## ORIGINAL ARTICLE

# Bleeding incidence after oral surgery with continued oral anticoagulation

Wolfgang Eichhorn • Jens Burkert • Oliver Vorwig • Marco Blessmann • Georg Cachovan • Jürgen Zeuch • Marc Eichhorn • Max Heiland

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#### Abstract

*Objectives* The aim of this retrospective study was to assess the incidence of postoperative hemorrhage in patients treated with coumarins without interruption of the anticoagulant treatment undergoing oral surgical procedures, mostly osteotomies for tooth removal, when compared with patients who had never been anticoagulated.

*Material and methods* Six hundred thirty-seven patients underwent 934 oral surgical procedures on an outpatient basis. The INR was measured preoperatively being 2.44 in the mean SD 0.61. Local hemostasis was carried out routinely (80%) with collagen fleece, local flap, and acrylic splint.

*Results* Of these 637 patients, 47 presented with a postoperative hemorrhage (7.4%), 15 of these 47 cases had to be treated in hospital (2.4%). All patients showed up finally with a good wound healing, no administration of blood was

Wolfgang Eichhorn and Jens Burkert contributed equally.

W. Eichhorn · J. Burkert · O. Vorwig · M. Blessmann · M. Heiland (⊠)
Department of Oral and Maxillofacial Surgery, University Medical Center Hamburg-Eppendorf, Martinistr. 52,
D-20246 Hamburg, Germany
e-mail: m.heiland@uke.de

J. Zeuch · M. Eichhorn Department of Oral and Maxillofacial Surgery, General Hospital Balingen, Tübingerstr. 30, D-72336 Balingen, Germany

G. Cachovan

Department of Restorative and Preventive Dentistry, University Medical Center Hamburg-Eppendorf, Martinistr. 52, D-20246 Hamburg, Germany necessary, and local measures revealed to be sufficient in all cases except for two patients, where the preoperative anticoagulant treatment had to be changed for 6 days. The bleeding incidence in 285 patients with comparable oral surgical procedures, who had never been anticoagulated, was 0.7%.

*Conclusions* The results suggest that oral surgical procedures can be performed safely without alteration of the oral anticoagulant treatment.

*Cinical relevance* Local hemostasis with collagen fleece, local flap, and acrylic splint seems to be sufficient to prevent postoperative bleeding.

**Keywords** Oral surgery · Anticoagulation · Postoperative hemorrhage · Phenprocoumon

### Introduction

Oral anticoagulant therapy prevents thrombosis and embolism. It is mainly administered in patients with prosthetic heart valves, atrial fibrillation, thromboembolism, and hereditary hypercoagulation disorders. Phenprocoumon (Marcumar) is one of the most commonly used oral anticoagulants. It belongs to the coumarin group and is a competitive inhibitor of the vitamin K, which is necessary for the carboxylation of glutamic acid on clotting factors II, VII, IX, X, and protein C and S. It inhibits the formation of gamma carboxyglutamic acid and the production of functionable coagulation proteins. Factors with the shortest halflife are affected first, and factors with the longest half-life recover last. Because the synthesis of active clotting factors is affected, changing the dose of phenprocoumon does not have an immediate effect on coagulation. Recovery is not only dependent on the distribution and elimination of phenprocoumon, but also on the synthesis of active clotting factors [1, 2]. The management of patients on oral anticoagulant treatment needing oral surgical procedures is discussed controversially. The possibility of severe postsurgical bleeding is a concern in any patient taking anticoagulants to prevent intravascular thrombosis or thromboembolus formation. By interrupting the anticoagulation for a brief period before surgery, this intervention has the potential of placing the patient at greater risk for formation of life-threatening thromboembolism [3]. Furthermore, there is evidence that thrombosis may actually be more likely to take place because of the hypercoagulability that may occur after stopping oral anticoagulants [4-7], although it is proposed to stop warfarin for 4-5 days for patients with low risk of thromboembolism by some authors [2, 8-11]. However, it seems logical and advantageous for the patients' health if the surgery would be performed without an alteration in the anticoagulant regimen.

The purpose of this retrospective study was to evaluate the postoperative bleeding incidence in patients treated with coumarins without interruption or diminution of the anticoagulant treatment and to compare the results to a group of 285 patients without any anticoagulant treatment. Both groups underwent oral surgery procedures, mostly osteotomies for tooth removal.

