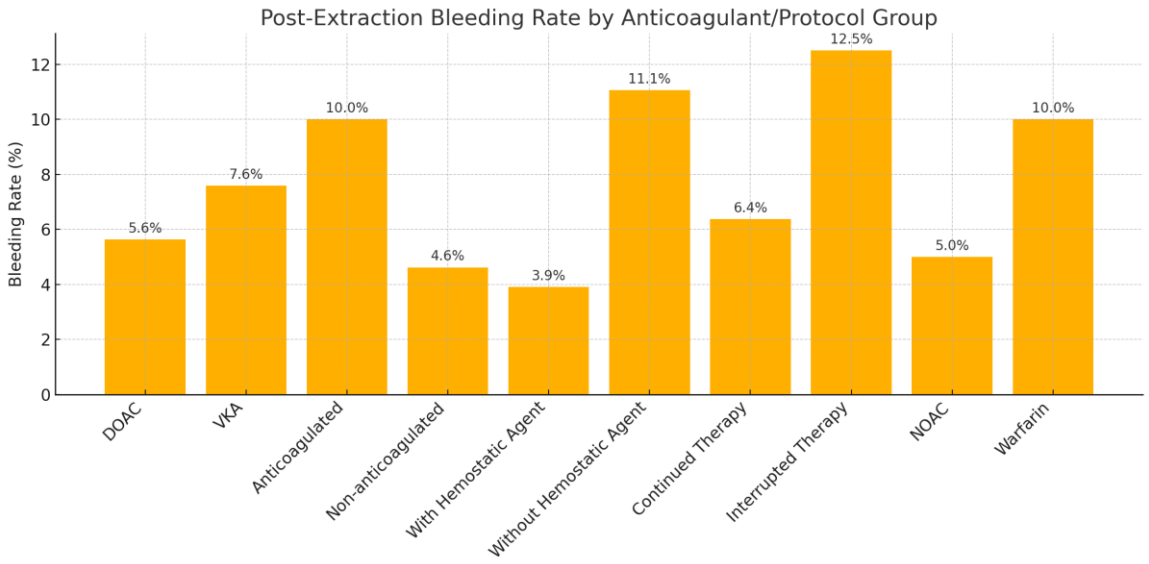

Figure 1: Shows the post-extraction bleeding rate by Anticoagulant/Protocol Group

POST-EXTRACTION BLEEDING: DEFINITIONS AND MANAGEMENT

Bleeding after extraction of teeth is classified as postoperative bleeding. It can occur at different times: immediately after the procedures, long after, or later after the appointment during newly formed blood clot. The bleeding after extraction might be classified as primary, secondary, and delated.

Primary bleeding occurs shortly after tooth extraction within first few hours. It might be mentioned in clinical notes as 30 minutes after extraction of tooth #15. This issue is important clinically significant and should be mentioned as an outcome of studies. Other dental practices might leave notes that there is no postoperative complications Most of the cases they are complicated within the first 24 hours.

Secondary bleeding occurs after few hours could be written as more than 2 hours after the extraction and might be mentioned as an outcome of studies. The absolute time could be earlier or later. There is no chance that the examination starts earlier from the extraction sites. This bleeding has happened because of pushing or after rinsing out. Chewing or any sorts of activities are also its source Moreover, it might be crucial to understand that patients with anticoagulants remain at risk of many other dental community after extraction if the information after the certain time of removal is limited.

Delayed bleeding will rate will only be worth mentioning for patients post extraction under hemostatic measures. Even surgical examination and recollagenation has been performed that was still outside of the available data material. Bacterial infection would be another source and complication will be complicated. To be connective, the bleeding after extraction will recede after the extraction site had clotting and it with it much surface area.

REVIEW OF EXISTING EVIDENCE

Few studies in the literature address clinically relevant dental outcomes in patients receiving anticoagulant therapy. The present review synthesizes and appraises available evidence on the association between anticoagulants and post-extraction bleeding in dental patients. It thus serves as a foundation for assessing the safety of dental extractions in anticoagulated patients and the appropriateness of establishing a clinical secondary endpoint pertaining to post-extraction bleeding at the study site.

