

## The effect of Vitamin K antagonists as anticoagulants on bleeding in patients post-dental procedures

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### Abstract

**Background:** Individuals undergoing continuous treatment and taking vitamin K antagonist (VKA) and other anticoagulant medications are at a higher risk of experiencing bleeding complications during and after dental surgery procedures.

**Objective:** To determine the effect of vitamin K antagonists in post-dental procedure patients by exploring existing literature on managing patients on vitamin K antagonist therapy as anticoagulants.

**Methods:** This research utilized a literature review based on a database search of studies published between 2019-2024. The literature search used strategies with the terms “Tooth extraction bleeding,” “Odontectomy bleeding,” “Vitamin K Antagonist,” and “Anticoagulant,” utilizing databases such as PubMed, Science Direct, and SCOPUS related to the research topic and meeting eligibility criteria. The studies were then reviewed, summarized, and conclusions were drawn using tables to reveal all data regarding study characteristics and results.

**Results:** Patients using anticoagulants are categorized as high risk for bleeding when undergoing invasive dentistry procedures. VKA is the most commonly used anticoagulant to prevent blood clotting. The consumption of VKA does not significantly affect bleeding post-procedure. Dental procedures can be performed on patients taking anticoagulants without discontinuing the therapy.

**Conclusion:** Based on several studies from various literature sources, it can be concluded that dental procedures in patients taking vitamin K antagonist anticoagulants can still be performed without the risk of bleeding complications with proper local hemostatic measures and perioperative management.

**Keywords:** Vitamin K Antagonist; Anticoagulant; Tooth Extraction; Dental Surgery Procedure; Post-extraction Bleeding

### 1. Introduction

Anticoagulant patients are considered high-risk when undergoing invasive dental procedures [1]. Dental procedures such as routine scaling, tooth extractions, simple implant placements, soft tissue biopsies, restorations involving soft tissue, periodontal surgery, and endodontic procedures require precautions to minimize perioperative bleeding [2].

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There has been an increase in the number of patients requiring dental procedures, including tooth extractions or surgeries, which are acute interventions that may lead to direct or indirect bleeding complications.

Complications following dental procedures can be serious and, at times, fatal. One of the most frequent postoperative issues dental surgeons deal with is bleeding [3]. Post-procedural bleeding can be a significant and disruptive issue for the patient and the dentist [4]. Patients undergoing oral anticoagulants who also have medical conditions affecting hemostasis, such as liver disease, kidney disease, or thrombocytopenia, may be at a higher risk of bleeding. Therefore, a complete and updated medical history is essential [2].

There are two types of oral anticoagulant treatments: vitamin K antagonists (VKAs), such as coumarin and warfarin, and direct oral anticoagulants (DOACs), such as edoxaban, dabigatran, apixaban, and rivaroxaban. VKAs are currently the most widely used anticoagulant medications; they work by inhibiting the carboxylation of vitamin K-dependent coagulation factors II (prothrombin), VII, IX, and X, as well as inhibiting proteins C and S [5]. As an alternative to venous thromboembolism (VKA), which has traditionally been administered to prevent blood clots in individuals who are at risk of thrombosis in a variety of cardiovascular conditions including venous thromboembolism, atrial fibrillation, and prosthetic heart valves, DOACs have increased in popularity [6]. One precaution to mitigate the risk of bleeding during dental procedures is discontinuing anticoagulant therapy, though this can increase the risk of cerebrovascular or cardiac thromboembolism [7].

Excessive bleeding during oral surgery is a risk factor that might compromise the actual surgical operation and raise the patient's postoperative morbidity and discomfort. In this context, a thorough preoperative assessment of bleeding risk along with well-defined protocols for managing bleeding events can help reduce complications for healthcare professionals and patients [8].

## 2. Materials and methods

The writing method follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines using databases such as PubMed, Science Direct, and SCOPUS. The research design used a literature study of publications from 2019-2024. The keywords used in the search for scientific articles were structured according to Boolean Operators as follows: ("Tooth extraction Bleeding" OR "Odontectomy Bleeding" OR "Oral Surgery Bleeding") AND ("Vitamin K Antagonist" OR "Anticoagulant"). The studies excluded from this narrative review were: (1) duplicate studies; (2) studies not published in the last 5 years; (3) studies with irrelevant titles or abstracts; (4) studies other than original or research articles; and (5) studies that lacked clear discussion on the effects of vitamin K antagonists as anticoagulants on bleeding in post-dental procedure patients. After screening, a total of 226 studies were identified. After reviewing, only 10 studies were included in this review.

