Bleeding in Office Dental Practice: Does it bother you?

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Abstract

More than expected bleeding complicates several office dental procedures thereby leading to increased morbidity or an aversion towards similar surgeries in the near future in a clinician's mind. Though most research labels dental surgical procedures as minor surgeries which obviously has a minimal bleeding risk, nevertheless the chances of the such bleeding increases in patients on anticoagulant therapy. In cases known for having pre-existing diseases such as hereditary bleeding disorders viz. von Willebrand disease, Hemophilia, etc. or those with a past history of exacerbated bleeding present to the clinician a definitive need for use of local/interventional methods to control such bleeding.

Through this paper, an attempt is being made to discuss in substantial detail the mode of action, uses, efficacy with side and adverse effects of currently available local hemostats (agents and drugs) for office dental surgery.

Keywords: bleeding, antiplatelet, hemostasis, pharmacological agents, topical agents, dental surgery

Introduction

Surgery which includes dental surgeries always carry a potential risk of periprocedural undesired bleeding.

Office dental surgeries include a clean incision or reflection of mucoperiosteum, simple or complicated exodontia, alveoloplasty, flap surgeries, etc.[(1)] Controlling bleeding is the most critical step in office dental procedures as overzealous bleeding may lead to increase in the chair side time thereby increasing morbidity as there are repeated visits to the clinic and a rare need for hospitalisation.To prevent such sequelae when prolonged or delayed bleeding occurs inspite of using all known measures to control it a plethora of hemostatic drugs/agents available at our disposal can be deployed periprocedurally.[(2)] Despite the increase in the numbers and variety of local agents over the past few decades, acceptable level of evidence based research about the appropriate use of such materials/drugs during periprocedural dental bleeding is currently not widely available.

The peri procedural therapy for patients on anticoagulant drugs also remains to be a topic of significant debate and controversy. The risk of hemorrhage must be weighed with the potential for thromboembolic sequelae. Hence recommendations for office dental surgery in patients on such drugs remains quite confusing, inspite of several publications in both dental[(4)] and medical[(5)] fields.

Discussion

This article aims to define practical, efficient methods to manage uncontrolled bleeding during office dental procedures, mainly for patients with predisposing factors. Role of commonly available pharmacologic and topical materials/drugs to minimise periprocedural bleeding during office dental surgeries and with their mechanism of action, clinical efficacy and use plus side effects will be discussed.

Normal Hemostasis

Primary and Secondary coagulation systems (refer to schematic Figure 1) maintain blood fluidity in the absence of trauma/injury and forming a clot whenever it occurs.[(6)]

Cessation of bleeding and avoiding thromboembolism depends directly on a good balance between pro and anticoagulant systems.[(6)]

