Journal of Dental Sciences 20 (2025) 1506–1512

Available online at www.sciencedirect.com

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journal homepage: www.e-jds.com

Original Article

Impact of continued antithrombotic use on bleeding risk in oral surgery- a retrospectively study in a population patients treated in a Korean university hospital

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Received 16 December 2024; Final revision received 30 December 2024
Available online 9 January 2025

KEYWORDS
Antithrombotic agent;
Bleeding;
Discontinuation;
Oral surgery

Abstract *Background/purpose:* With the growing elderly population and their increasing prevalence of systemic diseases, the use of antithrombotic medications is on the rise. These medications are essential for preventing thromboembolic events in patients with cardiovascular, cerebrovascular diseases. However, their use poses challenges in dental surgeries, where the risk of postoperative bleeding needs to be carefully balanced against the risks of discontinuing antithrombotic therapy. This study aimed to assess whether continuing antithrombotic therapy increases the risk of postoperative bleeding during dental procedures.
Materials and methods: Retrospective analysis was conducted on 118 patients who underwent oral surgeries, including extractions and dental implants. Patients were categorized based on whether they continued or discontinued antithrombotic therapy before the procedure. Data on age, sex, type of antithrombotic agent, and occurrence of delayed bleeding were collected. Multiple regression analysis was used to identify potential risk factors for postoperative bleeding.
Results: Of the 118 patients, 78 continued antithrombotic therapy, while 40 discontinued it. Delayed postoperative bleeding occurred in 10 patients (8.47 %), with no statistically significant difference between those who continued and those who discontinued their medication. The type of antithrombotic agent, interaction between drug cessation and procedure, preoperative platelet count, prothrombin time, and partial thromboplastin time did not significantly affect the incidence of bleeding.

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https://doi.org/10.1016/j.jds.2024.12.029
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Conclusion: Continuing antithrombotic therapy does not significantly increase the risk of postoperative bleeding in patients undergoing oral surgeries. Dental practitioners can consider maintaining antithrombotic therapy during certain procedures, emphasizing the importance of balancing bleeding risks with the potential for thromboembolic events.
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Introduction

As life expectancy increases and the elderly population grows, the number of patients with systemic diseases is also on the rise. With an increase in diagnosed diseases, the number of medications taken by these patients is also growing. Consequently, the number of elderly patients with systemic diseases visiting dental clinics is increasing. Many of these patients are on antithrombotic medications due to various conditions such as arrhythmia, cardiovascular diseases, and cerebrovascular diseases.

In dental clinics, invasive procedures such as extractions and implants are performed on patients taking antithrombotic medications. The mechanisms of action of antithrombotic agents vary depending on the type of medication, which may lead to different effects on bleeding during or after surgery. However, there is no consensus on whether to discontinue antithrombotic medications before such dentoalveolar surgeries. While some guidelines are provided based on the number of teeth to be extracted,[1,2] the results can vary depending on the presence of periodontitis, the formation of flaps and bone removal, and the clinician's level of expertise. The general guidelines for managing antithrombotic agents before and after surgery are mostly presented by cardiology or neurology, and as a result, they do not adequately address the specifics of dental surgeries.[3] Patients undergoing antithrombotic therapy are at risk of thrombus formation, and this therapy is essential for preventing such events. However, it is challenging for dentists to assess the thromboembolic risk a patient may face if antithrombotic therapy is discontinued.[4,5] Dentists often lack specialized expertise required on the patient's underlying conditions, their overall health, and the type of medication being used. Consultation with the patients treating physicians in internal medicine or neurology is necessary, but these specialists are not typically familiar with the bleeding risks associated with dental procedures. Therefore, clinicians must make judgments based on individual circumstances. Therefore, this study was designed to provide guidelines for dentists performing minor oral surgeries, such as extractions and dental implants. This study is a retrospective study utilizing real-world clinical data from patients in Korea.

The primary objective of this study was to retrospectively analyze the impact of discontinuing antithrombotic medications on postoperative bleeding in patients undergoing extractions or dental implant surgery. The secondary objective of this study was to determine whether the type of antithrombotic agent (antiplatelet vs anticoagulant) and the extent of surgery modulates the risk of postoperative bleeding. By providing evidence-based insights, it seeks to assist dentists in making safer and more informed decisions when treating patients on antithrombotic medications.