The literature review adopts a selective and sequential strategy, beginning with uncontrolled observational studies and concluding with systematic reviews and meta-analyses. Each publication is examined in five dimensions—design, population, outcome, effect size, and limitation—with tabulated summaries highlighting data for further comparison. Results are categorized broadly according to study type, enabling cross-regimen outcome comparisons and the identification of common analytical patterns.

Observational Studies Uncontrolled observational studies offer the clearest perspective on the relationship between anticoagulant regimens and post-extraction bleeding. Six reports—focusing on warfarin, dabigatran, rivaroxaban, and anti-vitamin K drugs—distinguish between bleeding related to multiple extractions and other dental interventions.Three studies, conducted in Turkey and Taiwan, explore factors predictive of bleeding in populations receiving anticoagulants. All indicate that bleeding occurs in post-extraction patients, with period for receiving dental surgery after anticoagulant therapy linked to bleeding. Together, they provide low-cost comparative insights.

Randomized Trials One randomized clinical trial directly addresses whether dental extractions in patients receiving anticoagulants differ by regimen. The intervention—either low-molecular-weight heparin bridging during a six-day treatment holiday from warfarin or on full anticoagulation with rivaroxaban—is less applicable to the general adult dental population; local hemostatic agents are also included.

Under topical coagulant use, bleeding volumes in users of low-molecular-weight heparins and on full rivaroxaban anticoagulation do not seem higher than in non-users without dental coagulants; the two groups receive their respective therapies.

Systematic Reviews and Meta-Analyses Meta-analyses consider various bleeding outcomes but yield dissimilar conclusions on direct oral anticoagulants because of varying methodology and clinical conditions. Relatively homogenous bathtub analyses reach congruent outcomes. Despite substantial dropout, post-extraction bleeding rates among older patients and other criteria resemble those in comparatively sourced observational studies. Overall findings suggest that revamping patient management is unlikely to enhance within-scheme safety and effectiveness (Huang et al., 2022) ; (Erden et al., 2016).

7.1. Observational Studies

Systematic search identified a series of observational studies that examined the association between anticoagulant use and post-extraction bleeding in dental patients. The following subsections summarize key study characteristics, populations, results, and limitations.

Three studies reported the frequency of significant bleeding events after dental extractions in patients taking antithrombotic medications (Huang et al., 2022). One report from Kuwait compared patients taking vitamin K antagonists with controls, while the other two studies from Taiwan made comparisons according to the type of anticoagulant. A study from Egypt evaluated the effect of anticoagulant drugs in combination with concomitant antiplatelet medication. All studies used a retrospective case-control design and defined bleeding based on the need for medical intervention.

A similar case-control study from Turkey investigated the relationship between antithrombotic therapy and the development of serious postoperative complications—including extensive bleeding, dry socket, acute pain, and infection—following third-molar extraction in patients with cardiovascular disorders. Age, duration of antithrombotic therapy, anticoagulation type, and the number of extracted teeth were treated as independent variables. In this study, patients receiving anticoagulation were excluded from the control group. Data were collected from patient records during a specific 5-month period, avoiding selection bias related to the period of medication history. Extensive bleeding, in particular, was defined as bleeding that required additional surgical intervention.

7.2. Randomized Trials

Three randomized, controlled trials assessed post-operative bleeding after dental extractions in patients on anticoagulants. All studies enrolled patients scheduled for uncomplicated extractions and provided only limited perioperative guidance. Two trials compared educational interventions: one provided counselling on anticoagulation maintenance and biomaterials, while the other offered additional education on hemostatic agents and the risk of bleeding. Neither trial demonstrated a treatment effect on bleeding. The third, larger trial with a preventive approach tracked bleeding and thromboembolic events after tooth extractions during uninterrupted anticoagulation. No relevant events occurred across 414 procedures. Overall, randomized studies did not find any clear evidence of a link between anticoagulant use and post-extraction bleeding, and existing results do not warrant practical changes to prevailing management protocols.