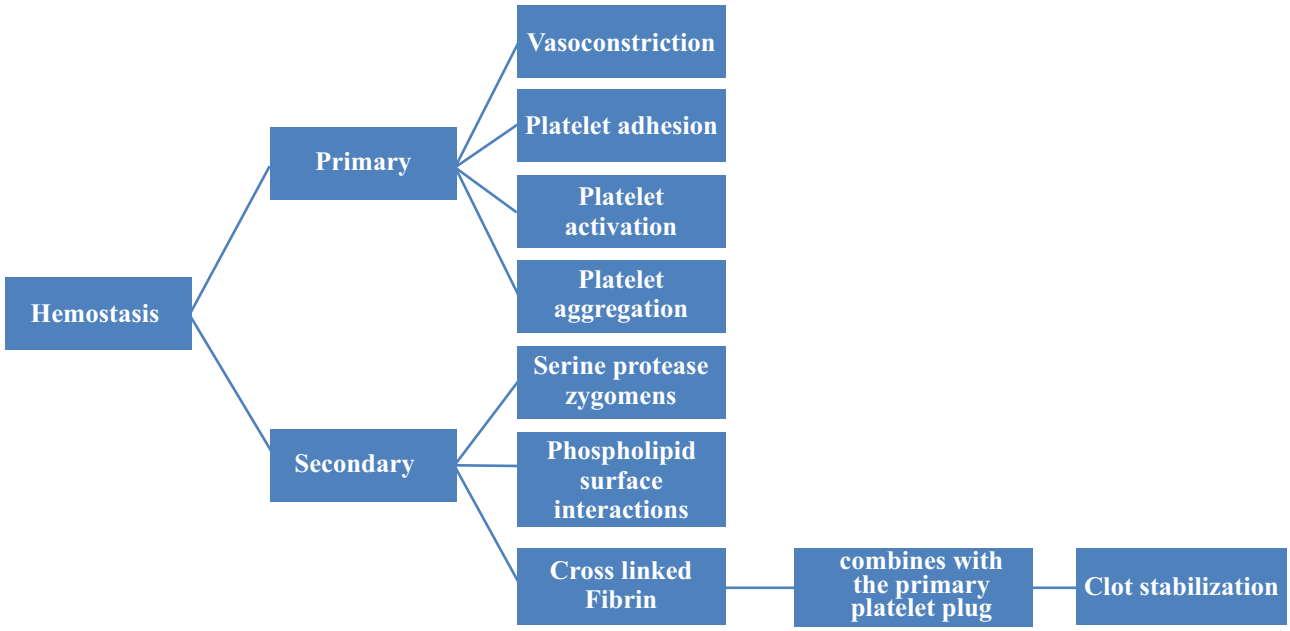

Figure 1 : Types of Hemostasis

Bleeding diathesis in office dental procedures -

Hemorrhage is classified as:

1. Primary hemorrhage: Intraoperative Bleeding
2. Reactionary hemorrhage: Post surgical (after 2-3 hrs) bleeding
3. Secondary haemorrhage: Bleeding which occurs a fortnight after the surgery; infection is the probable cause

Intra or post-surgical bleeding can occur through the hard and soft tissues or in rare cases directly from the vessels.[7,8] Bleeding disorders are nothing but an increased susceptibility to bleeding, which can be either hereditary, acquired or autoimuune.[12,13] Few commonly occurring bleeding disorders will be mentioned here- (Table 1)

Table 1 : Commonly occurring bleeding disorders.

Platelet Disorders	Thrombocyopenias: Immune Thrombocytopenia, Drug induced Thrombocytopenia (Chemotherapy, Heparin-induced), Hypersplenism, Myelodysplasia/Aplastic Anemia
	Platelet function alterations: Adhesion disorders – Genetic, von Willebrand disease
	Therapeutic Platelet inhibitors – $P2Y_{12}$ inhibitors (Clopidogrel and Prasurgel), Cyclo-oxygenase inhibitors (Aspirin), Phosphodiestarase inhibitors (Cilostazol), GP IIB/IIIA inhibitors, Adenosine reuptake inhibitors (Presantine), Uraemias, Cirrhosis
Coagulation Disorders	Haemophilia: Factor deficiencies VIII (A), IX (B) and XI (C), Factor antibody syndromes, Hepatic dysfunction
	Therapeutic anticoagulants: Vitamin K antagonists (Warfarin, Acecoumarol), Low molecular weight heparin (Tinzaparin, Enoxaparin, Dalteparin), Direct dental anticoagulants (Factor II inhibitor – Dabigatran, Factor X inhibitor – Apixaben, Rivaroxaben)
	Diffuse intravascular coagulopathy
	Massive transfusion states
Vascular Disorders	Scurvy
	Hereditary Haemorrhagic Telangiectasia
	Ehlers-Danlos syndrome
Fibrinolytic Defects	Streptokinase therapy
	Disseminated intravascular coagulation

Dental patients with a history of inherent bleeding have a very high probability of perioperative bleeding. Severity of such bleeding is related to the underlying disease like Hemophilia. Patient dependant factors include severe periodontitis, disorders involving primary or secondary hemostasis and procedural factors like number, type of tooth/teeth extracted, size and anatomical location of the tooth etc.[17]

Immune/Idiopathic thrombocytopenia

Autoimmune/Idiopathic bleeding diathesis is a condition, characterized by isolated thrombocytopenia without a clear clinical etiology.[1]

Commonly used medications which can alter hemostatsis -

Anticoagulant drugs are commonly prescribed for a multitude of conditions worldwide. They are used to prevent thromboembolic events since the past 50-60 years.[1] Unintentional internal or external major or minor bleeding are some of the inadvertent sequelae associated with the use of these agents.[4] Most commonly platelet inhibitors, antagonists of Vitamin K and oral anticoagulants are used. Sometimes, high risk patients may report serious periprocedural bleeding in dental surgeries. The local hemostats discussed in this article will be of great help in such cases to control undesired bleeding. (Table 2)

Preoperative assessment of bleeding risk -

The clinician should estimate the probability of bleeding in the elective surgical procedure, preoperatively. The clinician can then decide on the peri operative plan. Though the standard accepted guideline for International Normalised ratio (INR) value is 1[68], a leeway of upto 2-3.5 is suggested for patients on anticoagulant therapy. A combination of local and systemic measures can be used as and when required in such situations.

Presurgical evaluation

- Detailed patient history which shall enumerate the drug regimen so as to anticipate the potential undue bleeding
- Modificaction of surgical therapy into multiple appointments in patients who are on anticoagulant drugs
- Lab tests – Absolute platelet count (APC), Prothrombin time (PT)/INR especially in medically compromised cases
- Feamles and Old age are predisposing demographic risks
- Systemic diseases at risk of causing periprocedural bleeding : Diabetes Mellitus, Obesity, Systemic Hypertension, Bleeding disorders, Chronic Renal disease and failure, Chronic Liver disease and failure, etc.
- Early/Morning appointments for surgery so as to allow the patient to come back to the office in case of uncontrolled/continuos/delayed bleeding

Red flagging potential bleeders -

Bleeding risk is high in –

- Patients with a known history of bleeding in the family
- Previous history of bleeding after surgical procedure or trauma
- Individuals on drugs viz. Antiplatelets/Anticoagulants and long-term antibiotics.