Materials and methods

This study targeted patients who were on anticoagulant therapy and underwent oral surgeries such as extractions, implants, and bone grafts at the Department of Oral and Maxillofacial Surgery at Seoul Nataionl University Dental Hospital over a two-year period from May 2022 to April 2024. This study was conducted according to the guidelines of the Declaration of Helsinki approved by the Institutional Clinical Research Board Committees of Seoul National University Dental Hospital (IRB No. ERI24027).

Inclusion criteria

- Patients on anticoagulant therapy who underwent oral surgery, including extractions, dental implants, or bone grafts by one oral and maxillofacial surgeon.
- Patients who had been on antithrombotic therapy for at least three months.

Exclusion criteria

- Patients who did not complete follow-ups after procedures.
- Patients younger than 18 years.
- Patients with risk factors for bleeding other than antithrombotic medication
  A. Hereditary bleeding disorders: Hemophilia A (Factor VIII deficiency), von Willebrand disease, etc.
  B. Acquired bleeding disorders: chronic liver disease
  C. Idiopathic thrombocytopenia

Upon their first visit, patients were asked about their systemic diseases and the use of antithrombotic medications. If patients were unsure about their medications, they were instructed to bring their prescriptions or medication guides with the drug names listed for confirmation. During the initial examination, blood tests were conducted to check the platelet counts and prothrombin time international normalized ratio (PT INR) and partial thromboplastin time (aPTT).

This study investigated patients' gender, age, type of antithrombotic agent, underlying diseases, whether

antithombotic agents were discontinued before invasive procedures, type of procedure, the extent of the affected are (number of teeth), occurrence of delayed postoperative bleeding, timing and management of delayed bleeding, platelet count, PT INR and aPTT. The antithrombotic agents were classified as antiplatelet agents (e.g., aspirin, clopidogrel), vitamin K-dependent anticoagulants (e.g., warfarin), and direct oral anticoagulants (DOACs). Delayed postoperative bleeding was defined as cases where bleeding persisted beyond 24 h after surgery or when patients had to visit the hospital for hemostatic intervention due to uncontrolled continuous bleeding. The procedures included were categorized into extractions, implants, and other surgeries (such as bone grafting, alveoloplasty).

Statistical analysis was conducted using SPSS® ver. 29.0 (IBM, Armonk, NY, USA) employing muliple logistic regression analysis to identify risk factors for delayed postoperative bleeding.

Results

A total of 118 patients were included in this study, comprising 54 men and 64 women. The average age was 75.04 (±11.75) years. Patient demographic and clinical data are presented in Table 1. The included patients were classified according to their systemic diseases. These were categorized into cerebrovascular diseases such as cerebral infarction and cerebral hemorrhage, cardiovascular diseases, hypertension, diabetes, kidney diseases, hyperlipidemia, others, and unknown diseases. Patients with multiple diseases were counted in all relevant categories. There were 26 patients with cerebrovascular diseases, 73 with cardiovascular diseases, 64 with hypertension, 29 with diabetes, 10 with kidney diseases, 20 with hyperlipidemia, 10 with other conditions, and 3 with unknown conditions.

A total of 76 patients were taking antiplatelet agents such as aspirin or clopidogrel, 14 patients were taking warfarin, 3 patients were taking both aspirin and clopidogrel, and 24 patients were using DOACs. 102 patients were on a single medication, while 16 patients were on two medications. Among those taking two medications, 12 were taking aspirin and clopidogrel, 3 were taking warfarin and clopidogrel, and one patient was taking clopidogrel and edoxaban. Regarding the types of procedures performed, 92 patients underwent tooth extraction, 17 had implants placed, 1 patient had both extraction and implant placement simultaneously, 1 patient had extraction along with bone graft, and 7 patients underwent other surgeries, such as alveoloplasty or bone grafting.

