

STEROIDS IN ROOT CANAL TREATMENT

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ABSTRACT

Steroids are a most valuable adjunctive to the armamentarium available to health professionals for the management of mid and post endodontic flare ups. Up to 80% of endodontic patients who report with preoperative pain continue to experience some level of pain following the endodontic procedure. Since endodontic pain is often associated with chronic inflammation, the presence of bacterial by-products, influx of primed immune cells and activation of the cytokine network and other inflammatory mediators, pain may be reduced by administration of glucocorticoid steroids. During endodontic treatment and when managing trauma to the teeth steroids may be applied systemically (orally and/or parenterally) or locally (i.e. intra-dentally via irrigants and medicaments). Due to the potential risk of adverse effects following systemic application, and the ineffectiveness of systemic steroids in necrotic pulpless teeth and the periradicular tissues, the local application of antibiotics may be a more effective mode for delivery in endodontics. Antibiotics are typically used in conjunction with corticosteroids and these combinations have anti-inflammatory, anti-bacterial and anti-resorptive properties, all of which help to reduce the periapical inflammatory reaction including clastic-cell mediated resorption. Various classes of drugs have been studied for the management of post-treatment endodontic pain. The aim of this paper is to review the pharmacology and mechanisms of actions of steroids as well as their indications for endodontics, contraindications, dosages and side-effects.

Keywords: Steroids, Root canal.

INTRODUCTION

Steroids are organic compounds that contain a characteristic arrangement of four cycloalkane rings that are joined to each other. In human beings, steroids are produced by the adrenal gland. Although they serve to regulate several important functions, the prime role appears to be its regulation of the immune system. An action of steroids, which is of importance in endodontics is reduction of inflammation and pain [1]. Root canal treatment or endodontic treatment involved removal of the infected and inflamed pulp tissue to allow healing of the periradicular tissues. Most cases of root canal treatment exhibit inter appointment or postoperative pain because of the existing inflammation. Steroids like glucocorticoids act by inhibiting the inflammatory response through a cascade of events. By influencing gene transcription, it reduces chemoattractive and vasoactive factors, decrease secretion of proteolytic and lipolytic enzymes, reduces extravasation of leucocytes to areas of tissue injury, ultimately decreasing fibrosis. This anti-inflammatory process helps in reduction of pain during root canal treatment [2]. This has led to the recommendation that steroids may be prescribed to patients undergoing root canal treatment to decrease inter appointment pain (which is termed as flare up) as well as post operative pain. It has also been recommended that a combination of steroids and antibiotics be used as local drug delivery in the root canal [3] for the management of inter appointment pain during root canal treatment [4]. Steroids that are used in dentistry are glucocorticoids, corticosteroids, ledermix, dexamethasone, prednisolone and triamcinolone acetonide. The purpose of this review is to discuss the published work on the steroids and their combinations with antibiotics used in root canal treatment.

Corticosteroids

Systemic as well as local use of corticosteroids, with or without antibiotics have been tried to prevent or reduce post-treatment pain in endodontics [5]. Smith et al stated that corticosteroids were effective in decreasing inflammation secondary to instrumentation [6]. Local delivery of corticosteroids in the root canal may bring symptomatic relief from post-treatment pain. It has also been recommended that pain associated with root canal treatment is reduced by gently forcing a corticosteroid preparation into the periapical tissues [7].

