Review of Various Gingival Retraction Chemicals Used in Dentistry

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The chemo mechanical gingival margin retraction methods are still most popular in dental practice, using, beside retraction materials, also various gingival retraction agents (GRAs)[1,2,3,4]. This article reviews the various gingival retraction agents (chemicals) used in dentistry.

Different clinical forms of the retraction chemicals are applied in situ [5,6]:

- Fluids (GRFs),
- Gels(GRGs) or
- Pastes(GRPs)

The retraction fluids are used as "ex tempore" soaked or as manufacturer's impregnation in various types of retraction cords[4]. Gels & pastes can be injected into the gingival sulcus. These chemicals are based on two different pharmacological action categories [6,7]:

- Class 1 (vasoconstrictors, adrenergics group) or
- Class 2 (haemostatics, astringents).

Vasoconstrictors

The vasoconstrictor agents are divided into 2 groups [4,6,7]

- ∝ and β adrenergics (racemic epinephrine group)
- And ∝ adrenergics (sympathomimetic amines group).

Epinephrine in racemic form

It is used in concentration of 0.1%and 8%. Racemic epinephrine alone, or in combination with different astringents is available as commercially impregnated retraction cords. It provides effective vasoconstriction and hemostasis [9]. There is some debate regarding the use of epinephrine for gingival retraction. The local use of epinephrine as a gingival displacement medicament can be absorbed into the systemic circulation and, consequently, affect the cardiovascular system [10].

The possible cumulative effect of epinephrine from cord combined with epinephrine from other sources (epinephrine administered in the local anesthetic and endogenous epinephrine that may be secreted by the patient in reaction to stress associated with dental procedures) must also be considered [11].

For patients with cardiovascular disease, hypertension, diabetes, hyperthyroidism or known hypersensitivity to epinephrine, a cord impregnated with some other agent must be substituted. Epinephrine should also not be used on patients taking monoamine oxidase or tricyclic antidepressants, rauwolfia compounds, ganglionic blockers, or cocaine. Patients without abovementioned contraindications can also exhibit "epinephrine syndrome" (tachycardia, rapid respiration, elevated blood pressure, anxiety, and postoperative depression) [12,13,14,15,16,17,20]. In dental practice adverse drug interactions with epinephrine based vasoconstrictors were observed and fatality associated with combined use of halothane and epinephrine impregnated gingival retraction cords was noticed [18]. Local unfavorable influences such as hyperaemic response, trauma of crevicular and junctional epithelium were reported, with complete healing after the period from 7 to 10 days [19].

Clinicians should avoid using epinephrine for gingival displacement because of the significant number of contraindications for its use.

Advantages

- Vasoconstrictive
- Hemostatic

Disadvantages

- Systemic effects and epinephrine syndrome
- Risk of inflammation of gingival cuff
- Rebound hyperemia
- Risk of tissue necrosis.

Sympathomimetic amines

As an alternative to racemic epinephrine, Bowles et al. [20](1991) proposed three commercially available medicaments, used commonly in opthamology and laryngology; 0.05% Hcl-tetrahydrozoline, 0.05% Hcl-oxymetazoline and 0.25% Hcl-phenylephrine as new experimental gingival retraction agents. Retraction cord can be dipped in these agents to assist in hemostasis. Woody RD et al (1993)[21] demonstrated that newer hemostatic agents such as tetrahydrozolines and oxymetazolines have a more acceptable pH and are thought to be kinder to the tooth structure and soft tissues that conventional solutions. D. Nowakowska et al (2012)[4] carried out an in vitro study to evaluate cytotoxic effects of vasoconstrictor - and - adrenergics group versus -adrenergics group and obtained better results for latter. 0.05% Hcl-tetrahydrozoline fulfills the criterion of compatibility with the majority of elastomer impression materials [22].

Astringents

Over 80% of dentists applied astringents for gingival margin retraction in clinical practice [1,11,23].

Aluminium sulfate compounds

- Aluminium potassium sulfate (alum)
- And aluminium sulphate

Advantages

- Hemostasis
- Least inflammatory of all agents used with cords
- Little sulcus collapse after cord removal

Disadvantages

- Offensive taste
- Risk of necrosis if in high concentration.

Alum in 100% concentration has been shown to be only slightly less effective in shrinking the gingival tissues than epinephrine, and it shows good tissue response [28]. Alum is safer and has fewer side effects than epinephrine cords saturated with

100% alum. It can be safely left in the sulcus for as long as 20 mins without any adverse effects [25].

Aluminium sulfate is effective and biologically acceptable [9]. But like most sulfates, aluminium sulfate compounds can inhibit/retard the setting reaction of additional reaction impression materials.

Aluminium Chloride

One of the most commonly used astringents [1]. It is used in concentrations of 5% to 25%. Studies have shown that solutions stronger than 10% can cause local tissue destruction. A 10 minute application is usually sufficient[25]. Aluminium chloride is the least irritating of the medicaments used for impregnating retraction cords, but it is shown to disturb the setting of polyvinylsiloxane and polyether impression materials[26]. The inhibitory effect can be greatly reduced by thoroughly rinsing the preparation with water after the treated cord is removed. It causes less vasoconstriction than epinephrine [27].

Advantages

- No systemic effects
- Least irritating of all chemicals
- Hemostasis
- Little sulcus collapse after cord removal

Disadvantages

- Less vasoconstriction than epinephrine
- Risk of sulcus contamination
- Modifies surface detail reproduction
- Inhibits set of polyvinysiloxane and polyether impressions

Ferric Sulfate

Provides good hemostasis on exposed connective tissue. This astringent is provided in solution form only, generally in the concentration of 13% to 20%. Solutions of ferric sulfate above 15% are very acidic and can cause significant tissue irritation and postoperative root sensitivity. The recommended packing time for cord dipped in ferric sulfate solution is 1 to 3 minutes.

Ferric sulfate disturbs setting reaction of polyvinylsiloxanes and polyther impression materials, so use for gingival displacement in implants is questionable[28]. All traces of medicament should be carefully removed before the impressions are recorded [26].

It stains gingival tissues a yellow-brown to black colour for several days after being used as a retraction agent [29]. The esthetics of the anterior all ceramic crowns may also be compromised due to use of ferric sulfate since it has shown to produce internalized discoloration of the tooth structure [30].

In an in vitro study dentinal exposure to highly acidic ferric sulfate for 30 seconds can result in superficial smear layer removal. Removal of smear layer by hemostatic agents negatively affects the bonding mechanism of self etching adhesive which may further explain possible marginal microleakage and discoloration [31].

Advantages

- Hemostasis

Disadvantages

- Tissue discoloration
- Acidic taste
- Risk of sulcus contamination
- Inhibits set of polyvinylsiloxane and polyether impressions

Clinicians have sound knowledge the benefits and drawbacks and these agents. This will enable the clinician to provide a safe and predictable rxment to the patients.

Discussion

When the fact that we usually have inadequate data on the cardiovascular status of our patients is considered, as well as the tendency to make impressions of multiple prepared teeth, the continued use of epinephrine cord in dentistry must be viewed with alarm. Equally effective Gingival retraction agents's such as sympathomimetic amines, aluminium sulfate and Aluminium chloride exert no systemic effects. Therefore, there is little indication for use of epinephrine containing retractions cords [11]. Clinicians should have a sound knowledge of the benefits and drawbacks of the gingival retraction agents to provide a safe and predictable treatment to the patients.

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