

## COMPARATIVE REVIEW OF GINGIVAL RETRACTION AGENTS

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In order to obtain an adequate impression of demarcation line area of a prepared tooth located in or below the gingival edge it is necessary to perform the dilatation and drying of the gingival sulcus using retraction cord impregnated with adequate retraction agents. The aim of the study was to carry out comparative analysis of advantages and disadvantages of commercially available gingival retraction agents. Commercial retraction agents include astringents (metal salts) and vasoconstrictors on the basis of epinephrine. Further research should be aimed at examining the possibility of using sympathomimetic vasoconstrictors (tetrahydrosolin and oxymetasolin) for gingival retraction. *Acta Medica Medianae* 2012; 51(1):81-84.

**Key words:** retraction agents, tetrahydrosolin

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### Introduction

Appropriate impression taking for fixed dental appliances (crowns and bridges) involves precise impressing of the demarcation line area, which ensures perfect fitting of the marginal edges of artificial crown to teeth structures and reduces the possibility of marginal crevice appearance. The absence of discrepancy between prosthetic restoration and prepared tooth is required both for therapeutic purpose of using fixed dental prostheses, and for preventive purpose of arresting potential damage of hard dental tissue (1, 2).

In order to take adequate impression of demarcation line area of a prepared tooth located in or below gingival edge it is necessary to perform gingival dilatation and drying. Firstly, tooth cervical region should be extricated as to enable impression material to penetrate the area between prepared dentin, that is, between tooth cement and wall of gingival sulcus (2,3).

Mechanical-chemical gingival retraction represents one of the most frequently used methods (4). Mechanical component involves utilisation of retraction cord in order to ensure tissue compression and equal concentration of retraction agent in all parts of gingival sulcus. The depth of retraction cord is in the function of the gingival sulcus depth, depending on the patient's periodontal status. The lack of application of chemical agents without mechanical support implies low efficiency for gingival pockets deeper than 2 mm

(5). The use of retraction cord without impregnation agent also shows lower therapeutic effect (5).

The aim of the study was to carry out comparative analysis of advantages of commercially available gingival retraction agents.

### The role of retraction agents

The role of retraction agent is temporary suppression of gingival tissue as well as haemorrhage control and gingival fluid flow, the balance of which is always disturbed after marginal tooth preparation (6,7). To be considered, an optimal a retraction agent should meet the following criteria (8):

1. Efficiency implying providing substantial lateral and vertical recession of gingival tissue, haemorrhage control and gingival fluid flow.

2. Utilisation of retraction agent must not significantly and permanently damage the surrounding tissue. Any manipulation and chemical treatment of tissue result in a certain sort of damage. However, this damage should be reversible, which means that it is followed by full clinical and histological recovery within 2 weeks. The ultimate apical gingival recession after mechanical and chemical retraction treatment must not exceed 0.1 mm.

3. The absence of systemic effects, as a result of reabsorption of retraction agents into the surrounding tissue. The amount of reabsorbed materials depends on the type of retraction agent used, laceration of gingival tissue and the number of prepared teeth.

The effect of conventional retraction agents may be astringent and vasoconstrictive (9, 10).

### Astringent retraction agents

Astringents are metal salts that cause gingival retraction by precipitation of proteins and

inhibition of transcapillary movement of plasma proteins. They act by reducing cell permeability and drying surrounding tissue, leading to its reversible recession. Since precipitation of proteins in physiological conditions has antihemorrhagic effect, astringents are used as hemostatics. However, denatured proteins may lead to local tissue damage (6,7,11).

Aluminum based retraction agents are considered to have astringent role, to be safe and moderately effective in suppressing gingival tissues. The most commonly used are aluminum chloride, aluminum sulfate and alum (potassium aluminum sulfate or aluminum ammonium sulfate). Concentrations of compounds are different and depend on the manufacturer. Research has shown potential toxicity of concentrations higher than 10% (3, 12,13).

Zinc chloride represents less commonly used astringent. Since it is caustic, too, the concentrations higher than 20% are not recommended for use (6).

Unlike aluminum-based products, previously used ferrous sulfate produces no desired clinical results. Although it coagulates blood, hemorrhage often recurs after cord removal, the degree of tissue suppression is lower, and deepening of sulcus negligible. The disadvantages include irritative effects and tissue staining. The use of this agent in concentration greater than 20% is not allowed (11). Tissue damage is significantly higher in comparison with aluminum chloride (14).

### **Vasoconstrictive retraction agents**

Epinephrine is one of the most commonly used retraction agents. It shows local hemodynamic effects and is very effective vasoconstrictor that activates sympathetic  $\alpha_1$  receptors with peripheral blood vessels causing ischemic tissue reaction (7,15,16). In addition, local vasoconstriction results in a temporary and gingival recession (17). Although considered to be very effective agent, epinephrine may, however, lead to numerous side effects in a great number of patients, which significantly narrows its indication area.