Combinations of corticosteroids and antibiotics have various therapeutic effects, one of which is control of post-treatment

endodontic pain. The various therapeutic effects are anti pruritic, anti-inflammatory, antifungal and antibacterial. Triamcinalone acetonide is a potent corticosteroid which can be effectively used to eliminate or at least reduce the severe inflammation that occurs during endodontic treatment. However, the topical use of steroids can suppress the defensive body mechanism, which may result in bacteremia [8]. Schroeder recommended that antibiotics be used along with steroids in topical formulations to prevent the potential invasion of bacteria [9]. The corticosteroid antibiotic cream when placed in the root canal results in reduction of pain within an hour in a majority of patients. This supports the results of Schneider who stated that when a steroid-antibiotic cream is placed in the root canal, pain subsides before the patient leaves the dental office. And there was no occurrence of postoperative pain and swelling with the use of corticosteroid-antibiotic medication. The possibility of systemic side effects is rare because the constituents absorbed from the site over a relatively short duration are minute. Thus, the intracanal use of the corticosteroid-antibiotic combination can be used for effective relief of post-treatment endodontic pain. Topical corticosteroids have been used in endodontics as anti-inflammatory agents for many years [10], and studies have shown that they are effective in reducing pain in teeth with vital pulp, but ineffective in cases where the pulp is necrotic. Therefore, the use of corticosteroids in necrotic pulp has not been advocated [11]. However, there is no conclusive evidence to accept or refute the same. The most common commercial preparations containing antibiotics and corticosteroids that are available for use as root canal medicaments are Septomixine, Pulpomixine (Septodont, St. Murr DesFosses, France) and Ledermix paste. Septomixine and Pulpomixine pastes contain neomycin and framycetin respectively but none of the antibacterial agents were effective against any bacteria that are commonly involved in endodontic infections. The corticosteroid dexamethasone, is an anti-inflammatory component which is less potent, than other corticosteroids such as triamcinalone.

Glucocorticoids

The disruption of the inflammatory cycle will be the focus of the painful research. The primary target sites for pharmacological approaches were two classes of enzymes: Phospholipase and Cyclooxygenase. Phospholipase synthesises arachidonic acid from phospholipids. Cyclooxygenase, which synthesises prostaglandins. Steroidal anti-inflammatory drugs which is also known as glucocorticoids, are the group of drugs which functions by inhibiting

phospholipase A2, which reduces the production and concentration of prostaglandins and leukotrienes [12]. Non-steroidal anti-inflammatory drugs are the class of drugs which functions by inhibiting cyclooxygenase enzymes, which reduces prostaglandins but does not affect leukotriene production.

Glucocorticoids have been used in endodontics for their anti-inflammatory effects. Kaufman was the first to evaluate the effects of an intraligamentary delivery of corticosteroid on endodontic post treatment pain. The results showed significant decrease in postoperative pain in the methylprednisolone group comparing active and passive placebo groups [13]. Glucocorticoids are drugs, frequently employed to reduce or to avoid inflammation which occurs after traumatic dental procedures or injuries. In addition, they can inhibit the progression of inflammation, which ultimately leads to necrosis of pulp tissue. The anti-inflammatory effect of glucocorticoids, used in treating the vital pulps after direct pulp capping was first described by rapaport [14]. Mohammadi reported that the application of glucocorticoid steroids has been found to be very effective in decreasing the pain following endodontic treatment [15]. The ability of glucocorticoids to decrease the periapical inflammation after the endodontic treatment have been demonstrated in dog models by Holland [16]. Nobuhara evaluated, the anti-inflammatory effects of dexamethasone histologically on the periapical tissues after endodontic over instrumentation. It showed that local infiltration of dexamethasone produces a significant anti-inflammatory effect on the periapical tissues of the vital teeth or partially necrotised teeth [17]

The single dose of glucocorticoid, even with large dose, does not have any harmful effects. Czerwinski proved that the single large dose (2mg/kg) of dexamethasone will not have any harmful effects [18]. Glucocorticosteroids are contraindicated in patients with systemic fungal infection and those who were known hypersensitive to the drug. Psychological disturbances may occur during the glucocorticoid therapy. These reactions may be reversible and range in severity from mild (insomnia, euphoria or nervousness) to pronounced (schizophrenic psychosis). The severity of adverse effects were may be due to duration and dose of the therapy [19].