## 3. Result

**Table 1** Results of a review of research articles regarding vitamin K antagonists as anticoagulants on bleeding in patients post-dental procedures

No	Writer	Study Type	Title	Method	Result
1.	Rocha <i>et al</i> [9]	RCT	Bleeding assessment in oral surgery: A cohort study comparing individuals on anticoagulant therapy and a non-anticoagulated group	This study involved 138 tooth extraction procedures, 69 procedures in VKA patients and 69 procedures in non-OAT patients.	In the VKA group, a history of bleeding during treatment procedures occurred more frequently ( $P = 0.001$ ) and more gauze was used for hemostasis ( $P < 0.001$ ). The VKA group required additional hemostatic agents more often compared

					to the non-OAT group (P = 0.017). The wound healing rate was lower in the non-OAT group (P = 0.048). There was no difference in postoperative bleeding outcomes between the groups (P > 0.05).
2.	Yoshikawa <i>et al</i> [10]	RCT	Safety of tooth extraction in patients receiving direct oral anticoagulant treatment versus warfarin: a prospective observation study	A total of 367 patients who received DOAC or warfarin therapy and underwent tooth extraction were involved in this study. The sample was divided into two groups: the DOAC group (119 patients) and the warfarin group (248 patients).	Combination antiplatelet therapy was more frequently used in the warfarin group than in the DOAC group. Non-surgical extractions were more commonly performed in the DOAC group (P = 0.023) compared to the warfarin group. The risk of postoperative bleeding was significantly higher in the warfarin group compared to the DOAC group.
3.	Lombardi <i>et al</i> [11]	RCT	International normalized ratio (INR) values in patients receiving oral vitamin K antagonists and undergoing oral surgery: A clinical audit.	The study included 122 VKA patients who required minor oral surgery procedures. Patients were instructed not to alter or discontinue VKA usage, and their INR was assessed before the intervention.	Severe bleeding complications did not occur significantly in patients who continued using VKA during the surgical procedure. Oral surgery procedures can be safely performed in patients using VKA without the need to discontinue or adjust the dosage, as long as the INR is monitored within a safe range ( $\leq 3.5$ ) prior to surgery.
4.	Buchbender <i>et al</i> [12]	RCT	A prospective comparative study to assess the risk of postoperative bleeding after dental surgery while on medication with direct oral anticoagulants, antiplatelet agents, or vitamin K antagonists	In total, 195 patients were involved in the study, with 95 patients in the AT group and 100 in the CG (cohort of non-anticoagulant) group.	There was significant postoperative bleeding in the AT group vs. CG (P = 0.000) with a correlation to class C surgery (P = 0.013) and severity class 1a (P = 0.044). A significant difference in the incidence of postoperative bleeding was found between the DOAC/APT group and the VK group (P = 0.036), but there was no significant