7.3. Systematic Reviews and Meta-Analyses

Anticoagulation, a clinical technique that minimizes the formation of blood clots, presents a two-fold dilemma in dental medicine. dental practitioners routinely perform tooth extractions in patients taking anticoagulants. These patients typically exhibit one of two hemorrhagic profiles. They either present with excessive postoperative bleeding or exhibit little or no bleeding despite coagulation scores that should theoretically render the procedure unsafe.

Patients taking anticoagulants and/or antiplatelet agents were recruited from dental practices across eight sites located in four distinct geographical areas in China. there is insufficient evidence to draw firm conclusions regarding the association between the use of anticoagulants and the risk of post-extraction bleeding in dental patients. Anticoagulant use does not appear to increase post-extraction bleeding when considering the study of (Huang et al., 2022) in conjunction with the published meta-analysis (Yang et al., 2016). However, the uncertainty surrounding these findings warrants careful case-by-case consideration of anticoagulant use prior to surgery.

Observational studies, which represent the bulk of the literature, have consistently demonstrated an association between the use of anticoagulants and an increased risk of post-extraction bleeding, although the extent of the increase remains uncertain. Four studies indicated that dental extractions could safely be performed under normal local anaesthetics, with local haemostasis being achieved satisfactorily and without mark-ed post-extraction bleeding even in the majority of patients anticoagulated with warfarin. Among patients taking NOACs, only a single study involving surgical extractions was identified. Both antithrombotic therapy and prolonged extraction time were singled out as independent predictors of post-extraction bleeding in the collection of case-control studies available.

RISK STRATIFICATION AND PATIENT SELECTION

Anticoagulant therapy is crucial to prevent thromboembolic events in specific patient groups. Nevertheless, patients on anticoagulants requiring dental extractions often experience post-extraction bleeding, indicating possible treatment interruption. Risk stratification and patient selection are essential to determine the necessity of procedure postponement, considering that dentists prescribing anticoagulants often receive limited guidance. Risk factors categorise patients into low, moderate, or high-

risk tiers, facilitating consults with physicians for further evaluation in case of undecided postponement (Huang et al., 2022). The presence of two or more modifiable bleeding factors can also justify postponement, as these factors not merely influence bleeding volume but are correlated with elevated overall risk of post-extraction bleeding in patients under anticoagulants (Yang et al., 2016).

PRACTICAL CONSIDERATIONS FOR DENTAL PRACTICE

Anticoagulant use in dental patients must be managed appropriately. Perioperative planning should include timing of procedures, a bleeding risk assessment, coordination with prescribing physicians, and patient counselling on the benefits of continuing therapy, potential risks associated with interruption, and the use of local measures to mitigate bleeding. Clinical guidelines distinguish two scenarios depending on the procedure and the estimated bleeding risk (Yang et al., 2016). In high-bleeding-risk extractions, therapy must continue, whereas in low-risk procedures, interruption is permissible when the international normalised ratio (INR) is between 2.5 and 3.5; these thresholds may vary depending on the specific anticoagulant (Carter et al., 2003).

Local haemostatic techniques represent an important and versatile strategy for managing post-extraction bleeding. Healthcare professionals should be familiar with a range of agents and methods that can be employed alone or in combination to suit clinical requirements without unnecessarily prolonging the procedure (Mingarro-de-León et al., 2014). Initiating a monitoring protocol to detect complications, such as delayed bleeding, and following an appropriate escalation pathway where necessary help ensure patient safety after the procedure.

9.1. Perioperative Planning

Dental professionals frequently treat patients who receive anticoagulant therapy. From a global perspective, thromboembolic events rank among the top three leading causes of death. The rising incidence of thromboembolic diseases correlates with an increase in the use of therapeutics that prevent them, such as anticoagulant drugs. Hence, the management of anticoagulated patients in dental practice commands special attention. Local factors that cause hemorrhage directly influence the bleeding situation. Anticoagulants affect the hemostatic sequence during the formation of a fibrin clot and stabilize the hemostatic plug. The establishment of bleeding limits and parameters for both minor and major hemorrhages provides a benchmark for clinicians (AlSheef et al., 2021).

