

# Hemostatic Agents in Periapical Surgery: A Randomized Study of Gauze Impregnated in Epinephrine versus Aluminum Chloride

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## Abstract

**Introduction:** Adequate bleeding control is essential for the success of periapical surgery. The aim of this study was to evaluate the effects of 2 hemostatic agents on the outcome of periapical surgery and their relationship with patient and teeth parameters. **Methods:** A prospective study was designed with 2 randomized parallel groups, depending on the hemostatic agent used: gauze impregnated in epinephrine (epinephrine group) and aluminum chloride (aluminum chloride group). The analysis of the hemorrhage control was judged before and after the application of the hemostatic agents by the surgeon, and 2 examiners independently recorded it as adequate (complete hemorrhage control) or inadequate (incomplete hemorrhage control). **Results:** Ninety-nine patients with a periradicular lesion were enrolled in this study and divided into 2 groups: gauze impregnated in epinephrine in 48 patients (epinephrine group) or aluminum chloride in 51 (aluminum chloride group). In epinephrine group adequate hemostasis was achieved in 25 cases, and in aluminum chloride group it was achieved in 37 cases ( $P < .05$ ). **Conclusions:** The outcome was better in the aluminum chloride group than in the gauze impregnated in epinephrine group. (*J Endod* 2016; ■:1–5)

## Key Words

Aluminum chloride, endodontic surgery, epinephrine, hemostasis, hemostatic agents, periradicular surgery

The outcome of periapical surgery can be influenced by many factors. In this context, adequate bleeding control is essential for the success of these procedures, because it improves vision in the surgical site, minimizes the operating time, and is a requirement for placement and setting of retrograde filling. It also reduces surgical blood loss and postsurgical hemorrhage and swelling (1). Different agents have been used to guarantee hemostasis in periapical surgery to control bleeding of capillaries and small blood vessels, such as ferric sulfate, epinephrine, bone wax, aluminum chloride, or calcium sulfate; nevertheless, there is no consensus in the literature about which is the ideal hemostatic agent.

Only 3 human clinical studies have tried to identify the efficacy of the hemostatic agents (5–7). It has been more than 10 years since Vickers et al (2) and Vy et al (3) published comparative studies; the first compared epinephrine pellets and 20% ferric sulfate, and both agents produced adequate hemostasis. Vy et al suggested that CollaCote (collagen sponges) saturated with 2.25% racemic epinephrine provide excellent hemostasis compared with those saturated with saline. Recently, Scarano et al (4) compared the hemostatic efficacy between 3 groups with a limited sample size: calcium sulfate ( $n = 11$ ), gauze tamponade ( $n = 10$ ), and 20% ferric sulfate ( $n = 10$ ). They concluded that the use of calcium sulfate eliminated the bleeding, with a very good level of hemostasis.

The aim of this study was to compare hemostatic efficacy obtained with the use of gauze impregnated in epinephrine versus aluminum chloride during periapical surgery and their relationship with patient and teeth parameters. The null hypothesis was that the efficacy of hemostasis produced by gauze impregnated in epinephrine is equal to that produced by aluminum chloride in periapical surgery. We propose the alternative hypothesis that the hemostatic efficacy produced by aluminum chloride is superior to the gauze impregnated in adrenaline.

## Materials and Methods

### Study Design

A prospective study was performed following the CONSORT statement (5) in the Oral Surgery Department (Faculty of Medicine and Dentistry, University of Valencia,

### Significance

The outcome of periapical surgery can be influenced by adequate bleeding control because it improves vision, minimizes operating time, and is a requirement for setting retrograde filling. Nevertheless, there is no consensus about which is the ideal hemostatic agent.

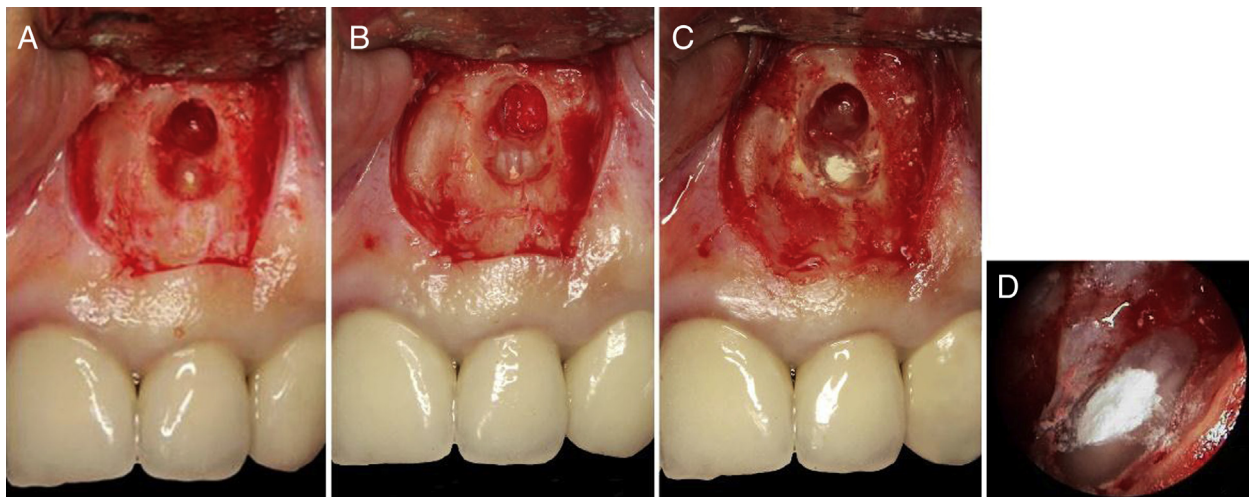
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<http://dx.doi.org/10.1016/j.joen.2016.08.005>



**Figure 1.** (A) Before application of the hemostatic agent. (B) After application of gauze impregnated in epinephrine, adequate hemostasis. (C) Root-end cavity was filled with mineral trioxide aggregate. (D) Evaluation of retrograde filling with endoscope.