The maximum recommended dose of epinephrine for cardiovascular patients is 0.04 mg, the amount approximately found in 2 capsules of local anaesthetic with a vasoconstrictor of 1:100000 dilution. For healthy patients the maximum permitted dose of epinephrine is 0.2 mg (8,18). Absorption of epinephrine is different depending on the intactness of gingival epithelium. Madrid et al. showed that intact cervical gingival epithelium was effective barrier for epinephrine bound to plasma proteins (16). Each thread impregnated with epinephrine contains 0.2 to 1 mg of epinephrine, depending on the diameter and the manufacturer. It is 2.5 times higher dose of this vasoconstrictor recommended for healthy patients, and 12 times higher dose for cardiovascular patients, so that there is a great possibility of epinephrine overdose as a retraction agent (7). Kella et al. concluded that

64% to 94% of epinephrine was absorbed from retraction cord to gingiva (19). The degree of resorption of retraction agent is greater if gingiva is lacerated during tooth grinding (17).

The use of epinephrine represents the risk for patients treated with beta-blockers and antihypertensive therapy (20). Its systemic absorption may lead to tachycardia, rapid breathing, hypertension, anxiety, feeling of weakness in the extremities, and depression (15,20). As a myocardial stimulant epinephrine accelerates heart rate, raises blood pressure (particularly systolic) and pulse rate. Epinephrine overdose may also result in ventricular tachycardia and potential fibrillation, angina attacks, myocardial and cerebrovascular infarction (8, 18).

The use of epinephrine in case of gingival retraction is not recommended for patients with hyperthyroidism, or for depressive patients who are using monoamine oxidase inhibitors (tricyclic antidepressants) (20). In patients with diabetes mellitus resorbed epinephrine increases blood glucose levels (8). If reparation of the entire oral cavity is performed under total anesthesia, using fluorinated hydrocarbon based anaesthetic (e.g. halothane), the myocardium becomes more sensitive to the effects of epinephrine, which could endanger the patient's life. The use of epinephrine as a retraction agent in such cases is contraindicated (6, 20).

Since dental procedures have stressful effect on patients, a sudden increase of epinephrine level in blood may be expected even in healthy patients (21). If the retraction procedure is performed after administering local anaesthesia combined with adrenaline-based vasoconstrictor, the risk of organ damage induced by epinephrine-based retraction agent increases. A thorough history and understanding of pharmacological status of the patient are the only ways to prevent unwanted systemic effects of epinephrine-based retraction agents. Given the risk of cumulative effects of this vasoconstrictor and the fact that in everyday dental practice little is known about the general health of patients, and patients themselves are often not aware of their cardiovascular status, this type of retraction agent should generally be avoided. This is supported by the fact that the effect is almost identical when using epinephrine, aluminum chloride and aluminum sulfate for gingival recession (3, 6). Hemorrhage control is the only advantage of epinephrine compared to aluminum-based agents (6, 18).

### **Alternative retraction agents**

Gingival retraction may cause damage to periodontal tissue (4, 10, 22). In order to find more appropriate retraction agents one should consider the possibility of using sympathomimetic vasoconstrictors that are assumed to have desired efficacy without adverse local and systemic effects (23). Tetrahydrozoline and oxymetazoline belong to group of sympathomimetic vasoconstrictors, that is

α agonists and are commercially available as nasal decongestive and eye drops. Systemic reactions to the use of these products are very rare, given that the maximum recommended doses are significantly higher than those required for effective gingival retraction (6). Studies by Bowles et al. showed a satisfactory clinical effect of tetrahydrozoline, strong local vasoconstrictive effect and the absence of systemic reactions (6). Clinical study by Tardy et al. demonstrated greater retraction efficiency of tetrahydrozoline without side-effects in relation to epinephrine (24).

## Conclusion

Retraction agents should provide adequate retraction thereby not giving any local or systemic side effects. Preference should be given to astringent agents based on metal salts as compared to epinephrine based agents regarding similar therapeutic effects and fewer adverse systemic effects. Further research should be aimed at examining the possibility of using sympathomimetic vasoconstrictors (tetrahydrozoline and oxymetazoline) for gingival retraction.

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## UPOREDNI PREGLED SREDSTAVA ZA RETRAKCIJU GINGIVE

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U cilju adekvatnog otiskivanja predela demarkacione linije brušenog zuba, smeštene u ili ispod nivoa gingivalne ivice neophodna je dilatacija gingivalnog sulkusa i njegovo isušivanje upotrebom retrakcionog konca impegiranog adekvatnim retrakcionim sredstvom. Cilj rada bio je uporedna analiza prednosti i nedostataka komercijalno dostupnih sredstava za retrakciju gingive. Komercijalna retrakciona sredstva obuhvataju adstringense (soli metala) i vazokonstriktore na bazi epinefrina. Dalja istraživanja treba usmeriti ka ispitivanju mogućnosti upotrebe simpatomimetskih vazokonstriktora (tetrahidrozolin i oksimetazolin) u svrhu retrakcije gingive. *Acta Medica Medianae 2012;51(1):81-84.*

**Ključne reči:** retrakciona sredstva, tetrahidrozolin