Bleeding complications in patients on oral anticoagulants after dental extraction: A comparative study of VAK *vs.* DOACs.

Lamia Harfouche*, Rachid Lattafi

Department of Dentistry, University of Medical Sciences Algiers, Algiers, Algeria

Abstract

Introduction: The management of cardiovascular diseases has developed since the arrival of a new family of Direct Oral Anticoagulants (DOACs), which represent a better alternative to Vitamin K Antagonists (VKA). DOACs do not require biological monitoring, and do not present any drug or food interactions, which makes them closer to the ideal anticoagulant.

Objective: The main objective of study is to evaluate the efficacy of local hemostasis protocol after dental extraction in two groups of patients subjected to oral anticoagulants: VAK (Sintrom®) and DOACs.

Materials and methods: A comparative and prospective study was carried out on two groups of patients, the VAK group (Sintrom®) consisting of 53 patients and the DOACs group consisting of 40 patients. A total of 106 dental extraction procedures were performed in each group without stopping the current treatment. A local hemostasis procedure was implemented for all procedures, consisting of an intrinsic method (oxidized oxycellulose wick type Surgicel®), followed by another extrinsic method (sutures of the alveolar edges). In the event of a hemorrhagic complication, bi-digital compression with tranexamic acid (xacyl®) is recommended or a resumption of local hemostasis methods. Data analysis was carried out using epi-info software version 7.

Results: We collected (12.41%) hemorrhagic complications in the VAK group and (9.68%) in the DOACs group. The statistical test (χ^2=0.52, P=0.47) does not reveal any superiority between the two groups with respect of hemorrhagic complications. The age of patients (≥ 65 years) presents a risk of occurrence of hemorrhages after dental extraction. The INR (between 2 and 4) is not the factor of hemorrhagic complications in patients in the VAK group. Extractions at the maxillary level in patients in the DOACs group represent a hemorrhagic risk factor.

Conclusion: This study shows that the local hemostasis technique applied to both groups is effective, and without resorting to stop or modify the current anticoagulant treatment.

Keywords: Antivitamin K, Direct oral anticoagulants, Dental extraction, Local hemostasis.

Introduction

Vitamin K-dependent factor synthesis inhibitors, or more commonly called vitamin K antagonists, have been the only possible recourse for long-term oral anticoagulation since the 20th century. However, they are far from having the ideal antithrombotic profile due to their low therapeutic margin, their relatively slow action and their sensitivity to numerous drug and food interactions, causing inter- and intra-individual variability, requiring regular biological monitoring and adaptation individual dosage [1].

Direct Oral Anticoagulants (DOACs) have the advantage of oral administration and do not require biological monitoring, thus approaching the ideal anticoagulant.

The odontostomatologist faces with clinical dilemmas regarding the management of these patients, particularly regarding the management of the risk of excessive bleeding and the need to maintain good control of hemostasis while minimizing thromboembolic risks [2].

Currently, oral medicine management of patients on DOACs is based exclusively on pharmacological criteria such as the half-life of the drug and the time of administration after the bloody act in the absence of a reliable routine biological test to assess the patient's hypocoagulability, as well as the unavailability of a specific antidote in case of hemorrhagic accidents. However, many studies based on clinical experience recommend continuing treatment in case of dental procedures with a low risk of hemorrhage.

***Correspondence to:** Lamia Harfouche, Department of Dentistry, University of Medical Sciences Algiers, Algiers, Algeria; E-mail: harfouchelamia@yahoo.fr

***Received:** 24-Jan-2025, Manuscript No. AACDOH-25-159908; **Editor assigned:** 27-Jan-2025, AACDOH-25-159908 (PQ); **Reviewed:** 10-Feb-2025, QC No. AACDOH-25-159908; **Revised:** 06-Jun-2026, Manuscript No. AACDOH-25-159908 (R); **Published:** 13-Jun-2025, DOI: 10.35841/aacdoh-9.2.251*

***Citation:** Harfouche L, Lattafi R. Bleeding complications in patients on oral anticoagulants after dental extraction: A comparative study of VAK vs. DOACs. J Clin Dentistry Oral Health 2025;9(2):251.*

The aim of the present clinical study is to observe the hemorrhagic events occurring per- and post-operatively following dental extractions in patients undergoing DOACs treatment, and to compare them to those undergoing VAK treatment, using the same local means of hemostasis [3].

