

## **Use of Local Anesthetics Associated with Vasoconstrictors in Dentistry. Is it a Safe Treatment? A Literature Update**

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### **Abstract**

The use of local anesthetics associated with vasoconstrictors offers advantages and disadvantages associated to its sympathomimetic effect and it should be considered during the dental treatment. This effect should be taken into consideration especially when the patient has a cardiovascular, endocrine or respiratory compromise.

**Objective:** Perform a bibliographical update on the use of local anesthetics with vasoconstrictors in “risk” patients.

**Conclusion:** The use of local anesthetics associated with vasoconstrictors is safe in patients with cardiovascular compromise as well as in controlled diabetic patients as long as a correct anesthetic technique is performed (avoiding intravascular anesthetic infiltration), the dose is not superior to 5.4 ml (equivalent to 3 vials of anesthetic with 1:100000 epinephrine), the analgesia maintenance and the behavioral management of the patient are appropriate during the treatment. In the case of patients with endocrine disorders such as decompensated diabetes mellitus, uncontrolled hyperthyroidism or pheochromocytoma the use of vasoconstrictors is contraindicated, independently of the dose and/or the anesthetic technique.

**Keywords:** Dentistry; Epinephrine; Hemodynamics; Local Anesthetics

### **Introduction**

Local anesthetics used in dentistry can be associated to a vasoconstrictor, mainly epinephrine. The advantages that vasoconstrictors give local anesthetics are: metabolism time extension and consequently a prolonged anesthetic effect; additionally an appropriate hemostasis is achieved thanks to its vasoconstrictor effect [1-3]. These characteristics not only guarantee a less traumatic treatment for the patient but also allows a better operative condition for the dental professional.

When this drug association is addressed, the disadvantages or adverse effects that can accompany it have to be mentioned. Keeping in mind that epinephrine is a sympathomimetic substance; the possible consequences of its use have to be acknowledged, especially in

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patients with cardiovascular risk or in medical treatment with vasoactive substances (e.g. Betablockers) [4-6]. Moreover, the adrenergic effects of this association do not exclude other diseases or systemic conditions. Thereby, these effects can also affect patients with endocrinopathies such as: Diabetes mellitus [7], Hyperthyroidism and Pheochromocytoma [8].

For these reasons, the use of local anesthetics associated to vasoconstrictors in “risk” considered patients is controversial. The aim of this study is to perform a bibliographical update regarding the safety of anesthetics with vasoconstrictors.

### **Epinephrine: mechanism of action**

Epinephrine is a sympathomimetic substance (catecholamine) synthesized by the adrenal glands. Its action originates from the union to the alpha ( $\alpha$ ) and beta ( $\beta$ ) adrenergic receptors, mainly located in the cardiac muscle, vascular smooth muscle and bronchial tree. The main effects produced are: increased heart rate (HR) and consequently increased blood pressure, coronary and peripheral vasoconstriction (mediated by  $\alpha$  receptors), vasodilation (mediated by  $\beta_2$  receptors) and bronchodilation [9]. Lastly but not less important, epinephrine intervenes in processes like gluconeogenesis and glycogenolysis, both of these effects are very important in patients with Diabetes Mellitus [7].

### **Patients with cardiovascular compromise**

This section only refers to patients diagnosed with coronary disease (Ischemic heart disease, angina pectoris and myocardial infarction), hypertension or patients under vasoactive medication (use of betablockers as antiarrhythmic) [10-12].

Coronary disease and hypertension are cardiovascular diseases highly prevalent on our society [1,13]; which means the number of patients that go for a dental consultation with this disease is increasing. Thus, the dentist must be qualified to take the proper actions during the treatment.

The use of local anesthetics associated to a vasoconstrictor such as epinephrine, usually is of great help during the dental treatment, due to the efficacy of the anesthetic and hemostatic effect [13]. However, in these types of patients, it can be a risk factor, because of the before mention adrenergic effects (heart rate and blood pressure increase, vasoconstriction) [2,9]. In Serrera MA., *et al.* (2012) systematic review, 6 randomized clinical studies were analyzed, with a total “n” of 321 patients with cardiovascular disease, the authors concluded that - as long as the patient is out of the risk period associated with any kind of dental treatment (e.g. 6 months after an acute myocardial infarction- AMI) - the use of local anesthetics with vasoconstrictor is justified. Although, a strict and proper anesthetic technique is recommended; as well as a maximum dose of 3.6ml, equivalent to two vials of anesthetic with epinephrine 1:100000 [1].

Likewise, Scarparo HC., *et al.* (2014) agree that blood pressure measures are not significantly altered after the injection of 5.4 ml to 10.8 ml of anesthetic with vasoconstrictor for the exodontia of 2 to 4 wisdom teeth, although their study was not performed on patients with cardiovascular disease [14].

Furthermore, there are absolute contraindications in patients with cardiovascular compromise. Such is the case of patients with unstable angina pectoris, recent myocardial infarction (less than 6 months from the event), refractory arrhythmias, high blood pressure, uncontrolled congestive heart failure and patients with a recent coronary artery bypass [15]. It is important to remark the importance of conducting a behavior management on the patient (anxiety, fear); and a proper analgesia during the treatment, avoiding in this way the exacerbation in the production of endogen catecholamines, these procedures also aid on the stabilization of the hemodynamic parameters of the patient [13].