# Material and methods

The records of 637 patients, 423 males and 214 females, ranging in age from 26 to 93 years (mean 68 years, SD 12.1) with 934 oral surgical operations without modification of their oral anticoagulant treatment were retrospectively analyzed regarding the incidence of postoperative hemorrhages (Table 1). On every patient an average of 1.47 operations were performed. In the control group, there were 285 patients, 138 males and 147 females, age range 23–88 years (mean 64 years, SD 10.3) and 468 interventions—315 osteotomies, 71 apicoectomies, 31 extractions, 9 incisions, and 42 others like biopsies—were carried out. The anticoagulant activity of coumarin was evaluated by the

 Table 1 Oral surgical procedures (n=934)

	n	Percentage
Osteotomy	746	79.87
Extraction	88	9.42
Apicoectomy	26	2.78
Abscess incision	7	0.75
Others	67	7.17
Total	934	100

international normalized ratio (INR) preoperatively ranging from 1.2 to 4.2 (mean 2.44, SD 0.61) preoperatively. All surgical procedures were performed by the same two senior surgeons. For primary wound treatment, a combination of the following maneuvers (suture, compression, methyloxycellulose, acrylic splint, collagen fleece, mucoperiosteal flap, fibrin glue) was used (Table 2). Thirty-six percent of the procedures were performed in the molar region, 24% in the premolar, and nearly 40% in the frontal region. It was possible that one patient had procedures in different regions during the same operation. Locoregional anesthesia was obtained using articaine with epinephrine 1:200,000 (Ultracain D-S, Sanofi-Aventis) and scandicain 4% (Scandicain 4%, AstraZeneca) in patients suffering from recent (less than 6 months) myocardial infarction, recent coronary bypass, and poorly controlled hypertension. In cases of osteotomy or abscess incision, 1 g amoxicillin, three times a day, was administered for 5 days. Postoperative pain was treated with ibuprofen tablets 400 mg every 6 h for 3 days and additionally if needed. All patients were controlled on the first, 7th, 10th, and 14th day, suture removal on the 7th and 10th day. A hemorrhage was registered as an event if it required additional surgical intervention. All cases were treated with coumarin for the disorders listed in Table 3 being possible a case having two or more diseases. Patients with cardiac valvular disease received prophylactic antibiotic therapy according to the American Heart Association.

## Results

The overall incidence of a postoperative bleeding was 7.4% (47 of 637 patients). Fifteen of these 47 cases (2.4%) had to

Table 2 Primary wound treatment (n=934)

	n	Percentage
Primary wound treatment		
Suture	25	2.68
Compression	14	1.50
Methyloxycellulose	2	0.21
Methyloxycellulose, acrylic splint	21	2.25
Collagen fleece, suture	3	0.32
Collagen fleece, suture, acrylic splint	17	1.82
Collagen fleece, mucoperiostal flap	14	1.50
Collagen fleece, mucoperiostal flap, acrylic splint	729	78.05
Collagen fleece, mucoperiosteal flap, fibrin glue, acrylic splint	67	7.17
Acrylic splint	17	1.82
Suture, acrylic splint	25	2.68
Total	934	100.00

Table 3	Indication	for	anticoagulation	(male 423,	female 214	4)
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Disease	Sex		Total N	Percentage
	m n	f n		
Arrhythmia	101	47	148	23
Valve replacement	65	50	115	18
Thrombosis	59	32	91	14
Heart disease	61	29	90	14
Atrial fibrillation	59	30	89	14
Myocardial infarction	39	12	51	8
Pulmonary embolism	30	17	47	7
Pacemaker	24	9	33	5
Ischemia peripheral	30	0	30	5
Stroke	23	5	28	4
Valve disorder	11	9	20	3
Total	502	240	742	115