Materials and Methods

This study was carried out between May 2019 and July 2022 in the Oral Pathology and Surgery Department of the Issaad Hassani University Hospital (Western region of Algiers). This is a non-randomized, prospective, comparative study. A complete oral clinical examination carried out beforehand for each patient, information regarding their general condition was provided by the treating physician. The procedure was only being carried out once the explanations were given to the patient and agreement was obtained for participation in the study.

Hemorrhagic complications were assessed after dental extractions in two groups of patients without stopping the anticoagulant, the first group was under VAK (Sintrom®) and the second group was patients under direct oral anticoagulants. The dental procedures concerned single tooth extractions (single-rooted teeth, multi-rooted teeth, upper teeth, lower teeth, teeth in root condition), multiple dental extractions in the same quadrant (maximum of 3 teeth) and alveolectomies where mucoperiosteal detachment below the mucogingival line. Concerning patients under VAK, special attention was given to those with a valve replacement (wearers of a mechanical valve prosthesis) due to the additional risk of infection (Oslerian risk), thus antibiotic prophylaxis was recommended [4].

Included were all patients who were:

- Undergoing direct oral anticoagulant treatment (Apixaban, Rivaroxaban and Dabigatran).
- Under VAK (Sintrom®) ($2<INR \leq 4$) the day before or the day of the procedure.
- Cardiovascularly stable (according to the opinion of the attending physician).

Excluded from this study were all patients who:

- Had an INR<2 or an INR>4, as they were referred back to the treating physician to monitor the patient's hypocoagulability.
- Required surgery at the oral cavity level (impacted wisdom teeth, impacted wisdom teeth, pre-prosthetic surgeries, endodontic surgeries, etc.).

The dental procedure was followed by local hemostasis using intrinsic and extrinsic means. This protocol includes: The placement of a regenerated oxidized cellulose wick (Surgicel®) followed by suturing of the alveolar edges. Patient monitoring is ensured on day 1, day 3 and day 8, in the absence of complications the suture remould was performed on day 8. However, additional intermediate control sessions were envisaged depending on the occurrence of postoperative complications. They were evaluated according to the classification of Iwabuchi et al., in Table 1. Any postoperative bleeding stopped by bi-digital compression within 20 min is considered oozing. The primary judgment criterion is the occurrence or absence of a post-operative hemorrhagic complication which corresponds to uncontrollable bleeding with simple compression or the formation of an exuberant clot, and this during the entire week following the dental extraction procedure [5].

Table 1. *Evaluation of hemorrhagic complications according to Iwabuchi et al.*

Grade	Occurrence of bleeding
0	No bleeding
1	Bleeding stopped with simple compression (once or twice a week)
2	Bleeding stopped with simple compression (more than three times a week)
3	Bleeding requiring the use of a pharmacological substance (tranexamic acid)
4	Bleeding requires surgery

Statistical analysis

In this study, Chi^2 statistical tests, Yates and Fischer correction were used to determine whether the association between variables is statistically significant.

These tests aim to verify a null hypothesis, noted H_0, which consists in saying that there is no difference between the two variables. In the case of its rejection, the alternative hypothesis H_1, which consists in saying that there is a difference between the two variables must be accepted.

To determine whether the variables are independent, the p-value is compared to the significance level α of 0.05, which indicates a 5% risk of incorrectly concluding that there is an association [6].

- p-value ≤ α: The variables present a statistically significant association (reject H_0).
- value of p>α: impossible to conclude that the variables are associated (do not reject H_0).