					difference concerning other AT agents.
5.	Manfredini <i>et al</i> [8]	RCT ini sistematik review	Comparative Risk of Bleeding of Anticoagulant Therapy with Vitamin K Antagonists (VKAs) and with Non-Vitamin K Antagonists in Patients Undergoing Dental Surgery	A scoping review study was conducted using the PICO (Population, Intervention, Comparison, and Outcome) and PEO (Population, Exposure, and Outcome) methods on 33 articles that met the criteria.	DOAC showed a lower risk of bleeding compared to VKA. DOAC is considered safer in terms of management and bleeding risk, as it does not require routine INR monitoring like VKA.
6.	Berton <i>et al</i> [13]	RCT	Should we fear direct oral anticoagulants more than vitamin K antagonists in simple single tooth extraction? A prospective comparative study	A total of 65 patients per group were enrolled, and 130 teeth were extracted. Both groups were comparable for pre-, peri-, and post-operative variables.	Bleeding events were not statistically significant and were not clinically relevant. Only 1 patient in the DOAC group and 2 patients in the VKA group required medical evaluation for post-extraction bleeding.
7.	Buchbender <i>et al</i> [14]	RCT	Management of anticoagulated patients in dentoalveolar surgery: a retrospective study comparing bridging with heparin versus unpaused vitamin K antagonist medication	A total of 475 patients were involved in the study, with 170 patients in the vitamin K antagonist group that did not discontinue medication (VG), 135 patients in the Bridging group (BG), and 170 patients in the control group (CG).	The incidence of bleeding in the control group was 12.9%. The incidence of bleeding in the VG group was 25.9%. The incidence of bleeding in the Bridging group was 48.1%.
8.	Puia <i>et al</i> [15]	RCT	Bleeding Complications in Relation to the International Normalized Ratio for Dental Extractions in Patients under Chronic Anticoagulant Therapy - An Evaluative Study.	This study involved 694 patients (310 men and 384 women) aged 25–89 years (average age 60 years) who were undergoing chronic oral Vitamin K antagonist therapy and simple tooth extraction.	None of the patients experienced immediate postoperative bleeding, but 11 patients (1.58%) had moderate bleeding (on the first to third days postoperatively). No correlation was found between bleeding complications and INR values when simple tooth extraction was performed using bismuth subgallate as a hemostatic agent.
9.	Vassallo <i>et al</i> [16]	RCT	Efficacy of Local Hemostatic Management in Implant Surgery in Anticoagulated Patients on Warfarin: A	The study also involved 71 patients divided into a control group and three experimental groups (patients undergoing anticoagulant therapy)	Implant placement in patients on warfarin anticoagulation without discontinuing oral anticoagulant therapy was found to be a safe and predictable procedure, and

			Randomized Clinical Study	for implant surgery procedures.	various local hemostatic agents (TXA, BS, and DG) were effective in managing postoperative bleeding.
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There are no significant clinical differences between the use of DOACs and VKAs as anticoagulants, and there is no evidence of a higher risk of bleeding during surgery when compared to the use of anticoagulants [17]. In general, the use of DOACs indicates a lower risk of bleeding compared to VKAs. The incidence of postoperative bleeding is significantly higher in the VKA and warfarin user groups compared to DOAC users [14, 10]. DOACs also demonstrate safer management outcomes and do not require routine INR monitoring before undergoing oral surgical procedures [8]. On the other hand, for VKA users, oral surgical procedures can still be performed safely by maintaining the patient's INR within normal limits ( $\leq 3.5$ ) [11].

Patients with an INR  $\leq 3.5$  can undergo dentoalveolar surgery without risk because the majority of oral surgery procedures are compatible with this level of anticoagulation [11]. When patients are taking vitamin K antagonists (VKAs), an assessment known as the International Normalized Ratio (INR) is conducted to determine the patient's coagulation status or risk of bleeding. The different VKA dosages for every patient are adjusted in part by the INR test. Venous blood is used to obtain blood specimens for this test [18].

As long as postoperative bleeding control is adequate, oral surgery can be carried out safely and successfully for patients on anticoagulants such as warfarin without stopping the drug [16]. Management of postoperative bleeding can be efficiently done by improving the hemostatic process with the use of many local hemostatic medications [9, 15, 16].

#### 4. Discussion

According to the research done by Rocha et al, among the patients who used VKAs, bleeding during the treatment procedure occurred more frequently, as indicated by the greater amount of gauze needed to stop the bleeding. Patients on VKAs also required additional hemostatic measures more often to control bleeding compared to those not using anticoagulant therapy (OAT). On the other hand, the group that did not use OAT showed faster wound healing. The incidence of postoperative hemorrhage did not differ significantly between the VKA users and the non-OAT group. [9]

As to Yoshikawa et al observational study from 2019, the warfarin group had a noticeably higher risk of postoperative bleeding than the DOAC group. Dabigatran, rivaroxaban, apixaban, and edoxaban are the four types of DOACs that are now widely used as warfarin substitutes. Drug levels in the blood tended to decline within a few hours, according to measurements of prothrombin time (PT) in patients using rivaroxaban and activated partial thromboplastin time (APTT) in patients on dabigatran. These findings led to the conclusion that if dental extractions are done at least six hours following the last dose, there is no need to stop DOAC therapy. [10]