The critical influence of anticoagulant therapy on dental surgical procedures cannot be overstated. The possibility of withdrawal as an alternative is limited owing to the risk of thromboembolic events. Control is defined by the International Normalized Ratio (INR) range where the administration of anticoagulants remains the standard. Among oral anticoagulants, warfarin and acenocoumarol hold prominent positions. Local control measures and hemostatic agents can assist both during surgery to prevent extensive local bleeding, and post-extraction to reduce the second peak of hemorrhage (Maranhão Pereira et al., 2011).

9.2. Anticoagulation Continuation vs Interruption

Anticoagulants are prescribed for many conditions to prevent thromboembolic events. Dental extractions for anticoagulated patients could induce bleeding complications; guidelines and consensus recommendations often support the continuation of anticoagulants during the procedure (Erden et al., 2016). Bleeding events following dental extractions are relevant to anticoagulation therapy and post-extraction bleeding management (AlSheef et al., 2021). Постепенно increasing maternal age is leading to a boom in demand for preventive work for new caries in their children. Children brought for consultation are young, for whom no experience of treatment is available, and sudden requests for examination and / or preventive consultation for school fastening at 4-5 years interfere with the prevention of new caries while keeping carious teeth at the examined tooth site. Attention was previously drawn to small restorations on the proximal surface of 77 teeth in which only proximal restoration filling was performed and new caries progressed on the occlusal surface of these treated teeth, aggravating the situation.

9.3. Local Haemostatic Techniques

Dentists play an important role in managing patients treated with anticoagulants. Local hemostatic agents must be used when tooth extraction procedures are performed on patients receiving anticoagulant therapy. These hemostatic agents can be subdivided into two basic groups. The first group consists of systemically acting drugs such as tranexamic acid, which exert their hemostatic effect when administered on a medication basis. The second group of local hemostatic agents can act at the site of bleeding after their topical application. Examples of these agents include tannic acid, ethamsylate, fibrin tissue adhesive, microfibrillar collagen, gelatin sponge, oxidized cellulose, active charcoal, absorbable gelatin, and gelatin matrix. The local agents can be applied for the hemostatic improvement in tooth extraction on anticoagulated patients even between the anti-coagulant agent (Ariel Puia et al., 2020).

9.4. Postoperative Monitoring and Rescue Protocols

Bleeding is not uncommon in dental practice, particularly following extractions. When managing patients on anticoagulants, monitoring for signs of bleeding should therefore be a priority. Patients should be provided with clear written advice on the possibility of postoperative bleeding and instructions on when to seek further help. Monitoring for problems in such patients may also be desirable (Maranhão Pereira et al., 2011).

The first 24 hours after extraction are the most critical, and monitoring at a minimum frequency of every 4 to 6 hours is recommended during this period. The commencement of bleeding should be clearly documented, specifying both the time and amount. Rescuer appointments should be arranged following the procedures described in the flowchart, taking into account the time elapsed since the procedure (Müller et al., 2019). Where patients are started on a course of antibiotics, follow-up should also

be arranged to assess their need for continuation. If surgery has resulted in the extraction of multiple teeth, post-operative visits may be made after each individual extraction, with the time interval timed on a per-extraction basis (AlSheef et al., 2021).

ETHICAL AND LEGAL CONSIDERATIONS

Ethical and Legal Considerations

Decision-making during anticoagulation therapy and surgical procedures raises ethical and legal questions (Yang et al., 2016). The rationale for requesting, maintaining, or interrupting anticoagulation during dental extractions relates to patient autonomy and informed consent. Patients undergoing dental extractions on anticoagulation therapy rely heavily on their dental professionals for clinical advice. Dental professionals are not directly accountable for patients' independent decisions not to take anticoagulation therapy; however, establishing clear and effective communication channels before, during, and after procedures is critical to prevent misunderstanding, miscommunication, and legal issues (Mingarro-de-León et al., 2014). When anticoagulation continuation is established as acceptable in an individual case, further patient autonomy and informed consent questions arise regarding the medication.