### **Patients with endocrine compromise**

Dentists usually have special considerations regarding the use of local anesthetics associated with vasoconstrictor in patients with heart disease. However, there are more diseases whose physiopathology can be exacerbated by the use of epinephrine [8,15]. This section mentions Pheochromocytoma (tumor originated), Hyperthyroidism and Diabetes Mellitus.

### **Pheochromocytoma**

Pheochromocytoma is an endocrine tumoral pathology and its physiopathology has repercussions in several organs, due to the overproduction of catecholamines (neurotransmitters): Epinephrine and Norepinephrine [16]. This overproduction stimulates the action of adrenergic receptors; which turns to exacerbated cardiovascular manifestations such as: increased heart rate (HR), increased peripheral vascular resistance (PVR) and hypertension. Patients with this pathology are usually medicated with alphablockers and –sometimes- also with betablockers. Additionally, they may experience arrhythmias, hypotension, shock, acute myocardial infarction, cardiomyopathy, aortic dissection and peripheral ischemia. Due to these facts, the use of vasoconstrictors during a dental treatment is of absolute contraindication, independently of the concentration [8,16].

### **Hyperthyroidism (Thyrotoxicosis)**

The term refers to an excess of T3 and T4 hormones in the blood stream. Among the more frequent causes is Graves-Basedow autoimmune disease [17]. Patients with thyrotoxicosis have cardiovascular manifestations as a consequence of the increased metabolism; experiencing increased heart rate, increased systolic blood pressure and supraventricular arrhythmias [18]. It is important to know that when these patients are uncontrolled or the pharmacological treatment is insufficient, they have a higher sensitivity to the action of neurotransmitters. For this reason in such cases is contraindicated the use of epinephrine or any other vasopressor agent during the dental treatment [8,17].

### **Diabetes Mellitus**

To discuss about patients diagnosed with Diabetes Mellitus the physiopathology of the disease must be considered, additionally to the possible adverse effects of its pharmacological treatment (risk of hypoglycemia).

Furthermore, the reviewed literature indicates that the use of local anesthetics with vasoconstrictor can modify glycemic levels in healthy and diabetic patients; however, the type of modification (increase or decrease) is controversial [20,21]. Tily FE., *et al.* (2007) performed a clinical trial in 60 patients (30 healthy and 30 diabetics) who had undergone oral surgery (dental extraction) assessing their glucose levels pre and post-surgery, their aim was to demonstrate if the administration of local anesthetics with epinephrine increased glucose levels. They explain that –theoretically- the administration of local anesthetic with epinephrine can significantly increase blood glucose levels. Although, in 66.7% of the cases assessed in their study a decrease in glycemic levels was observed. The possible causes attributed to this phenomenon are: a compensation effect, during a stress situation such as oral surgery and a dental consultation, muscles increase their energy demand, as a consequence the body consumes the “possible excess” of blood glucose. Another cause is attributed to the average half-life of hypoglycemic drugs, which are frequently administered before surgery [20]. It is important to remark that the literature only considers safe the use of local anesthetics associated with epinephrine in controlled diabetic patients.

Santos-Paul MA., *et al.* (2015) carried out a randomized prospective study in 70 patients with therapeutically controlled (hypoglycemic drugs and/or insulin) diabetes mellitus type 2 undergoing oral surgery, and compared the effects of two types of anesthetics (2% Lidocaine vs. 2% Lidocaine associated to 1: 100000 epinephrine) on glycemic levels. Their study showed no significant differences in glycemic levels between the two groups during the monitoring time. It is worth highlighting, that this is the first study that used a continuous monitoring method with MiniMed (every 5 minutes) starting at 24 hours pre-surgery until 1 hour after the surgical procedure. As a conclusion the authors stated that the use of epinephrine associated with local anesthetics did not increased the risk of hyperglycemia or the hemodynamics repercussions [7]. Haji IU., *et al.* (2012) also concluded that the use of local anesthetics with epinephrine was safe in patients with controlled diabetes mellitus [19]. Whereas, in the case of diabetic patients not compensated, uncontrolled or poorly controlled, the use of epinephrine is contraindicated [8,19].

## Conclusion

It is imperative to clearly know the pharmacodynamics concepts of the products or active principles of the drugs used on dental treatments, in this case, local anesthetics and the importance of its association to a vasoconstrictor agent such as epinephrine. The use of local anesthetics with vasoconstrictors is safe in patients with cardiovascular compromise, and on controlled diabetic patients -as long as- a proper anesthetic technique is performed (avoiding intravascular infiltration), the dose used is not higher than 5.4ml (equivalent to 3 vials of anesthetics with 1:100000 epinephrine) and the behavioral management of the patient and the analgesia maintenance during the treatment are adequate. In the case of patients with endocrine disorders such as uncontrolled Diabetes Mellitus, uncontrolled Hyperthyroidism and Pheochromocytoma, the use of vasoconstrictors is contraindicated, independently of the dose and anesthetic technique.

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