Diseases which can cause bleeding -

  - Leukemia
  - Congenital heart disease
  - Chronic Liver disease
  - Hemophilia
- Advanced periodontal disease

The surgical plan in these patients is modified to consist of a preoperative phase in which scaling, root planning and chlorhexidine gargles is done fortnight before the planned surgery.[19]

Ranking the risk of bleeding –

- High
- Moderate
- Low

In low risk patients, anticoagulant drugs are not stopped, in view of the relatively disastrous sequelae like thromboembolism Temporary discontinuation/Bridging of the anticoagulant drug regimen may be needed in cases with a high probability of periprocedural bleeding.[18,62-64]

Table 2: Common office procedures which demand no interference with anticoagulant therapy –adapted from Kaplovitch and Dounaevskaia

Dental interventions that are unlikely to cause bleeding	Dental interventions that are likely to cause bleeding(low risk)
Local anesthesia	Ordinary extractions (I-3)
Basic periodontal clinical examination	Incision and drainage of intradental abscess
Supragingival cleaning	Periodontal probing
Supragingival indirect or direct restorations	Subgingival scaling
Endodontics	Subgingival margins of direct or indirect restorations
Impressions and other prosthetic procedures	Implant surgery
Fitting and adjustment of orthodontic appliances	Soft-tissue biopsies

*** For vitamin K antagonist therapy (INR values should always be within the therapeutic range when possible)**

Material & Methods

Biological Topical Hemostatic agents for office use-

Peri surgical bleeding can occur in either a healthy adult or medically diseased individuals.Patients may bleed indiscriminately perioperatively due to a variety of reasons viz.

- Anticoagulant therapy
- Inherited bleeding disorder
- Uncontrolled hypertension
- Extreme soft tissue trauma
- Non-compliance to postoperative instructions

Patients which the abovementioned comorbidities, necessitate the application of a topical hemostatic which is effective and has a significant benefits like decreased surgical time, minimal exposure of the surgical site thereby decreasing fatality in cases on anticoagulant therapy.

The hemostatic agent of choice should be biologically inert and compatible, economical and effective[11,19,20]. A well-informed clinician will have an ability to choose the most efficacious, potent and practically applicable hemostatic as per the requirements and availability of the drug/product after weighing the risk benefit ratio.

In relation to local hemostats in office dental surgeries, currently available evidence is not enough and conclusive. Most citations describe different types of single use or combinations of topical agents to decompensate effects of anticoagulant drugs.[22] Commonly used topical hemostats for office dental procedures with FDA (Food and Drug Administration) approval are given below - (Table 3)

Classification of local biological hemostats -

1. Passive
2. Active
3. Flowables[30]

Table 3: Types and commercial names of commonly used biological materials– Pereira et al.[21]

Topical hemostatic		Commercial name
Passive or Mechanical Agents	Gelatins	Surgifoam®, Gelfoam®, Gelfilm®, Gelitaspon®, Geli putty®
	Collagen	Instat®, Helitene®, Helistat®
	Cellulose-based products : oxidized regenerated cellulose	Surgicel Original®, Surgicel Nu-Knit®, Oxycel®, Surgicel Fibrillar®, Interceed®, Gelitacel®
	Cellulose-based products : oxidized cellulose	ActCel®, Gelitacel®
	Polyssacharide hemospheres	Arista™ AH
	Adhesives	BioGlue®
Active Agents	Topical thrombin	Thrombin-[M]®, Evithrom®, Recothrom®
	Fibrin sealants	Tisseel®, Evicel®, Crosseal™
Flowable agents	Porcine gelatin + thrombin Bovine collagen + thrombin	Surgiflo®, Floseal®

Passive/Mechanical agents

These agents are found to be very effective in small volume bleeding, by supplementing activation and aggregation of platelets. Thus there is a matrix formed at the surgical site which acts as a barrier. Bleeding is stopped by stimulating the extrinsiccoagulation cascade thereby providing ascaffold which allows faster coagulation.[23] As these products are inert in nature, they depend on the patients' own fibrin to reach hemostasis. Passive hemostats are indicated only in cases with a normal or near normal coagulation cascade.[27] Mostly used as frontline agents as these are readily available, not requiring any special store conditions, and reasonable costs.[11,27,24]

Gelatin (Gelfoam®, Surgifoam®, Gelita-Spon®, Gei Putty®) (Figure 2a, 2b)

Reasons for popularity in office dental surgical procedures (Extractions, Periodontal surgeries)

- Affordability
- Ease of use
- Good hemostatic activity
- Gelatin is derived frompurified animal collagen which

undergoes hydrolysis to form a hydrocolloid. It is available as a sponge or powder which can be converted to a paste or film. It can be placed dry or wet (mixing with saline). Products with gelatinous base adapt very well to all types of wounds and surfaces making them highly popular. The mechanism of action is mainly physical. There is a reduced risk of bleeding when used in high risk cases.