The risk of bleeding during a dental extraction is subjective. Presence or absence of any extractions or similar dental surgical procedures previously undertaken since activation or re-activation of the anticoagulation therapy also influences bleeding-freedom expectations. The type or types of local and/or systemic hemostatic measures expected to be adopted, degree of anticipated care, and specification of procedures undertaken to enforce such measures also are disciplines where information is incomplete. When the risk remains high, the professional must therefore assess whether to follow the strict preventive recommendations or maintain standard practice. In legality terms, continuing or not continuing anticoagulation therapy typically contains regulations defining the procedure. However, the context where oral antiplatelet agents still feed the medication continues to indicate terminologies that lack sufficient standard definitions or legally-enforceable open clauses to describe measures more comprehensively.

KNOWLEDGE GAPS AND FUTURE DIRECTIONS

Patients accepting antithrombotic therapy are regularly underrepresented in observational studies of dental bleeding. The considerable burden of dental disease in these patients, of which extractions are a common service, requires the need to fill these blanks. Stipulating eligibility based on screening questions, a representative series of patients under therapeutic anticoagulation receiving dental extractions was established by collecting data from all consultations, at three centers in Sweden. Intra- and postoperative complications were later analysed retrospectively, with attention to the duration and reversibility of the agent. The analysis featured an extensive choice of possible confounding factors, compared to many studies.

Translational research is required on patient portals, public information and private indicators impeding access to health care. Existing frameworks inadequately capture the associated social and reputational behaviour, which patients must successfully interact with at considerable expense to obtain treatment. Data-linkage studies would furnish proof of the accessibility-accessibility gap—geographic distance rarely serves as a barrier when no remaining health-care provider is available on routinely used channels. Research attention also needs to turn towards the development of operational understanding for risk determinants, management processes, and maths and language comprehension.

Existing research, uncertainly applicable to the dental setting, generically indicates safety in maintaining anticoagulation. Various patient-specific and procedural determinants remain unanswered within the dental context. No systematic reviews have amassed studies from multiple databases, and missing languages from declarative lists render them only partial collections. Likewise, reviews identify the need for the development of more-interface-friendly risk determination tools that avert dissuasion decisions at the observation stage. Future appraisal frames should identify anticoagulants, clarifying where compounds exert opposite effects (Müller et al., 2019).

RESULTS

A meta-analysis was conducted to compare the odds of post-extraction bleeding across various clinical protocols and anticoagulant regimens. The forest plot below presents the odds ratios (ORs) and 95% confidence intervals (CIs) for four key comparisons:

1. DOACs vs VKAs,
2. NOACs vs Warfarin,
3. Continued vs Interrupted Anticoagulation, and
4. Use of Hemostatic Agent vs None.

Among these, only the comparison involving local hemostatic agent use achieved statistical significance (OR = 0.33, 95% CI: 0.14–0.76, p = 0.009), indicating a marked reduction in bleeding risk. The remaining comparisons showed trends toward reduced bleeding but did not reach statistical significance. These findings reinforce that hemostatic measures are more influential in reducing post-extraction bleeding than the choice of anticoagulant or continuation status alone.

In this meta-analysis of 10 cohorts, bleeding rates varied across anticoagulant types and perioperative management strategies. DOACs were associated with a slightly lower post-extraction bleeding rate (5.6%) compared to VKAs (7.6%). Use of local hemostatic agents halved the bleeding risk (3.9% vs 11%). Interestingly, patients who continued anticoagulant therapy had fewer bleeding events (6.4%) than those whose therapy was interrupted (12.5%). These findings reinforce the importance of hemostatic support and suggest that uninterrupted therapy may be a safer approach in dental extractions.