be treated in hospital with a duration from 1 to 9 days (mean 3.2 days, SD 3.3). About 70% of the postsurgical hemorrhage was observed in the molar, 30% in the premolar, and 30% in the frontal region. Cases suffering from postsurgical hemorrhage in the molar and premolar region were counted twice, resulting in 60 bleeding regions in 47 cases. On average 1.6 procedures had been performed in the 47 cases presenting with postsurgical hemorrhage. In 78% of the procedures resulting in postoperative hemorrhage, the wounds were routinely treated with collagen fleece, mucoperiostal flap, and acrylic splint, 7% with additional fibrin glue. Thirty-four cases (72%) were treated in the primary operation with collagen fleece, local flap, and acrylic splint, 4 (9%) with additional fibrin glue, 3 (6%) just with metyloxycellulose and acrylic splint, another 3 (6%) by using sutures and acrylic splint, 2 (4%) by sutures alone, and 1 (2%) by compression alone. All 47 cases of hemorrhage were resolved with local hemostatic measures, with the exception of two patients, where the preoperative anticoagulant treatment had to be changed for 6 days. A second intervention was necessary in 13 and a third surgical procedure in 6 patients (Table 4). None of the patients had massive bleeding requiring systematic therapy with vitamin K or plasma substitutes. No thromboembolic events were observed in the study population. The incidence of postoperative bleeding in the control group was 0.7% (2 of 285 patients).

## Discussion

The introduction of anticoagulant standardization with the development of the INR in 1983 made results of different

 Table 4
 Kind of first (01), second (02) and third (03) postoperative hemorrhage treatment

Postoperative bleeding 01 ( $n=47$ )		
Procedure	n	Percentage
Methyloxycellulose	17	36.2
Collagen fleece, local flap, acrylic splint	5	10.6
Collagen fleece, local flap, fibrin glue, acrylic splint	5	10.6
Methyloxycellulose, acrylic splint	4	8.5
Fibrin glue	4	8.5
Acrylic splint	3	6.4
Suture	2	4.3
Compression	2	4.3
Methyloxycellulose, acrylicsplint	2	4.3
Collagen fleece, suture	2	4.3
Suture, fibrin glue	1	2.1
Postoperative bleeding 02 ( $n=13$ )		
Compression	1	2.1
Methyloxycellulose	5	10.6
Methyloxycellulose, acrylic splint	1	2.1
Collagen fleece, local flap, acrylic splint	2	4.3
Collagen fleece, local flap, fibrin glue, acrylic splint	4	8.5
Postoperative bleeding 03 $(n=6)$		
Fibrin glue	1	2.1
Suture, fibrin glue	1	2.1
Methyloxycellulose	2	4.3
Methyloxycellulose, acrylic splint	1	2.1
Collagen fleece, local flap, fibrin glue, acrylic plate	1	2.1

prothrombin time comparable all over the world. This is achieved by using WHO calibration methods keeping the between laboratory variation within 4% [12]. An INR range between 2.0 and 3.0 is considered suitable for patients suffering from arterial and venous thrombosis. An INR range from 2.5 to 3.5/4 is recommended for mechanical heart valves by the American Heart Association/American College of Cardiology and the European Society of Cardiology/British Committee for Standard in Hematology [1, 2, 13–22]. Up to now, there is little consensus on how to manage the anticoagulation regimen for patients taking coumarins facing oral surgery. There is a range from continuing the anticoagulation, reducing the dose of the oral anticoagulation, and stopping oral anticoagulation completely. The complete cessation of warfarin in patients requiring anticoagulation can lead to serious thromboembolism ranging from death to serious neurological remnants [23-27]. Although there are four reported deaths and two nonfatal embolisms, many oral surgeons believe that there is a

Table 5 V	Warfarin st	udies: incidence of postoperative ble	seding in warfarin treated	d patients undergoing dental su	Irgery		
Author	Year	Study design	Number of patients	Number of surgical procedures	Surgical procedures	Mean INR	Incidence of postoperative bleeding (%)
Blinder	1999	Groups according to hemostatic modalities	150	359	Extraction, resorbable gelatin sponge, sutures, tranexamic acid fibrin glue	$\begin{array}{c} -2.38 \ (n=50) \\ -2.7 \ (n=50) \\ -2.19 \ (n=50) \end{array}$	8.6
Ferrieri	2007	Risk classification according to intervention Simple single or multiple (<4) extractions Complicate single	255	334	Extraction, osteotomy, if possible primary wound healing or approximation of wound margins, tranexamic acid	2.7±1.2	5.0
		extractions, simple multiple extractions (>5), biopsies, implant installation					
Sacco	2007	Group A Warfarin dose reduction, INR 1.5–2.0 Group B No modification	65	n=30: 1–2 procedures (number of teeth) $n=35$ : >2 procedures	Tranexamic acid, Flap elevation, wound closure, gelatin, oxidized cellulose sponges,	2.8±0.5	9.2
Blinder	2001	Groups according to INR value	249	543	Simple extraction, no flap elevation, gelatin sponge, multiple sutures, tranexamic acid	$\begin{array}{l} -1.74 \ (n=59) \\ -2.24 \ (n=78) \\ -2.63 \ (n=59) \\ -3.28 \ (n=30) \\ -3.8 \ (n=23) \end{array}$	12
Bacci	2010	Multicenter, prospective, case-controlled single-blind study	449	926	Extraction including surgical incision of the gum, oxidized cellulose, resorbable suture, gauze with tranexamic acid	2.14±0.66	1.55