Figure 2a : Surgifoam

Gelatin is derived frompurified animal collagen which undergoes hydrolysis to form a hydrocolloid. It is available as a sponge or powder which can be converted to a paste or film. It can be placed dry or wet (mixing with saline).[14,21,25,26] Products with gelatinous base adapt very well to all types of wounds and surfaces making them highly popular.[20] The mechanism of action is mainly physical. There is a reduced risk of bleeding when used in high risk cases. [21,27]

Figure 2b : Gelfoam

Gelfoam is the most popular, most affordable and most readily available compressible sponge derived from gelatin in purified porcine skin. It is capable of absorbing liquids/blood.[26] When placed in soft tissues complete resorption occurs within 4-6 weeks.[28]

Collagen (Helistat®, Instat®, Helitene®) (Figure 2c, 2d)

Figure 2c : Integra

Products based on collagen are non-toxic, absorbable and non-pyrogenic. They are sourced from bovine sources of dermal collagen/tendon.Collagen sheets/plugs make a scaffold of matrix which acts as a base for formation and consolidation of clot.

They also enhance release of clotting factors along with aggregation and degranulation of platelets. Their commercial supplu in sheets, flour and plugs facilitates adhesion and adaptation to irregular wound surfaces easy and convenient. Though collagen based products are priced higher than their gelatin based counterparts, hemostasis is achieved relatively fast in 1–5 min. These agents resorb in 8-10 weeks when left in situ. Since materials are mainly bovine based they might lead to swelling and foreign body reaction like response in some cases.[23]

Figure 2d : Helistat

Helistat® , a collagen based sponge like product is derived which undergoes a process of purification and freeze drying.[11, 27] It holds fluids many times its actual weight, making it highly absorbent. Collagen causes platelet aggregation when it contacts blood. For achieving good bleeding control, Helistat® is left in place for an approximate duration of 2–5 minutes. Thereafter, need based replacement can be done. Dry and to the size handling of the product is recommended for ease of usage. It is fully resorbed in 14–56 days.[11, 27, 29] It sometimes fosters bacterial growth thereby acting as a nidus for infection[11, 27, 30] and therefore its prudent not to place it in

contaminated surgical sites or those with any kind of pre-existing infection. Allergic/Foreigh body reactions and adhesions may be seen in some patients.[27,31]

Oxidized regenerated cellulose (Surgicel®, Oxycel®, Interceed®)

Oxidized cellulose was first used in the US in 1940s. Then in 1960s, another topical agent by the name of oxidized regenerated cellulose (ORC) was introduced. It was an absorbable, knitted fabric mesh like material made by treating sterilized cellulose— commercially available today as Surgicel®. It was derived from vegetable-based alpha cellulose. Surgicel/Oxycel is ready-to-use which can be easily stored at room temperature. Fluid absorption is 7–10 times of the actual weight of the product.[20,23] ORC causes activation of platelets when it comes in contact with them and then forms a gelatinous matrix, thereby assisting clot formation.[23] It requires a dry field for application and is most effective in veno-capillary bleeding.A combination with Thrombin is ineffective due to low pH. [27,32] It generally resorbs within 4-8 weeks, depending on the local physiological factors.[27,33-35] Excess of material can delay healing in some cases.[27] Its usage in osseous defects delays bone regeneration and healing. [11, 27, 24] Acidic nature of the material may lead to encapsulation of fluids, allergy like reaction, inflammation and necrosis of the wound.[11,27]

The most commonly available materials include Surgicel and Oxycel. Surgicel fibers are solid whereas Oxycel has hollow fibres. Both are weaved to form a grid matrix like structure..[23]

Oxidized cellulose (ActCel®, Gelita-Cel®) (Figure 2e)

Figure 2e : Polysaccharide hemospheres (AristaTMAH)

When contacted with blood the volume of this material increases by 3-4 times its original volume. It forms a gel like structure which breaks down completely into glucose and water by 3-4 weeks thereby causing no hindrance in wound healing.[11,27]

Gelita-Cel® is a rapidly acting, ORC topical gauze derived naturally. It resorbs within 96 hours thereby decreasing the chances of encapsulation.[11,27,30]

Polysaccharide hemospheres (AristaTMAH) (Figure 2f)

New category of topical biological agents used for controlling bleeding. They are obtained from vegetable starch, and made available for use in the form of a powder. These agents act by forming a barrier on account of its hydrophilic nature thereby concentrating the solid components of blood.[11,20] Thus a 3D scaffold is formed which enhances formation and maturation of clot inspite of no intrinsic coagulation activity.[11, 37, 38] As this material contains sugar it is contraindicated in diabetic patients.[20]

Figure 2f : ARISTA AH

AristaTMAH (Figure 2f) (FDA-approved) is used in dental procedures to control bleeding when conventional practices, viz.pressure and ligature are not unable to completely stop bleeding makes it a handy material at the disposal of the clinicians.