Seventy-eight patients underwent invasive procedures like tooth extraction or implant placement without discontinuing antithrombotic agents, while 40 patients discontinued the medication for the recommended period before the procedure. The proportions of continuation and discontinuation by medication are shown in Fig. 1. Among the 76 patients taking antiplatelet agents, 59 (77.6 %) underwent the procedure without discontinuation. Of the 14 patients taking vitamin K antagonists, 5 (35.7 %) proceeded without discontinuing the medication. In the case of DOACs, 13 out of 24 patients (54.2 %) underwent the procedure without discontinuation. The extent of surgery was most commonly limited to a single tooth in 63 patients, followed by 2 teeth in 32 patients, 3 teeth in 14 patients, and more than 4 teeth in 9 patients. Out of a total of 118 patients, 10 experienced delayed bleeding (8.47 %). Among these, 8 had not discontinued their antithrombotic agents, while 2 had (Fig. 2). However, there was no statistically significant difference in the incidence of postoperative bleeding between the group that continued antithrombotic agents and the group that discontinued them ($P > 0.05$). The medications taken by the 10 patients who experienced delayed bleeding were aspirin (1 patient), clopidogrel (2 patients), aspirin and clopidogrel (3 patients), warfarin (3 patients), and warfarin and clopidogrel (1 patient) (Fig. 3). When examining the continuation/discontinuation rates of

Table 1 General characteristics of the study sample.

Category	Variables	Number
Sex	M	54
	F	64
Age (years)	<40	2
	40 ≤ x < 50	2
	50 ≤ x < 60	2
	60 ≤ x < 70	28
	70 ≤ x < 80	41
	80≤	43
Underlying diseases	Cerebrovascular disease	26
	Cardiovascular disease	73
	Hypertension	64
	Diabetes mellitus	29
	Chronic kidney disease	10
	Hyperlipidemia	20
	Others	10
	Unknown	3
Antithrombotics	Antiplatelets	80
	Vitamin K antagonist (warfarin)	17
	Direct oral anticoagulants	14
Number of antithrombotics	Single	102
	Dual	16
Procedures	Extraction	94
	Dental implants	18
	Others	8
Extents of surgery (included tooth number)	1	63
	2	32
	3	14
	4	6
	5	1
	6	2
Presence of delayed bleeding	Present	10

Abbreviation: M, male; F, female.

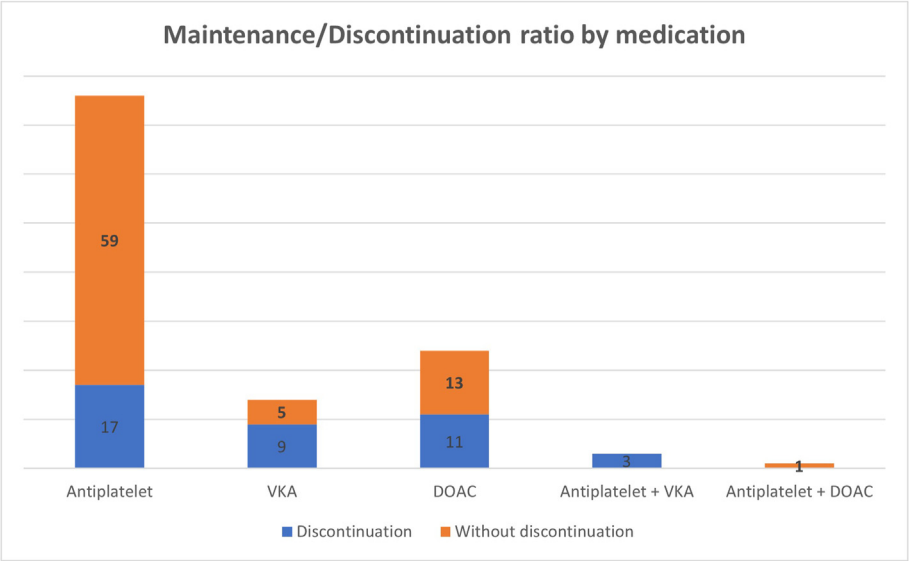

Figure 1 Continuation and discontinuation by medication. Abbreviation: VKA, vitamin K antagonist.