The calculation of the number of subjects required for the study is given by the statically module of the epi-info software version 7 (number of subjects required for cohort studies).

Citation: *Harfouche L, Lattafi R. Bleeding complications in patients on oral anticoagulants after dental extraction: A comparative study of VAK vs. DOACs. J Clin Dentistry Oral Health 2025;9(2):251.*

Results

Descriptive study

We grouped 93 patients in whom 212 dental extraction procedures were performed. Two groups of patients were collected. The first group of fifty-three (53) patients were treated with Anti-Vitamin K (VAK), twenty patients (36.8%) were male and thirty-three patients (63.2%) were female. The second group of forty patients (40) was treated with Direct Oral Anticoagulants (DOACs), thirteen patients (32.0%) were male and twenty-seven (68%) were female. In the group of patients treated with VAK, most of the patients were recorded in the age group ≥ 65 years with twenty-six cases (49.1%). In the other group of patients treated with DOACs most of the patients were recorded in the age group ≥ 65 years with thirty-one cases (77.5%). As for oral hygiene, neglect of oral hygiene was clearly observed in patients in both the VAK and DOACs groups. In the VAK group, only seven patients (13.2%) presented with good oral hygiene and forty-six patients (86.9%) with poor oral hygiene. In the DOACs group, ten patients (25.0%) presented with good oral hygiene and thirty (75.0%) with poor oral hygiene [7].

In this study, two types of procedures were performed. In the VAK group, sixty-four (60.4%) procedures were single-type and forty-two (39.6%) were multiple-type. In the other DOACs patient group, seventy-eight procedures (73.6%) were single-type and twenty-eight procedures (26.4%) were multiple-type. As for the location of the procedure, in the VAK group, sixty-two procedures (58.5%) were performed at the maxillary level and forty-four (41.5%) at the mandible level. Regarding the DOACs patient group, fifty-five procedures (51.9%) were performed at the maxillary level and fifty-one (48.1%) at the mandible level (Table 2) [8].

Table 2. *Descriptive data of patients in the VAK and DOACs groups.*

	AVK		DOACs		p-value
	Number of patients	Number of acts	Number of patients	Number of acts	
Sex					
Male	20	39	13	41	0.78
Female	33	67	27	65	
Age class					
<65 years old	27	53	9	25	1.2E-04 (Yates)
≥ 65 years old	26	53	31	81	
Oral hygiene					
Bad	46	96	30	82	0.01
Good	7	10	10	24	
Extraction type					
Simple	44	64	37	78	0.04
Multiple	21	42	15	28	
Seat of the act					
Maxillary	39	62	28	55	0.33
Mandibular	32	44	30	51	

Analytical study

Two groups of patients treated with VAK and DOACs were collected, with a number of one hundred and six (106) procedures performed in each group. The first group of patients, treated with AVK, developed eighteen hemorrhagic complications for forty-seven procedures (44%). The second group of patients, treated with DOACs, developed the same number of hemorrhagic complications but for a greater number of procedures, namely eighteen hemorrhagic complications for fifty-eight procedures (55%).

We observed a percentage of 12.8% bleeding complications in males in the VAK group, versus 12.2% in the DOACs group. Women developed 19.4% bleeding complications in the VAK group versus 20.0% in the DOACs group [9].

The assessment of hemorrhagic complications according to age allowed us to find 6 cases of hemorrhagic complications in the age group ≥ 65 years, in the VAK group and 12 cases in the age group <65 years. Concerning the DOACs group, 13 cases in the age group ≥ 65 years against 5 cases in patients in the age group <65 years, in the DOACs group.

Patients in the DOACs group developed a prevalence of bleeding complications of 21.9% over 73 procedures in patients treated with Rivaroxaban, 5.6% over 18 procedures in

Citation: *Harfouche L, Lattafi R. Bleeding complications in patients on oral anticoagulants after dental extraction: A comparative study of VAK vs. DOACs. J Clin Dentistry Oral Health 2025;9(2):251.*

patients treated with Apixaban and 6.7% after 15 procedures in patients treated with Dabigatran.