Actcel® acts by binding to calcium ions thereby making it specifically available at the surgical site for the aggregation of platelets and the process of coagulation.[14,20,30] This causes a 3- dimensional stabilisation of the clot. This can be used in sockets of third molars to prevent dry sockets, periodontal procedures and orthognathic surgeries.[20] Since it contains no chemical additives like collagen and thrombin it is a relatively inert material. Its bacteriostatic nature is particularly useful in infected and contaminated wounds.[20,36]

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Adhesives (BioGlue®)

Hemostatic adhesives are adjuncts to conventional hemostatic measures to control bleeding.[23] BioGlue is the most popular material of this group. Commercially supplied form is made up of a solute of 10% glutraldehyde and 45% bovine purified albumin[1,46] BioGlue® is used extensively because its sealant and hemostatic qualities. It has a potential for leakage via suture tracks.[20]

Active agents

As the name suggests these biologic agents play an active role in the process of coagulation by directly participating in it.[19,20]

Thrombin (Thrombin-JMI, Evithrom, Recothrom) (Figure : 3 a

Figure 3a : Topical Thrombin

Thrombin is necessary for topical hemostasis and inflammatory cell signalling processes. Being main component of the clot it also fosters the generation of fibrin from fibrinogen.[11,20,21] In yesteryears Thrombin which was an efficient a hemostatic agent was derived from bovine plasma (Thrombin-JMI) thereby inducing a hyperimmune response.[21, 39] This restricted its use in hemodialysis patients who already have an increased levels of antibodies and can the use of topical bovine thrombin can lead to thrombosis and coagulopathy.[21, 40] Thus Thrombin derived from humans was discovered and it is known as Evithrom (plasma derived) and Recothrom (recombinant human thrombin). Browman et al in 2010[41] demonstrated, that in a comparison of Recothrom and Thrombin-JMI, Recothrom demonstrated a better profile of safety and minimal immune reaction with no decrease in its hemostatic potential when weighed against Thrombin-JMI. It may be used locally, individually or combined with gelfoam (most common), gelatin matrix or in powder form, or spray.[11,20]

Fibrin sealants (Tisseel, Evicel, CrossealTM) (Figure: 3b)

Fibrin sealants/glue is obtained from the blood derivates of humans or cows. It simulates the last phase of the coagulationpathway and helps in clot generation.[23] Thereby controlling both local and diffuse bleeding from the operative site. Severe bleeding cannot be controlled with fibrin sealants. Mostly used after dental extractions, periodontal procedures and bone grafting surgeries if required.[11]

It is also routinely used in complex oral surgical procedures.

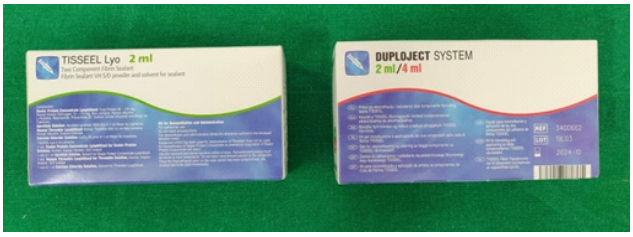

Figure 3b : Fibrin sealant (Tisseel)

Tisseel –1st sealant to have and FDA approval. It is composed of Fibrinogen and human thrombin plus aprotinin (bovine derivative – allergic potential) and $CaCl_2$. Multiple exposures can lead to allergic responses, ranging from mild reactions to anaphylaxis.[23,42] It requires a dry surgical field and should be ideally used before hemorrhage starts. Here fibrinogen polymerizes before blood pressure induced increase in local microcirculation. In cases where the bleeding has already started, local pressure application over the wound is recommended to allow polymerization.[21,43] Tisseel, is supplied as a pre-filled syringe and therefore allows for quick and effective use.

Evicel, is derived from pooled human plasma. It is supplied in 2 different bottles which contain fibrinogen and Evithorm Before use, the two frozen liquids are thawed, defrosted, heating (upto 20–30°C) and then mixed.

CrossealTM is a virally inactivated, 2nd generation sealant. It is made from a concentration of human coagulation proteins.[44] It is applied by spraying or dripping it at the surgical site.