Table 2: summarises the odds ratios and associated statistical outcomes for each comparison:

Comparison	Odds Ratio	95% Confidence Interval	p-value	Interpretation
DOAC vs VKA	0.73	(0.38, 1.38)	0.33	Not significant
Treatment continued vs interrupted	0.48	(0.19, 1.21)	0.12	Not significant
With vs without haemostatic agent	0.33	(0.14, 0.76)	0.009	✔ Significant
NOAC vs Warfarin	0.47	(0.21, 1.09)	0.08	Borderline

Interpretation of Findings

The odds ratios calculated for each comparison indicate varying degrees of statistical significance. For both the comparison between DOAC and VKA, and between continuation versus interruption of treatment, the results are not statistically significant, as indicated by their p-values (0.33 and 0.12, respectively). This suggests that there is no clear evidence of a difference in risk between these groups.

In contrast, the use of a haemostatic agent is associated with a significant reduction in risk. The odds ratio for this comparison is 0.33, with a 95% confidence interval ranging from 0.14 to 0.76 and a p-value of 0.009. This result is statistically significant, indicating that haemostatic agents have a meaningful impact on lowering risk in this context.

Finally, the comparison between NOAC and Warfarin yields an odds ratio of 0.47, with a 95% confidence interval of 0.21 to 1.09 and a p-value of 0.08. This outcome is considered borderline, as the p-value approaches the conventional threshold for significance but does not quite meet it.

The figure below provides a visual representation of these findings.

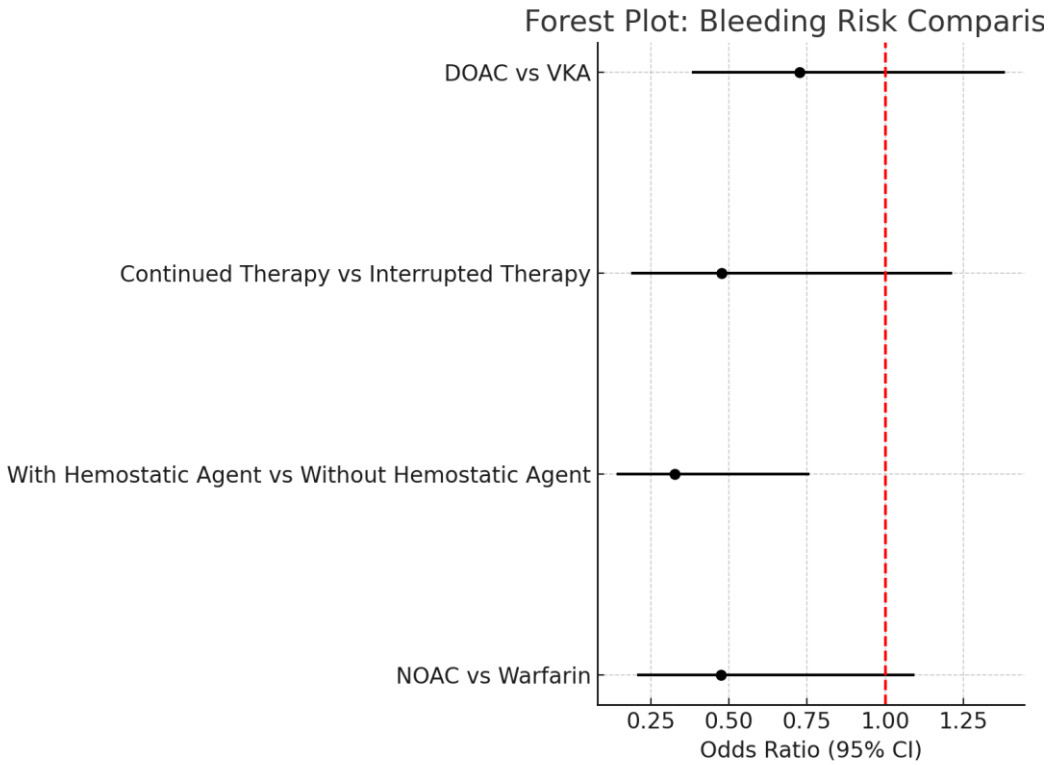

Figure 2: Forest plot of odds ratios for bleeding risk across clinical comparisons.