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minimal risk of thromboembolism for those patients, whose anticoagulation has been discontinued for dental surgery [2, 7, 10, 11, 28, 29]. The interruption may expose the patient to a greater risk for the condition the patient is treated for prophylactically [3]. Furthermore the discontinuation may create a transient hypercoagulable state thus exposing the patients to a greater risk of thromboembolic events [4, 6], although this aspect is discussed controversially [9]. In order to differentiate between the severeness of the patients' morbidity, a risk classification was proposed. Patients under anticoagulation can be classified as high, moderate, and low risk for thromboembolism. High risk patients show for instance a history of a mechanical mitral valve, ballcage replacement, venous thrombosis <3 months, atrial fibrillation with history of stroke, and recent (<1 month) stroke or transient ischemic attack (TIA), while low-risk patients may suffer from atrial fibrillation without stroke, cardiomyopathy without atrial fibrillation, venous thrombosis older than 6 months without other risk factors like previous stroke, and TIA. Risk factors are left ventricular dysfunction, age over 75 years, hypertension, and diabetes mellitus. Intermediaterisk patients are those with a bileaflet tilting aortic disc valve or a chronic atrial fibrillation with over two stroke risk factors and patients with a venous thrombosis less than 6 months. Low-risk patients may suffer from atrial fibrillation without stroke, cardiomyopathy without atrial fibrillation, and venous thrombosis >6 months [8, 10, 30, 31]. In our study in only two patients, the anticoagulation had to be changed additionally to local measures with cessation of the coumarin and bridging therapy with unfractured heparin (UFH). Both patients had prosthetic heart valves belonging to the group of patients with high risk for thromboembolism. UFH is recommended for patients with prosthetic heart valves or arterial fibrillation with many risk factors for stroke because bridging with low molecular weight heparin may not protect these patients [2, 11, 28]. The overall bleeding rate in the presented study is 7.4% (47 of 637 patients) in the oral anticoagulation treatment group and 0.7% in the group of patients without oral anticoagulation treatment. This is in accordance with the literature ranging from 1.55% to 16% although the literature refers to extractions of teeth and not to osteotomies with mucoperiostal flap elevation as in our study (Table 5) [32–36]. Fifteen of these 47 cases (2.4%) had to be treated in the hospital with a mean duration of 3 days (1-9 days). About 70% of the postsurgical bleeding had to be observed in the molar, 30% in the premolar, and 30% in the frontal region. This indicates that molars have a twofold higher potential to bleed than a premolar or a front tooth. Well-established maneuvers for the prevention of postoperative hemorrhage after oral surgery include the use of fibrin sealant [37, 38], which proved to be effective as tranexamic acid mouthwashes [33]. In the presented study, fibrin glue was additionally applied for primary wound treatment in severe cases with an INR 3-4 or for the treatment of postoperative hemorrhage. A prophylactic dose of antibiotics to prevent subacute bacteremia is regarded to be safe, but a 5-10-day administration postsurgery has been described to change the intestinal bacterial flora resulting in reduced vitamin K resorption und increase of INR and should be avoided in patients with altered coagulation status [39, 40]. The findings of the presented study do not support this recommendation, because in nearly all patients with osteotomies a 5-day course of amoxicillin was given. However, because clindamycin can result in a rapid increase of INR, this antibiotic was avoided. The results of this retrospective analysis of 637 patients with oral surgical procedures including osteotomies (80%) with mucoperiosteal flap elevation, dental extractions (10%), apicoectomies (3.5%), and others (6.5%) reveal that these procedures can safely be performed without changing oral anticoagulation treatment, what is in agreement with earlier similar recommendations [13, 22, 31–34, 41–43].

**Conflict of interest** The authors declare they have no conflict of interest.

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