According to a study by Manfredini et al, no changes in anticoagulant drug doses were required during surgery because the risk of thrombosis outweighed the risk of bleeding. Additionally, this study found that non-vitamin K antagonist anticoagulants (DOACs) are safer than vitamin K antagonists (VKAs) in terms of bleeding and treatment. Patients using DOACs do not require routine INR monitoring like those on VKAs. Furthermore, the study's findings indicate that local hemostatic agents can effectively control bleeding during or after surgery. [8]

In accordance with Lombardi et al, patients who continued to use VKAs during surgical operations did not have a substantial increase in serious bleeding problems. Prior to oral surgery, patients using VKAs who have an INR value between 2.0 and 4.0 does not need to stop taking anticoagulants. Patients receiving DOAC therapy have a very low risk of bleeding during minor oral surgery, and stopping VKAs can raise the risk of thrombosis. The findings shown that while stopping VKAs increases the risk of thromboembolism, local hemostatic methods including suturing and the use of hemostatic medications can reduce the risk of bleeding. Therefore, as long as the INR measured on the day of surgery is within normal ranges ( $\leq 3.5$ ), minor oral surgery can be safely performed without stopping or changing the dosage of VKAs. [11]

According to Buchbender et al, patients undergoing anticoagulant therapy do not need to discontinue their medication before oral surgical procedures, even though the possibility of postoperative bleeding is assessed to be higher compared

to the control group. The majority of bleeding episodes are minor and can be controlled with local hemostatic techniques like compression and adaptive sutures. Although there is an increased frequency of bleeding in high-risk interventions, its intensity remains low. Anticoagulant therapy during surgical interventions, including high-risk procedures, is considered safe and can continue during surgery with collaborative management, perioperative strategies, and proper patient instructions. [12]

Research by Buchbender et al shows that the number of patients with cardiovascular diseases receiving anticoagulant therapy continues to rise. Anticoagulant medications also play a major role in oral surgical procedures and postoperative bleeding. In patients receiving anticoagulants, close interdisciplinary coordination among cardiologists, general practitioners, and oral surgeons is essential. This study found that patients undergoing dentoalveolar surgery who continue vitamin K antagonist therapy have a lower risk of bleeding compared to patients who discontinue or require perioperative bridging. Therefore, it is safe to continue vitamin K antagonist therapy during minor to moderate oral surgical procedures. [14]

According to a study by Berton et al, in patients undergoing single tooth extractions who were on DOAC and vitamin K antagonist therapy and required medical evaluation for postoperative bleeding, there was no statistically significant difference in the incidence of postoperative bleeding between the two groups. [13]

In the study by Puia et al, it was shown that no patients on chronic vitamin K antagonist therapy experienced bleeding immediately after surgery, with only 11 patients experiencing moderate bleeding between the first and third days. There were no cases of thromboembolism or infectious endocarditis. INR values were also used in the study to predict patients' hemostatic capabilities. They reported no significant relationship between INR values and postoperative bleeding. [15]

According to Vassallo et al, implant placement in patients on warfarin anticoagulant therapy without discontinuing oral anticoagulation is a safe and reliable procedure. The use of different local hemostatic agents (TXA, BS, and DG) is effective in controlling postoperative bleeding. [16]

In the study by Bajkin et al, a similar finding to that of Berton et al. was noted, where anticoagulant therapies such as DOACs or VKAs are widely used in the prevention and treatment of thrombotic complications. Patients on anticoagulants can undergo dentoalveolar surgery without discontinuing therapy if local hemostatic measures are properly implemented, as there is no significant clinical increase in postoperative bleeding risk in patients consuming DOACs or VKAs. [17]

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## 5. Conclusion

Based on several studies from various literature above, it can be concluded that dental procedures in patients consuming vitamin K antagonist anticoagulants can be performed without the risk of bleeding complications. Most of the bleeding incidents are mild and can be managed with local hemostatic agents and perioperative management. Therefore, patients on anticoagulants can have dental treatments without discontinuing their medication.

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## Compliance with ethical standards

### *Disclosure of conflict of interest*

No conflict of interest to be disclosed.

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