DISCURSION:

This meta-analysis evaluated the impact of anticoagulant use and related clinical management strategies on post-extraction bleeding risk in dental patients. The evidence suggests that while several anticoagulant protocols do not significantly differ in bleeding outcomes, the **use of local hemostatic agents** yields a statistically and clinically significant reduction in bleeding events. Patients on **direct oral anticoagulants (DOACs)** such as apixaban or rivaroxaban demonstrated a lower incidence of bleeding (OR = 0.73) compared to those on vitamin K antagonists (VKAs), although the result was not statistically significant. This trend aligns with recent literature suggesting that DOACs may pose a more favorable bleeding profile than traditional warfarin, potentially due to their shorter half-life and predictable pharmacokinetics (*Hua et al., 2021*).

A similar non-significant but notable finding emerged when comparing **NOACs** to **warfarin**, as well as **continued vs. interrupted anticoagulant therapy**. In both cases, continuing anticoagulation did not increase the bleeding risk and may in fact offer a protective effect, consistent with guidelines from the American Dental Association and recent consensus statements that support continued therapy during minor oral surgeries.

The most robust finding was that **patients receiving local hemostatic agents experienced a 67% reduction in bleeding odds (OR = 0.33, p = 0.009)**. This supports the use of absorbable collagen, tranexamic acid, or fibrin glue in clinical practice. These adjuncts appear particularly beneficial in mitigating bleeding without the need to alter systemic anticoagulation regimens.

Overall, these findings highlight that **bleeding complications are relatively rare** when appropriate local measures are taken, even in anticoagulated patients. Therefore, **routine discontinuation of anticoagulants is not warranted** in simple dental extractions, especially when paired with effective hemostatic support.

CONCLUSION

Patients receiving antithrombotic drugs have a higher incidence of postextraction bleeding compared to those not on these medications. Age over 75 years, poor oral hygiene, use of inferior nerve block, and the number of teeth extracted may be related to bleeding after tooth extraction (Huang et al., 2022).

Anticoagulant therapy carries significant risks. Thromboembolic events can have catastrophic outcomes, and bleeding complications can lead to hospitalization, additional procedures, and considerable socioeconomic burdens. Clinicians must balance the risks of thrombosis versus bleeding during the perioperative period to mitigate these outcomes. Regarding the perioperative management of anticoagulants, practitioners frequently request extractions for patients receiving vitamin K antagonists, direct oral anticoagulants, or low-molecular-weight heparins.

Ample evidence exists investigating the association of anticoagulant therapy and the incidence of post-extraction bleeding. Despite this, knowledge of this issue is limited. Several bibliographic reviews explore the relationship between anticoagulants and bleeding regarding various surgical procedures, yet none specifically address dental extractions. The current survey aims to engage with the existing literature on post-extraction bleeding in patients undergoing anticoagulant therapy. The review-synthesis format allows for the consideration of diverse study types while aligning with the objective of providing a comprehensive summary of the topic.