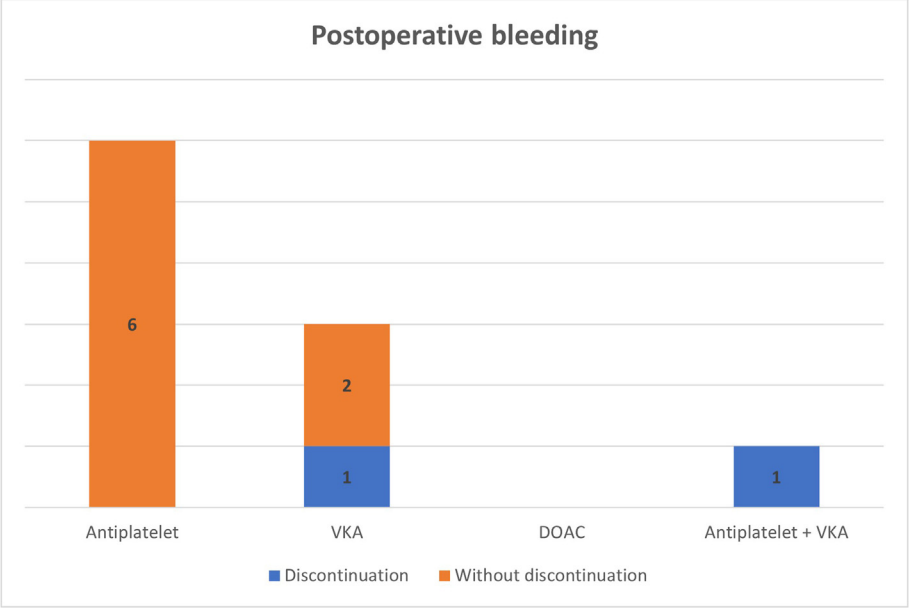

Figure 2 Comparison of postoperative bleeding occurrence based on the type of medication. Abbreviation: VKA, vitamin K antagonist; DOAC, direct oral anticoagulant.

antithrombotic agents by procedures, 67 out of 92 patients (72.8 %) undergoing tooth extraction proceeded without discontinuing the medication. In contrast, only 6 out of 17 patients (35.3 %) undergoing implant surgery continued their medication during the procedure (Fig. 4).

The timing of delayed bleeding occurred on the 1st postoperative day in 4 patients, the 3rd day in 3 patients, the 4th day in 1 patient, the 7th day in 1 patient, and the 8th day in 1 patient. For the management of delayed bleeding, 9 patients achieved hemostasis with gauze biting, while one patient required hemostatic packing, such as Surgicel® (Ethicon, Somerville, NJ, USA), and suturing to achieve hemostasis. The comparison of preoperative platelet count, PT INR, and aPTT values between the groups based on whether the medication was discontinued did not reveal any statistically significant differences between the groups. Similarly, the comparison of the same values according to the presence or absence of postoperative bleeding also showed no statistically significant differences between groups (Table 2).

Logistic regression analysis was performed to investigate potential risk factors that could affect delayed postoperative bleeding, including the discontinuation of antithrombotic agents, the interaction between drug agents and cessation, the type of antithrombotic agents, and the extent of surgery, platelet count, PT INR, and aPTT. No variables were found to have a statistically significant association with delayed postoperative bleeding at the

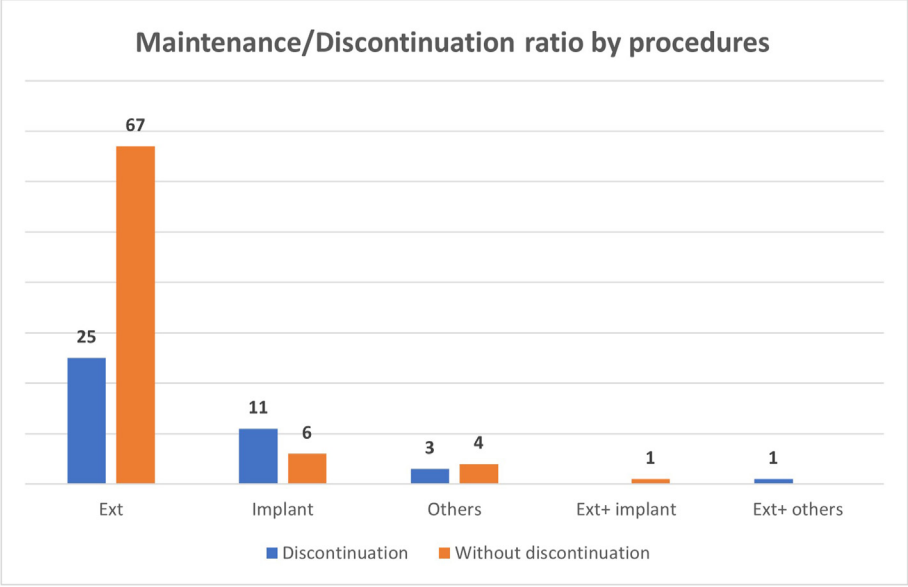

Figure 3 The proportion of patients who continued or discontinued antithrombotic medication before surgery based on the type of procedure. Abbreviation: Ext, extraction.