Bleeding complications were observed in the maxilla with a prevalence of 21.0% in patients in the AVK group and 9.1% in patients in the DOACs group. Bleeding complications were observed in the mandible with a prevalence of 11.4% in patients in the VAK group and 25.5% in patients in the DOACs group.

Bleeding related to single dental extractions was observed with a prevalence of 23.4% in patients in the VAK group and 18.0% in patients in the DOACs group. As for bleeding complications related to multiple dental extractions, a prevalence of 7.1% was recorded in patients in the VAK group and 14.3% in patients in the DOACs group (Table 3).

Table 3. *Comparative data on hemorrhagic complications observed in the two groups of patients treated with Vitamin K Antagonists (VAK) and Direct Oral Anticoagulants (DOACs).*

	AVK	AOD	Total	p-value
Sex				
Male	5	5	10	0.71 (Yates)
Female	13	13	26	
Age group				
<65 years old	12	5	17	0.04 (Yates)
≥ 65 years old	6	13	19	
Oral hygiene				
Bad	6	1	7	1.00 (Fischer)
Good	12	17	29	
Seat of the act				
Maxillary	13	5	18	0.02 (Yates)
Mandibular	5	13	18	
Extraction type				
Simple	15	14	29	1.00 (Fischer)
Multiple	3	4	7	
Sector				
Prior	5	2	7	0.52 (Fischer)
Posterior	0	11	11	

Discussion

We recorded the hemorrhagic complications from day 0 to day 8. A total of 18 hemorrhagic complications were recorded in both groups without interruption of anticoagulant treatment, 12.41% in the AVK group and 9.68% in the DOAC group (χ^2=0.52 and P=0.47). All hemorrhages were not serious and stopped locally by local means of hemostasis. These results corroborate with those of Mauprivez et al.; Yagyuu et al.; Bertron et al.; Yoshikawa et al.; Iwabuchi et al.; Ono et al. and Bertron et al., who all found no significant difference between the two groups under AVK and under DOAC with the exception of the results of the study by Caliskan et al., who found a significant difference between the two groups. The highest bleeding rate found in the literature is that of Iwata and al. It was 26.8% in patients under AVK and 26.0% in patients under DOACs.

We noticed through this study that type 4 hemorrhages (according to the Iwabuchi classification) are observed from day 2 in the group under VAK and between day 0 and day 1 for the group under DOACs. In the work of Bacci et al.; Irshad et al.; Bajkin et al.; Dinkova et al. and Boukais, bleeding occurred early in patients on VKA, between day 1 and day 3, and gradually decreased over the following days. In the study by Kwak et al., postoperative bleeding was observed in patients on DOACs on day 2 (72 hours) and generally between day 5 and day 6, while in the studies by Zeevi et al. They occurred from day 6. It is important to note that both authors stopped treatment 1 to 2 days before management. During the first postoperative days, the fibrin clot, partially infiltrated with inflammatory cells, is fragile and poorly organized. Physiological aggressions during chewing, swallowing and the fibrinolytic action of saliva, among others, can promote the occurrence of bleeding, to which is added the action of anticoagulants. In the presence of an anticoagulant, this clot is

Citation: *Harfouche L, Lattafi R. Bleeding complications in patients on oral anticoagulants after dental extraction: A comparative study of VAK vs. DOACs. J Clin Dentistry Oral Health 2025;9(2):251.*

doubly weakened, leading to secondary hemorrhage during the first three days. As for the hemorrhages observed in patients taking VAK (Sintrom®), they can be explained by the lability of the INR, which can also be influenced by diet. Extraction hemorrhage in the VAK group was observed in 19.4% of patients, corresponding to 13 cases in women and 12.8% in men, corresponding to 5 cases. In the DOACs group, the percentage of hemorrhage after dental extractions was 20.13% in women, corresponding to 13 cases, and 12.2% in men, corresponding to 5 cases (P=0.71, Yate's test). No correlation between post-extraction hemorrhage and gender has been reported in the literature. We can conclude that gender is not a risk factor for post-extraction bleeding.