Feracrylum (Themiseal liquid, Sepgard gel, Hemolok) – (Figure : 3c)

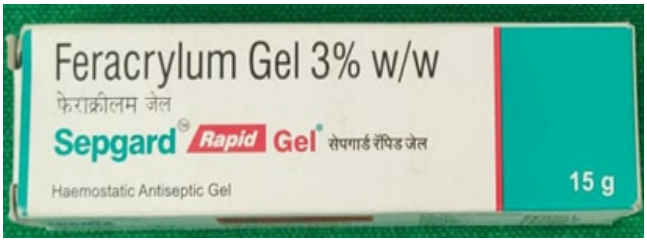

Figure 3c : Feracrylum (Sepgard Gel)

It is a polyacrylic polymer which is non allergenic, water soluble though cannot be absorbed by the system. It's a hemostatic as well as an antiseptic agent. It is used during surgeries from incision to healing, typically as an adjunct to conventional hemostatic in capillary and vein oozing in several surgeries along with dental and oral surgeries.

Mechanism of action –

3 ways

1) Hemostatic – fastens clot formation and stops bleeding by forming a biodegradable complex with albumn
2) Hygroscopic – promotes faster healing by aiding the growth of granulation tissue, helps easy removal of dressing
3) Antimicrobial – against gram positive, gram negative bacteria and fungi thereby decreasing the risk of wound infection

Dosage –

1% w/w/100 ml for solution

3% w/w for Gel and Tulle

Contraindications –

History of allergy to drug or its ingredients

Persons taking Epsilon aminocaproic acid (EACA) for any bleeding disorders

Tranexamic Acid[14,15,16] (Inj. Pause, T. Pause) –

It acts by slowing down the breakdown of blood clots, thereby preventing prolonged bleeding. It belongs to the antifibrinolytics group of drugs.

Mechanism of action - Competitive and reversible inhibition of the activation of plasminogen via binding at several distinct sites, including 4-5 low-affinity and one high-affinity site, which is the site for fibrin binding. This plasminogen-fibrin binding normally triggers fibrinolysis. By occupying these binding sites tranexamic acid prevents the dissolution of fibrin, thereby stabilizing the clot and preventing further bleeding.

Indications –

Oral	Intravenous (used for 2-8 days)
Hereditary angioedema	Hemophilia
Premenopausal females	Prevention of pre or post op office or major surgical bleeding
Heavy menstural bleeders	

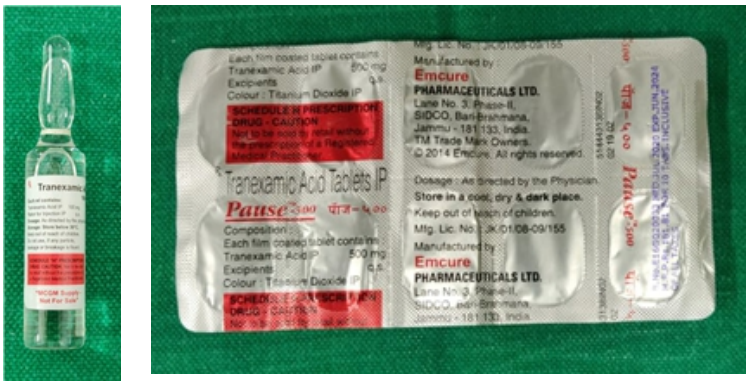

Figure : 3d Tranexamic Acid (Inj. Pause, T. Pause)

Flowables (Surgiflo®, Floseal®)

Categories –

1. Porcine gelatin based
2. Bovine collagen based

Both can be combined with, which can be combined with thrombins (bovine, human-pooled plasma thrombin, or rhThrombin). These agents are postulated to be the most efficacious local agents.t[23,45]

Surgiflo is an absorbable, porcine gelatin matrix, combined with bovine-derived thrombin. When used directly over the bleeding area it activates the coagulation cascade.[23] Polymerization of the sealant components occurs due to topical pressure.[21]

Floseal is composed of a gelatinous matrix derived from the cow, human plasma rich in thrombin plus $CaCl_2$. The uniqueness of this material lies in sealing of the bleeders when it contacts blood by virtue of 10-20% expansion of Its gelatin granules plus there is activation of coagulation by conversion of fibrinogen to fibrin which is catalysed by thrombin.[20,23] This also makes its adaption to irregular

wounds very easy and convenient and hence it's a preferred hemostat in office dental plus major surgeries where other traditional methods have failed. They are effective in both soft tissue and bony wounds.[20,23]

Also we can conclude that blood is required at the site for the activation of this product.[21.23.46]It reabsorbs within a period of 6-8 weeks which is also the routine duration for uncomplicated wound healing. There is a potential of transferring infections and therefore should not be used in cases with a known history of hypersensitivity response to any of its components.[20]