Valencia, Spain) from October 2010 to November 2014, which included the patients subjected to periapical surgery that included root-end resection and root-end filling.

All patients were provided with full information about the study and procedures and were asked to sign a written informed consent before taking part. The study design was approved by the Ethical Committee of University of Valencia (H1275980266460), Spain.

Criteria for inclusion were periapical lesions involving a single tooth and a diameter of the periapical lesion less than 10 mm. Criteria for exclusion were apicomarginal defects or probing greater than 6 mm, teeth with periapical pathology associated with a vertical fracture, teeth in which the hemostatic agent did not allow the placement and setting of the retrograde filling, patients with anticoagulant therapy, or incomplete protocols.

Two parallel groups were established depending on the hemostatic agent used: gauze impregnated in epinephrine (epinephrine group) and aluminum chloride (aluminum chloride group). A block randomization scheme was generated by using the Web site [Randomization.com](http://www.randomization.com) (<http://www.randomization.com>) (seed: 13053). Assignment was concealed from the investigator until the time during the surgical procedure that required application of the hemostatic agent by using an opaque envelope. Patient-dependent variables (sex, age, smoking habits, and plaque index [6]) and variables dependent on the tooth (arch and position) were collected.

The surgeon (M.P.D.) and 2 independent blinded examiners (J.C.B., I.M.N.) judged the initial and final bleeding and recorded it as adequate or inadequate. On the basis of Vy et al (3) and Azarogon et al (7), adequate hemostasis was defined as complete hemorrhage control, providing a dry surgical field, and inadequate hemostasis was defined as slight but apparent intermittent bleeding that persisted after application of the material. The surgeon recorded the value at the time of the surgery, and the bony crypts were photographed (Canon EOS 70D, Canon Macro Ring Lite MR-14EX, Canon EF 100 mm f/2.8 Macro USM; Tokyo, Japan) before the application and after the removal of the hemostatic agents for the record of the 2 independent examiners. A PDF (Adobe Acrobat Reader DC; Adobe Systems Inc, San Jose, CA) document was given to each observer with the clinical photographs

for viewing on a 21.5-inch monitor (iMac; Apple, Cupertino, CA) with a screen resolution of 4096 × 2304 pixels.

### Surgical Technique

All operations were carried out by the same surgeon (M.P.D.). Infiltrative locoregional anesthesia was accomplished with 4% articaine and 1:100,000 epinephrine (Inibsa; Lliça de Vall, Barcelona, Spain). After elevation of a full mucoperiosteal flap with submarginal incision design, ostectomy was carried out by using round 0.27-mm tungsten-carbide burs (Jota AG, Rüthi SG, Switzerland) mounted in a handpiece and abundant irrigation with sterile physiological serum. The minimum apical resection necessary to access the apex was made, and the pathologic soft tissue around the apex was thoroughly debrided. The roots were resected with an ultrasonic surgery device at approximately 3 mm of the root end with minimal or no bevel. Retrograde cavity was prepared by using ultrasonic retro-tips (Piezon Master 400 EMS; Electro Medical Systems S.A, Nyon, Switzerland) to a 3-mm depth. The root ends were inspected by using a rigid endoscope (Möller-Wedel, Munich, Germany).

Hemostasis of the bony crypt in epinephrine group was performed by using gauze with epinephrine (B-Braun, 1 mg/mL; Rubí, Barcelona, Spain) (Fig. 1). Dry gauzes were then placed, and pressure was applied for 2 minutes to compress against the bony walls; after that time all the dressings except the first impregnated gauze were removed. In aluminum chloride group Expasyl (Produits Dentaires Pierre Rolland, Merignac, France) was used because the contact with the blood precipitates a protein complex that seals vessels (Fig. 2). Its presentation allows placement with a spatula to apply it on the bony crypt for 2 minutes and is removed by washing the cavity with sterile saline and with the help of a curette. The root-end cavities were filled with mineral trioxide aggregate (MTA; Dentsply Tulsa Dental, Tulsa, OK), and the quality of the retrograde fillings was evaluated with the endoscope. In aluminum chloride group the superficial bone layer was removed with rotary instruments; in both groups the cavity was irrigated with sterile saline solution to remove remaining hemostatic agent. Flap tensionless soft tissue closure was performed with 6/0 suture (Polinyl; Sweden & Martina, Carrare, Italy).

In all cases the following medications were prescribed: 2 g amoxicillin-clavulanic acid or 600 mg clindamycin 1 hour

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