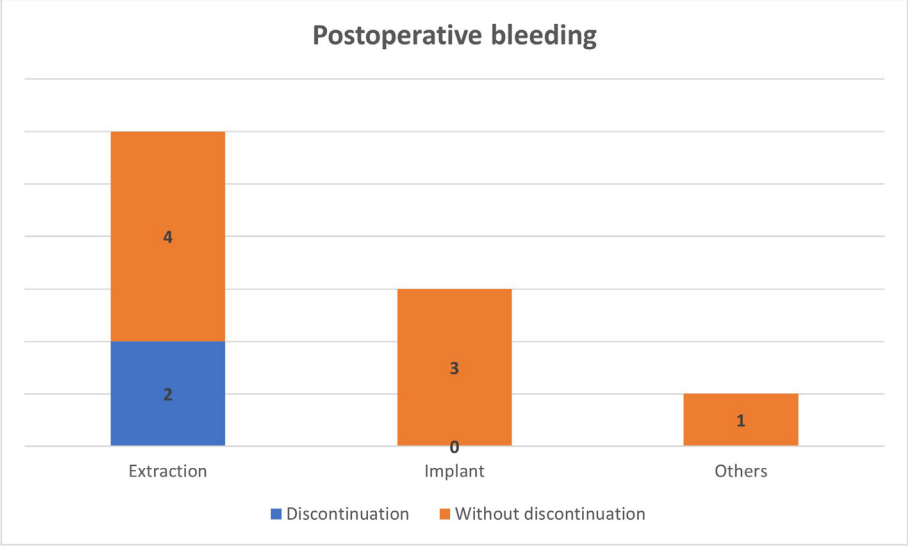

Figure 4 A chart categorizing patients with delayed postoperative bleeding based on the procedure and medication discontinuation status.

Table 2 Comparison of blood test results between groups based on medication discontinuation and postoperative bleeding occurrence.

Group	Number	Platelet (K/μl) Mean ± SD	PT INR Mean ± SD	aPTT(s) Mean ± SD
Discontinuation	78	191.40 ± 54.55	1.40 ± 0.69	41.95 ± 12.24
Continuation	40	202.37 ± 55.43	1.15 ± 0.41	38.60 ± 7.76
No postoperative bleeding	108	202.26 ± 56.18	1.22 ± 0.51	39.42 ± 9.09
Postoperative bleeding	10	166.89 ± 56.70	1.32 ± 0.67	41.90 ± 13.06

Abbreviation: K, $x10^3$; s, seconds; PT INR, prothrombin time and international normalized ratio; aPTT, activated partial thromboplastin time; SD, standard deviation.

$P < 0.05$. However, platelet count exhibited a borderline significance ($P = 0.069$), suggesting a potential role in bleeding risk. The interaction between procedure and discontinuation of medication demonstrated a trend toward increased bleeding risk (Exp(B) = 1.57), which warrants further investigation in larger studies (Table 3).

Discussion

In South Korea, as life expectancy increases and the population ages rapidly, the number of people aged 65 and older is rising. With the growing elderly population, there is also an increasing demand for procedures such as tooth extractions and implants in dental clinics. One of the challenges with elderly patients is that they have a higher prevalence of systemic diseases compared to younger patients, which can affect the occurrence of surgical complications and hinder bone healing.[6] In a study of patients who underwent outpatient surgeries such as extractions and implants, 356 out of 6252 patients were aged 65 and older, and among these 356 elderly patients, 239 (67.13 %) had at least one underlying condition.[7] Elderly patients often take various medications due to their underlying conditions. Among these medications, antithrombic agents can affect the process and outcomes of invasive dental procedures, such as surgical extractions, dental implants, and bone grafts, which are routinely performed in dental clinics.[8] However, there is a lack of standardized data on the bleeding risk associated with dental surgeries in patients taking these antithrombic agents.[1] Previously, antithrombotic agents were discontinued for the duration recommended by guidelines before performing invasive procedures. However, more recently, the focus has shifted to the potential risk of thromboembolic events that may occur if these medications are discontinued.[4,5] Patients taking oral antithrombotic agents often have various life-threatening conditions such as atrial fibrillation, a history of angina or myocardial infarction, coronary artery disease prevention, the presence of coronary stents, or ischemic cerebrovascular accidents.[9,10] Discontinuing antithrombotic agents can increase thromboembolic risk, which may sometimes lead to fatal outcomes.[10] Dentists face situations where they must assess both the thromboembolic risk associated with discontinuing antithrombotic agents and the risk of bleeding during or after surgery when treating patients who are taking these medications.[11]