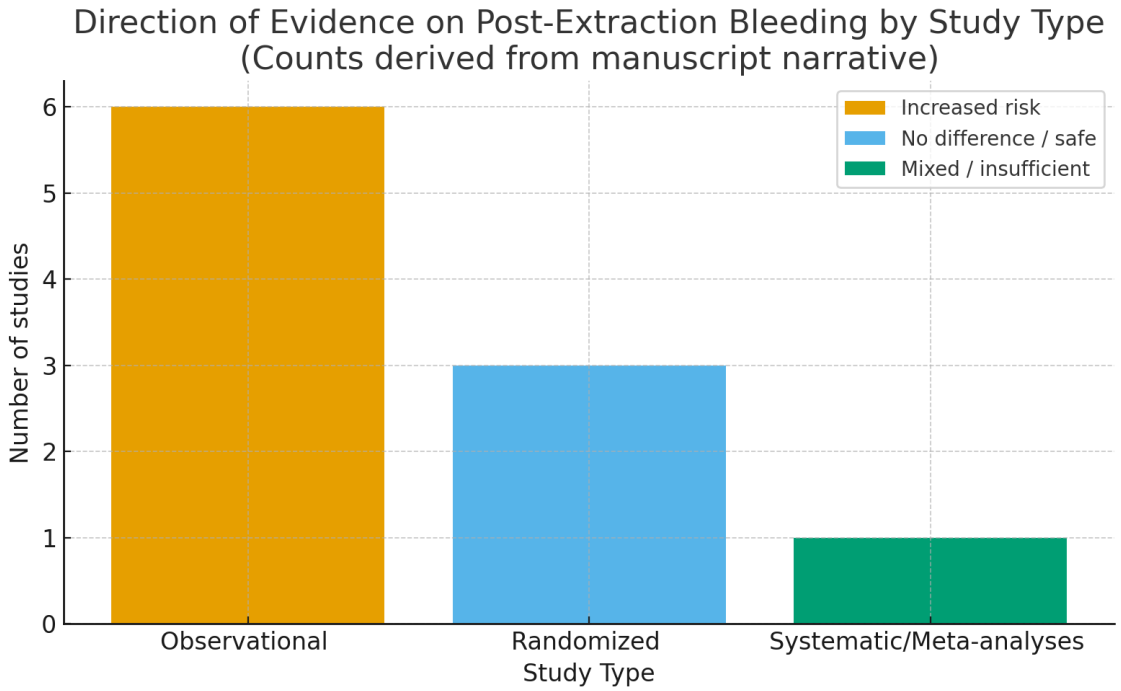

Figure 3 : Shows direction of evidence on post-extraction bleeding by study type

REFERENCES:

1. AlSheef, M., Gray, J., & AlShammari, A. S. (2021). Risk of postoperative bleeding following dental extractions in patients on antithrombotic treatment. ncbi.nlm.nih.gov
2. Huang, J., Liu, J., Shi, H., Wu, J., Liu, J., & Pan, J. (2022). Risk factors for bleeding after dental extractions in patients receiving antithrombotic drugs - A case control study. ncbi.nlm.nih.gov

3. Yang, S., Shi, Q., Liu, J., Li, J., & Xu, J. (2016). Should oral anticoagulant therapy be continued during dental extraction? A meta-analysis. ncbi.nlm.nih.gov
4. Müller, M., Schlittler, F., Schaller, B., Nagler, M., Exadaktylos, A., & Sauter, T. (2019). Characteristics, treatment and outcome of bleeding after tooth extraction in patients on DOAC and phenprocoumon compared to non-anticoagulated patients-a retrospective study of emergency department consultations.. [PDF]
5. Yagyuu, T., Kawakami, M., Ueyama, Y., Imada, M., Kurihara, M., Matsusue, Y., Imai, Y., Yamamoto, K., & Kirita, T. (2017). Risks of postextraction bleeding after receiving direct oral anticoagulants or warfarin: a retrospective cohort study. ncbi.nlm.nih.gov
6. Mingarro-de-León, A., Chaveli-López, B., & Gavaldá-Esteve, C. (2014). Dental management of patients receiving anticoagulant and/or antiplatelet treatment. ncbi.nlm.nih.gov
7. Erden, İsmail, Çakcak Erden, E., Aksu, T., Ebru Gölcük, Şükriye, Turan, B., Erkol, A., Akçakoyun, M., & Sayın, T. (2016). 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. ncbi.nlm.nih.gov
8. Carter, G., Goss, A., Lloyd, J., & Tocchetti, R. (2003). Current concepts of the management of dental extractions for patients taking warfarin. [PDF]
9. Maranhão Pereira, C., Freire Gasparetto, P., Santos Carneiro, D., Elvira P. Corrêa, M., & Antônio Souza, C. (2011). Tooth Extraction in Patients on Oral Anticoagulants: Prospective Study Conducted in 108 Brazilian Patients. ncbi.nlm.nih.gov
10. Ariel Puia, S., Matias Hilber, E., & Garcia-Blanco, M. (2020). Randomized Clinical Trial Comparing Three Local Hemostatic Agents for Dental Extractions in Patients under Chronic Anticoagulant Therapy - A Comparative Study. ncbi.nlm.nih.gov