The number of post-operative hemorrhagic complications in the VKA group was 12 cases in patients under 65 years of age and 6 cases in patients aged 65 years or older. For the DOACs group, there were 5 cases of hemorrhagic complications in patients under 65 years of age and 13 cases in those aged 65 years or older ($p=0.04<0.05$, Yate's test). We can suggest that there is a correlation between bleeding and the advanced age of the patient. The risk of bleeding associated with VAK is higher after the age of 65. Changes linked to aging, multiple pathologies or even polymedication expose the elderly subject to more significant complications during a bleeding episode.

In our study, we recorded 16 cases of hemorrhagic complication in patients taking Rivaroxaban, or 21.9%. For patients taking Apixaban, the percentage of hemorrhage was 5.56%, while it was 6.7% in patients taking Dabigatran (Fischer test=2.26 with a probability p=0.21).

These results corroborate with the results found by Brenan et al.; Hiroshi et al. and Huang et al., who did not find any significant difference between the three groups of patients undergoing DOACs treatment. Post-avulsion hemorrhages in patients undergoing DOACs treatment should be considered taking into account the following factors:

- Pharmacological factors, which are related to the maximum plasma concentration of the DOAC. This concentration is obtained between 2 and 4 hours after taking the medication for Rivaroxaban. As for Apixaban and Dabigatran, they are taken in the form of tablets in two doses per day, in the morning and in the evening. The maximum concentration is reached between 2 and 4 hours, so bleeding can occur both in the morning and in the evening.
- The European Hearth the European Heart Association (EHRA) recommends that blood tests be performed 4 hours after taking the medication.
- Local factors related to the course of the alveolar healing process. The fragility of the fibrin-platelet clot formed during the first days of healing may be a risk factor.
- Other factors, such as patient age and periodontal disease, may also influence the risk of post-extraction hemorrhage.

We also recorded the number of periodontal lesions in each group, with a total of 33 lesions in the VAK group and 39 in the DOACs group. We assessed the number of therapeutically induced hemorrhages (tooth extraction) in patients with periodontal involvement and found 3 cases in the VAK group and 7 in the DOACs group.

These findings are consistent with the results of the work of Mauprivez et al., because they did not allow us to conclude on the existence of a link between periodontal diseases, gingival inflammation and hemorrhagic complications. On the other hand, the results of Huang et al., allowed us to find a significant relationship between periodontal inflammation and postoperative bleeding. The inflammatory state and congested periodontal soft tissues associated with poor oral hygiene increase the risk of bleeding in the oral cavity. In addition, periodontitis is also linked to diseases of the cardiovascular system. Studies have reported that periodontal pathogens can penetrate the cardiovascular system and interfere with the coagulation function of the circulatory system. However, the exact pathogenic mechanism is not yet elucidated.

Regarding the location of the surgical procedure in the group under AVK, out of the 18 cases of hemorrhagic complications recorded, we noted 13 at the maxilla, or 21.0% and 5 (27.78%) at the mandible. The number of hemorrhagic complications found at the maxilla in the group under DOAC was 5, or (9.1%), compared to 13 found at the mandible, or (25.5%). $p=0.02$ by Yate's test ($p<0.05$). The difference observed between these two percentages is therefore statistically significant. We can conclude, on the basis of the results obtained, that the two groups, under AVK and under DOACs, are not comparable, because the occurrence of postoperative hemorrhagic complications at the maxilla constitutes a risk factor in the group under AVK. Our results corroborate with the findings of Bertron et al.; Czembirek et al.; Berton et al., as well as the results of Iwata et al.