Table 3 Results of multiple logistic regression analysis.

Variables	Wald	*P* value	Exp(B)
Discontinuation_Procedure	2.696	0.101	1.570
Drug	1.153	0.283	0.391
Range of operation	1.183	0.276	0.986
Platelet cound	3.299	0.069	0.986
PT INR	0.015	0.903	1.183
aPTT	0.425	0.515	1.042

Abbreviation: Discontinuation_Procedures, interaction between medication discontinuation and procedure; Drug, kinds of antithrombotics; PT INR, prothrombin time and international normalized ratio; aPTT, activated partial thromboplastin time.

This study retrospectively evaluated whether continuing antithrombotic therapy in patients undergoing oral surgeries such as tooth extractions and implant placements increases the risk of postoperative bleeding. Among 118 patients, 78 continued antithrombotic agents, while 40 followed the recommended cessation period. Postoperative delayed bleeding occurred in 10 patients, with no statistically significant difference in the incidence between the two groups. Overall, 8.47 % of patients experienced delayed postoperative bleeding. In the group that did not discontinue medication, 8 out of 78 patients (10.3 %) experienced bleeding, while in the group that discontinued medication, 2 out of 40 patients (5 %) experienced bleeding. However, there were no significant statistically differences between groups.

The largest number of patients were those taking antiplatelet agents. Among them, 59 patients did not discontinue the medication before the procedure, while 17 patients did. Of the 59 patients who did not discontinue the medication, 6 experienced postoperative bleeding (10.17 %), but hemostasis was achieved with gauze biting. There were 14 patients on warfarin and 3 patient taking both antiplatelet agents and warfarin. Among these 14 patients, postoperative bleeding occurred in 2 patients who discontinued the medication and in one patient who did not. Notably, the patient taking both antiplatelet agents and warfarin required flap elevation and suturing for hemostasis, as gauze biting alone was insufficient. Among patients on DOACs, there was no delayed postoperative bleeding regardless of whether the medication was discontinued or not. Although there was no statistically significant difference based on the type of medication, it is believed that the characteristics of DOACs, such as their short onset and half-life, played a role in these outcomes. In a systemic review analyzing the risk of bleeding in patients receiving anticoagulant therapy during implant treatment, it was concluded that anticoagulant therapy does not increase the risk of postoperative bleeding if appropriate local hemostatic measures are taken. Additionally, it was reported that vitamin K antagonists tend to increase postoperative bleeding more than DOACs.[12] In our study, although there was no statistically significant difference in the risk of postoperative bleeding depending on the medication, no delayed postoperative bleeding occurred in patients taking DOAC. This is thought to be related to the shorter duration of the drug's effect. Although it was another limited case-controlled study, one report stated that it is possible to safely perform sinus lifting using the lateral window approach, which was considered relatively difficult and associated with a higher risk of bleeding, in patients taking DOACs.[13]

No variables in this analysis reached statistic significant threshold of $P < 0.05$ in association with delayed postoperative bleeding. However, platelet count showed a borderline significant, indicating a careful approach when considering discontinuation of antithrombotics in patients with lo platelet counts. The interaction between medication cessation and procedure type demonstrated a trend toward an increased risk of delayed bleeding (Exp(B) = 1.57), highlighting a potential area for future investigation. This study also found no significant correlation between postoperative bleeding and whether antithrombotic agents were

discontinued in patients taking various medications. Among the 10 patients who experienced bleeding, hemostasis was achieved using simple hemostatic measures, and no postoperative complications occurred. This showed similar results to previous studies.[4,14,15]

The limitations of this study include the relatively small number of patients, the wide range of surgical procedures involved, and the variety of medications included. Future studies that include a larger number of patients and control for various variables could provide practical clinical guidelines for dentists treating patients on antithrombotic medications.