Invasive methods to control bleeding – (Figure 4a : Truglyde™)

- Suturing extraction wounds
  - Figure of 8 suture
    - Non resorbable material
    - Resorbable suture material

Figure 4a : Resorbable suture material (Truglyde™)

  - Suturing over the biological dressing material
- Direct Vascular Ligatures or Clamping
  - Halsted/Curved Hemostats (Figure 4b)

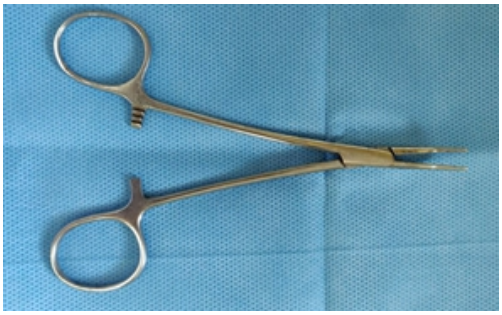

Figure 4b : Halsted/Curved Hemostats

- Thermal Quaterization of the bleeder
  - Monopolar – allows field coagulation of the bleeding area (Figure 4c)

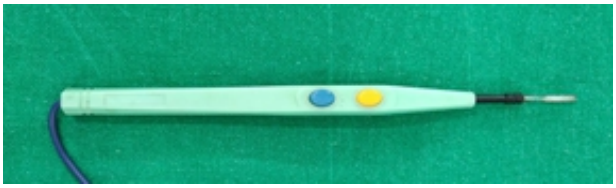

Figure 4c : Monopolar

  - Bipolar – allows direct and precise coagulation of the bleeding vessel (Figure 4d)

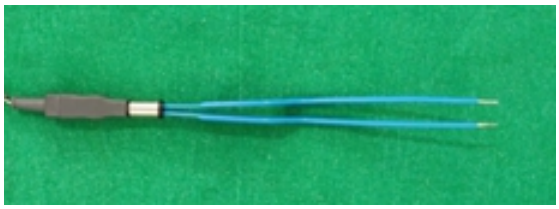

Figure 4d : Bipolar

Invasive techniques can be used in office dental practice as final preventive steps to control moderate to high levels of per-procedural or post-surgical bleeding. A certain degree of skill and expertise along with knowledge is desirable for effective selection and use of such invasive methods.

Effectiveness of different biological agents -

Even though conventional techniques viz. suture/ligature and tactile pressure promotes hemostasis, they are not effective every time especially in less accessible areas and complex dentofacial injuries. Furthermore, hemostasis is especially challenging in cases having congenital or acquired coagulation disorders.

Topical biological hemostatic agents comprise a variety of products all of which aim at controlling bleeding. From a review of most of the recent clinical studies, which compare and rate the various hemostats we can clearly notice the heterogenities in these articles in terms of a lack of standard protocol or methodology when such reviews were made plus [2,3,47-61] a minimal number of randomised trials.

In a nutshell, there are many topical biologic hemostats which have a multitude of applications. Presently, there is nothing like an evidence-based therapy to guide the clinician about selection of an appropriate agent.

Bleeding in office dental practice: Clinical Implications

Office dental surgeries are mostly labelled as minor surgeries which have very low

blood loss and minimalistic post-surgical bleeding risk. Such type of bleeding is generally controlled by topical measures, which are discussed here.[18,62-66]

Common anticoagulants and potential interactions with dental medications

Even though it is widely known that anticoagulants help in preventing thromboembolic events still their potential for perisurgical bleeding cannot be ignored. Also the interactions of such drugs with other commonly used medications in dental practice leads to an increased risk of bleeding in most of the cases plus other fatal complications it is very difficult to

predict the gravity of such interactions as they are grossly dependent on the pharmacodynamics of the drugs involved.[18,67]

As far as patient safety is considered, the potential for drug interactions and a thorough knowledge of appropriate monitoring and management, is important. Selection of an appropriate anticoagulant agent which has minimal or no drug interactions is very crucial.[7–12,13,18] Commonly occurring drug interactions between various dental and anticoagulant drugs is given below -[18,62,68] (Table 4)

Anticoagulant medication	Drug interactions with anticoagulants*
Vitamin K Antagonists	Antibiotics* [92,93] : Clindamycin; Amoxicillin; Amoxicillin Clavulanate; Cephalexin; Doxycycline; Macrolides; Metronidazole
Warfarin Acenocoumarol	Azole antifungals [92] Analgesics [94-96] Carbamazepine Oxcarbazepine Nonsteroidal anti-inflammatory drug
Direct Dental Anticoagulants Apixaban Rivaroxaban Dabigatran Edoxaban	Antibiotics [97] : Clarithromycin; Erythromycin[b] Azole antifungals [97] Analgesics [97] Carbamazepine Nonsteroidal and-inflammatory drugg
Low-Molecular-Weight Heparins Tinzaparin Dalteparin Enoxaparin	Analgesics [98] Nonsteroidal anti-inflammatory drug