From an anatomical point of view, the maxilla which houses the group of molars and the tuberosities is a spongy and pneumatized bone and therefore not very resistant. An excessive effort of dental luxation at the level of this region exposes the maxillary vascular network especially in case of excessive effort of dental luxation to hemorrhagic complications.

The procedures performed were divided into two categories: Simple procedures, which consist of single dental extractions, and multiple procedures, which group together the extractions of two or three teeth simultaneously in the same quadrant.

In the VAK group, we found 15 cases of hemorrhagic complications in patients who underwent a single extraction, which represents 23.4%, and 3 cases of complications in those who underwent multiple extractions, which represents 17%.

In the DOACs group, we noted 14 cases of hemorrhagic complications in single-rooted patients (18.0%), and 4 after extraction of multi-rooted teeth (14.3%). Fischer test gave the following value: $p=1$ ($p>0.05$). This indicates that the difference between the two groups is not statistically significant. We deduce that the two groups are comparable with regard to the extent of the procedure. These results are consistent with those obtained in other studies such as those conducted by Yagyuu et al.; Mauprivez et al.; Lababidi et al.;

Citation: *Harfouche L, Lattafi R. Bleeding complications in patients on oral anticoagulants after dental extraction: A comparative study of VAK vs. DOACs. J Clin Dentistry Oral Health 2025;9(2):251.*

Huang et al.; Buchbender et al. When the surgical field is large, resection of the interdental septa allows satisfactory approximation of the wound edges, which improves hemostasis and better protection of the surgical wound. However, the risk of bleeding is multiplied when the number of extractions is greater than 3 teeth per procedure.

Conclusion

We have demonstrated through this study that the hemorrhagic complications occurring in patients treated with oral anticoagulants are comparable in both groups. Biostatistical analyses have confirmed the effectiveness of local hemostasis methods without interruption of anticoagulant treatment. These methods used in the management of patients on VAK are also applicable to patients on DOACS. The results obtained indicate that the benefit-risk ratio is in favor of continuing the administration of anticoagulants in the event of dental extraction.

Conflict of Interest

The authors declare that they have no conflicts of interest.

References

1. Milin C. New anticoagulants. Suggestions for management in oral surgery. Rev Odont Stomat. 2013;42:276-84.
2. Mueller RL, Scheidt S. History of drugs for thrombotic disease. Discovery, development, and directions for the future. Circulation. 1994;89(1):432-49.
3. Samama MM, Depasse F. From old to new anticoagulants: The role of the biologist. Ann Biol Clin (Paris). 2009;67:525-34.
4. Ahrens I, Lip GYH, Peter K. New oral anticoagulant drugs in cardiovascular disease. Thromb Haemost. 2010;104(1): 49-60.
5. Salem JE, Sabouret P, Funck-Brentano C, et al. Pharmacology and mechanisms of action of new oral anticoagulants. Fundam Clin Pharmacol. 2015;29(1):10-20.
6. Costantinides F, Rizzo R, Pascazio L, et al. Managing patients taking Novel Oral Anticoagulants (NOAs) in dentistry: A discussion paper on clinical implications. BMC Oral Health. 2016;16:5.
7. Wilson WR, Gewitz M, Lockhart PB, et al. Prevention of viridans group streptococcal infective endocarditis: A scientific statement from the American Heart Association. Circulation. 2021;143(20):e963-78.
8. Sendi P, Hasse B, Frank M, et al. Infective endocarditis: Prevention and antibiotic prophylaxis. Swiss Med Wkly. 2021;151:w20473.
9. Berton F, Costantinides F, Rizzo R, et al. Should we fear direct oral anticoagulants more than vitamin K antagonists in simple single tooth extraction? A prospective comparative study. Clin Oral Investig. 2019;23(8):3183-92.

Citation: *Harfouche L, Lattafi R. Bleeding complications in patients on oral anticoagulants after dental extraction: A comparative study of VAK vs. DOACs. J Clin Dentistry Oral Health 2025;9(2):251.*