This study provides evidence that continuing antithrombotic therapy during dental surgeries, such as tooth extractions and implants, does not significantly increase the risk of delayed postoperative bleeding. These findings suggest that for many patients, discontinuing these medications may not be necessary, thus avoiding the potential thromboembolic risks associated with medication cessation. However, larger studies with more controlled variables are necessary to confirm these findings and further guide clinical decision-making.

In conclusion, dental practitioners can more confidently proceed with oral surgeries in patients taking antithrombotic medications, particularly when procedures are minimally invasive and limited to a narrow surgical field. In addition, when deciding whether to discontinue the antithrombotic drugs, the patients' systemic disease, general condition, and bleeding risk of the procedure must be comprehensively considered.

Declaration of competing interest

The author has no conflicts of interest relevant to this article.

Acknowledgements

This research was supported by Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education (2021R1I1A1A01058939).

References

1. Chan MH, Sun F, Malakan J. Controversies in stoppage of antiplatelet and anticoagulant medications prior to oral surgery. *Dent Clin* 2024;68:21—45.
2. Moster M, Bolliger D. Perioperative guidelines on antiplatelet and anticoagulant agents: 2022 update. *Curr Anesthesiol Rep* 2022;12:286—96.
3. Fleisher LA, Fleischmann KE, Auerbach AD, et al. 2014 ACC/AHA guideline on perioperative cardiovascular evaluation and management of patients undergoing noncardiac surgery: a report of the American College of Cardiology/American Heart Association Task Force on practice guidelines. *J Am Coll Cardiol* 2014;64:e77—137.
4. Miziara LNB, Sendyk WR, Ortega KL, Gallottini M, Sendyk DI, Martins F. Risk of bleeding during implant surgery in patients taking antithrombotics: a systematic review. *Semin Thromb Hemost* 2021;47:702—8.
5. Wahl MJ. Dental surgery and antiplatelet agents: bleed or die. *Am J Med* 2014;127:260—7.
6. D'Ambrosio F, Amato A, Chiacchio A, Sisalli L, Giordano F. Do systemic diseases and medications influence dental implant osseointegration and dental implant health? an umbrella review. *Dent J* 2023;11:146—65.
7. Seo MH, Eo MY, Mustakim KR, Sodnom-Ish B, Myoung H, Kim SM. Reasonable necessity of preoperative laboratory tests in office-based oral and maxillofacial surgery. *J Korean Assoc Oral Maxillofac Surg* 2023;49:142—7.
8. Guabello G, Zuffetti F, Ravida A, et al. Avoiding implant-related complications in medically compromised patients with or without unhealthy lifestyle/elevated oxidative stress. *Periodontol* 2000 2023;92:329—49.
9. Sbricoli L, Bazzi E, Stellini E, Bacci C. Systemic diseases and biological dental implant complications: a narrative review. *Dent J* 2022;11:10—21.
10. Statman BJ. Perioperative management of oral antithrombotics in dentistry and oral surgery: part 2. *Anesth Prog* 2023;70:37—48.
11. Lee JK. Dental management of patients on anti-thrombotic agents. *J Korean Assoc Oral Maxillofac Surg* 2018;44:143—50.
12. Zou L, Hua L. Risk of bleeding with dental implant surgery in patients on anticoagulant or antiplatelet drugs: a systematic review and meta-analysis. *Acta Odontol Scand* 2023;81:98—104.
13. Cappare P, Tete G, Alfieri O, Pantaleo G, Montemezzi P. Postoperative bleeding in patients under direct oral anticoagulation after maxillary sinus floor augmentation: a case-control study. *Int J Oral Maxillofac Implants* 2022;37:365—72.
14. de Abreu de Vasconcellos SJ, Souza Dos Santos Marques R, Gomes Magalhaes de Melo E, et al. Risk of bleeding in anticoagulated patients undergoing dental extraction treated with topical tranexamic acid compared to collagen-gelatin sponge: randomized clinical trial. *J Cranio-Maxillo-Fac Surg* 2023;51:393—8.
15. Buchbender M, Schlee N, Kesting MR, Grimm J, Fehlhofer J, Rau A. 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. *BMC Oral Health* 2021;21:504—12.