* "This list is not exhaustive. * Single does of antibiotics are unlikely to modify anticoagulation effect in a clinically significant manner. Consider increased monitoring for 2 or more days of treatment. [b]Erythromycin predominantly interacts with Dabigatran and Edoxaban*

Table 4 : Anticoagulant drugs and their interactions with medications deployed commonly in dental practice-Kaplovitch and Dounaevskala[18]

Calculating blood loss –

Before we can determine the volume of permissible blood loss for any individual; we need to first understand the normal volume of blood in different patients. The average blood volume of an adult male patient is 75ml/kg body weight and that of an adult female patient is 65 ml/kg body weight. These levels increase to 80-85 ml per kg body weight in neonates and infants.

Transfusion Trigger -

The need for blood transfusion is based on the commonly used "10/30"rule which states that a patients' Hemoglobin should be maintained at or above 10 g/dl or hematocrit at or above 30 %.

Calculation of Allowable blood loss[16-21] -

Acceptable blood loss (ABL) = Calculated Blood Volume (CBV) X Hi (Initial hematocrit) – Hf (Final hematocrit) / Hi (Initial hematocrit)

Step 1: Calculated Blood Volume (CBV) = Patient's weight (in kilograms) X Blood volume (as per the normal levels for age and gender mentioned in the table above)

Step 2: Decide the tolerated decrease in hematocrit from initial hematocrit by the patient.

Estimating Blood loss -

Blood lost can be estimated by measuring the volume of fluid absorbed in the mops/pads/gauzes used during the surgery. The absorption by these dry mops/pads used during surgery depends on their size.

4 x 4 cm = 10 ml (commonly used in dental practice)

30 x 30 cm = 100 ml

Based on this we determine the exact volume of blood loss that ispermissible for a particular patientduring surgery andthen take the exact number of mops, pads and/or gauze.

Let's understand this with an example 50 kg female with pre-operative hematocrit of 45%. So, what is the allowable blood

loss for the final or the targeted hematocrit of 30%?

The number of mops / gauzes that can be deployed intraoperatively?

Step 1. CBV = (weight in Kg) X (Blood volume in females)
= 50 x 65
CBV = 3250 ml

Step 2. Allowable blood loss (ABL) = Calculated Blood Volume (CBV) x (Hi – Hf)/ Hi

ABL = 3250 x (45 – 30)/ 45

ABL = 1083 ml

The allowable blood loss in this case is 1083 ml, rounded off to an approximate figure 1100 ml. Therefore, a total of 11 mops of (30 x 30) cm = 1100ml can be used by the operating team or a combination of – 10 mops of (30 x 30) cm = 1000ml + 10 Gauze of (4 x 4) cm = 100 ml can also be used as per the requirements. When the patient has lost 1100ml blood and team can decide regarding the blood transfusion. Even based on the surgery and surgeons requirement the sizes of mops and gauzes can be used in combination to reach 800 ml.

A common method used in estimation blood loss in the operating room is by subtracting the amount of irrigation fluid used from the total volume of collected fluid in the suction bottle.

Readers can be reminded of the usefulness of the microhaematoerit method to determine the packed cell volume (PCV) of the blood and fluid in the suction bottle, and therefore to estimate blood loss. The following calculation method estimates the amount of blood in the fluid:

Blood loss = volume in the suction bottle x suction Packed cell volume (PCV) /Patient's Packed cell volume (PCV)

Many methods are used by surgeons and anaesthetists to estimate blood loss. The most accurate methods involve complex calculations & hence have minimal practical acceptance.

Conclusions

Based on the current level of research and data on the periprocedural recommendations for office dental surgeries for patients on antiplatelet/anticoagulant/vit K antagonist drugs and our knowledge of the various biosurgical hemostatic agents/techniques we can say that -

Majority of office dental surgeries can be safely performed without interrupating the anticoagulant therapy with usage of hemostats as readily available efficient adjuncts for controlling bleeding whenever deemed to be required.

A fair knowledge of anticoagulants and their potential drug interactions is desirable for effective patient management, in addition to the through awareness about the biosurgical materials/techniques available at your disposal

- Topical biological hemostats are diverse materials with specific uses. The clinician must have reasonable knowledge about the properties of each product/drug, in order to appropriately select the one needed as per clinical requirements.
- Based on current available data, no particular material may be termed as better than the other one.[2]
- A clearly defined specific need based regimen is still needed for office dental procedures particularly in cases with bleeding disorders. The most efficacious local hemostatic agent with minimal complications, easy availability and reasonable cost should be discovered by further research and randomised controlled trials.

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