

# Er:yag Laser assisted Endodontic Surgery in the Era of New Antithrombotic Treatments

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## Abstract

**Background and Objective:** The effectiveness of lasers and their use in many fields of dentistry have been reported. To our knowledge, lasers have not been employed to prevent operative bleeding and maintain a sterile surgical field in patients treated with antithrombotics. Furthermore, new generation anticoagulant and antiplatelet treatments have led to a significant increase in the number of individuals under antithrombotic medications, leading to increased risk for bleeding during treatment as well as post-operative hematomas and infections. Our aim was to review current surgical protocols and clinical guidelines for the management of patients using antithrombotic during minor oral surgery, and determine whether lasers may offer an advantage in the clinical management of such cases.

**Methods:** A literature search for protocols and clinical guidelines for the management of patients treated with antithrombotic medications and its association with excessive bleeding during minor oral surgery was done. Publications which clear relevance to the topic of the current review were included.

**Results:** 794 relevant publications were identified, of which 29 were with clinical guidelines and 9 were evidence based studies. Relevant information and guidelines from the publications were extracted and summarized. Furthermore, evidence of bleeding and infection control by laser therapy was reviewed to address the possible advantage of such approach in anti-thrombotic treated patients.

**Conclusions:** Using lasers during intra-oral surgery seems to be beneficial in patients medicated with antithrombotics. The clinical guidelines indicate that anti-thrombotic treatment should not be interrupted for minor oral surgical procedures.

**Keywords:** Endodontic surgery; Laser assisted surgery; Antithrombotic treatment; Post-operative bleeding

## Introduction

Laser therapy is used for ablation, vaporization, excision, incision and photothermolysis in surgical and non-surgical treatments in the oral and maxillofacial regions [1]. The rapid development of laser technology and understanding of the interaction between lasers and biological tissues led to introduction of laser therapy in endodontic surgery. Classic indication for endodontic surgery includes failure of nonsurgical re-treatment root canal filling, cases of persistent or refractory intra-canal infection [2] or extraradicular infection [3-6]. Despite the fact that the success rate of endodontic surgery is approximately 94% [7], recent study by Angiero et al. showed promising results utilizing laser instruments during endodontic surgery [8].

The main two laser technologies which have been tested in endodontic procedures are the Carbon dioxide laser and the erbium YAG laser. Carbon dioxide laser is a 0.6 µm wavelength emission and is more suitable for soft tissues management [9]. Erbium YAG laser is a 2.94 µm wavelength emission and is mainly suitable for enamel and

dentin tissue, and has sterilizing properties in periapical surgery [10]. Er:YAG laser also leads to smoother and cleaner surface without thermal damage during apisectomies [11]. In fact Zhao et al. confirmed the superiority of the Er:YAG laser for apisectomy compared with ultrasonic and rotating-diamond instruments, with less postoperative complaints and improved wound healing [12]. Nevertheless, lasers may also lead to side effects such as thermal damage to periodontal tissues [13]. This however, may be controlled by using the laser in a pulsed emission mode.

Approximately one-third of the patients referred for endodontic treatment are medically compromised [14], with growing numbers as a result of extended life expectancy. Furthermore, better understanding of the impact of arterial and venous thromboses on the pathophysiology of several major diseases has broadened the indications for antithrombotic treatment in the general population [15]. To date common conditions are treated with antithrombotic and include: coronary thrombosis; ischemic stroke; limb gangrene; deep vein thrombosis; pulmonary infarction [16]; Atrial Fibrillation (AF); patients post stroke [17,18]; patients with ischemic heart disease following either percutaneous coronary intervention or the placement of stents [19]; patients after coronary artery bypass grafting and heart-valve replacement [20,21]; patients with thrombophilia [22] and those

with a history of venous thromboembolism [23]. Still, the largest group of patient is those who receive anti-thrombotic medication for primary and secondary prevention of cardiovascular diseases [24]. New anticoagulant medications are also introduced into the market with two oral anticoagulants for the prevention of stroke or systemic embolism in AF which were recently approved by the FDA and more drugs are expected to be considered for approval in the near future.

Anticoagulant medication mechanism of action is based on interference of normal coagulation cascade. Medication which interfere with the tissue factor VIIa complex inhibit the initiation of coagulation, while antiplatelet-aggregation drugs (antiaggregants) decrease platelet aggregation and inhibit thrombus formation in the arterial circulation (where anticoagulants have little effect). These drugs are widely used in primary and secondary prevention of thrombotic cerebrovascular or cardiovascular disease [24].

The antithrombotic treatment may have grave implications mainly regarding bleeding control in any surgical procedure, including endodontic surgery. For these patients, some dental treatments may need to be modified [14]. Accordingly, clinical risk assessment during ambulatory dental treatment plan should include evaluation of the possibility of exaggerated/extensive bleeding [25]. This is extremely important in cases where the treatment plan includes surgical modalities.

## Methods

A search of the literature was undertaken using MEDLINE data base and a manual citation review of the relevant literature from 1980 to 2012. Eligible studies included all systematic reviews or any other kind of reviews that suggested clinical guidelines for oral surgical procedures in anti-thrombotic treated patients. Furthermore, all kind of treatment modalities regarding safe treatment and outcome, such as continuation vs. discontinuation of anti-thrombotic treatment were included as well.

## Results and Discussion

794 studies were found in the initial search. Of these, 765 were excluded since they did not include clinical guidelines. 29 reviews and 9 evidence based clinical guidelines were included in the review [26-33].

Overall, there were five management strategies [27] which be summarized in three treatment combinations: 1) continuation of antithrombotic treatment, 2) partial decrease to complete cessation of treatment and 3) switch therapy (discontinuation of one type of antithrombotic treatment and replacement of the medication with a different kind of medication). Evidence-based clinical guidelines suggest that in patients undergoing minor surgical procedures, there is no need to stop vitamin K anticoagulant therapy [27] as long as the INR is within therapeutic values. Alternatively, warfarin intake can be discontinued for 2 to 3 days before surgery. There is no need to change the intake of aspirin or clopidogrel before surgery [34]. Discontinuation of antithrombotic treatment has life threatening risks, such as stroke in patients with AF, and stent thrombosis in patients following PCI. As a consequence this approach is not recommended. Also, switch therapy may increase postoperative bleeding and therefore is not recommended as well [35,36].

Nevertheless, dentist should be prepared for excessive bleeding during surgical procedures in patients under anti-thrombotic therapy.

As such, clinician must employ any mean available to prevent such grave side effect. One novel approach is laser therapy. The advantages of using lasers for endodontic surgical treatment includes relatively bloodless field and excellent visibility, high precision in tissue removal, enhanced infection control and elimination of bacteremia, no need for sutures, decreased or absent mechanical tissue trauma, fast tissue healing, reduced post-operative pain and edema as well as reduced scarring and tissue shrinkage [37]. Lasers such as Er:YAG laser show anti-inflammatory properties, the the ability to reduce bacterial infiltration of the resected root after apicectomy and retrograde obturation [38,39]. This features makes laser assisted surgery as a promising candidate for the treatment of choice for endodontic surgery, as well as for all oral surgical procedures in patients using anti-thrombotic medications.

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