Ledermix

Ledermix is a combination of a steroid with an antibiotic. The formulation contains 1% triamcinolone and 3% demeclocycline. This formulation was first recommended for use in endodontics by Schroder and Triadan in 1960. Abbott stated that the dentinal tubules is the major route of supply of the active components to the periradicular tissues than the apical foramen. The concentration of demeclocycline with ledermix paste, when placed within the root canal is high enough to be effective against particular species of bacteria. Adjacent to the root canal wall, effect of demeclocycline is achieved for all reported bacteria within the first day of application but this effectiveness dropped to one-tenth of the initial level after one week. Further away from the root canal towards the cementum, the concentration of demeclocycline after one day is not that high to eliminate the 12 of the 13 strains of commonly reported endodontic bacteria [20]. Thereon, this material has undergone several modifications and currently, it is available as two different compositions: Ledermix paste (which contains 1% triamcinolone and 3% demeclocycline-calcium) and Ledermix cement (0.7% triamcinolone, 3% demeclocycline with calcium based salts). Research has shown that Ledermix paste and Ledermix cement are unlikely to result in any systemic side effects [21]. Ledermix when used as an intracanal medicament reduces the incidence of post-operative pain in necrotic teeth. The antibacterial action of ledermix paste results from demeclocycline which is a broad spectrum tetracycline. The two therapeutic components of Ledermix paste ie, demeclocycline and triamcinolone are capable of diffusing through dentinal tubules and cementum to reach the periapical and periodontal tissues [22]. Ledermix cement is a hard-setting material that can be used as a dentin liner, as a pulpotomy agent and as a pulp capping agent [23]. Pierce, demonstrated histologically that Ledermix eradicated experimentally induced external inflammatory root resorption [24]. He also found that Ledermix paste has no damaging effects on the periodontal membrane, and this paste was

an effective medication for the treatment of progressive root resorption in traumatically injured teeth. Bryson evaluated the effects of immediate intracanal placement of Ledermix paste on healing replanted dog teeth after an extended drying time for 60 minutes. Results showed that the roots treated with ledermix paste have significantly more healing and less resorption than the roots treated with calcium hydroxide. It also reduced loss of root mass due to less resorption when compared with the roots filled with calcium hydroxide [25]. Ehrmann evaluated the relationship of postoperative pain to three different medicaments placed in the root canal after complete cleaning and shaping in patients who reported with acute pain. He found that the teeth in which Ledermix was used as the intracanal medicament showed lesser pain when compared to the calcium hydroxide dressing and no dressing [26].

Athanassiadis et al have reported the beneficial effect of Ledermix in the treatment of cracked teeth with signs of irreversible pulpitis [27]. Kim et al. studied the discoloration of teeth due to Ledermix paste as an intracanal medicament. This change in colour may be attributed because of the presence of tetracycline in the formulation. The mechanism in which the tetracyclines are incorporated in tooth are not understood clearly. However, it is the results of chelation of tetracycline with calcium ions in the molecular structure. This occurs only during the calcification process and therefore the discoloration of teeth occurs during the third trimester of pregnancy and early childhood stage. Hence a clinical recommendation may be provided that Ledermix paste limited to be the part of the root canal apical to the cemento enamel junction. It was suggested that if the placement of the Ledermix is restricted to the canal below the cemento enamel junction, staining effects will be minimised [28].

Chen evaluated the individual influence of demeclocycline and triamcinolone on external root resorption after an extended extra-oral dry time for 60 mins. The group treated with ledermix, triamcinolone and demeclocycline had significantly more favorable healing than the group filled with gutta-percha and replanted after 60 mins dry time(positive control). There was no significant difference between ledermix group and triamcinolone group. They concluded that tetracycline and corticosteroid, are anti-inflammatory and anti-resorptive agents [29]. This is understandable because tetracycline is a known inhibitor of matrix metalloproteinases and hence inhibits resorptive activity. Trope et al evaluated the relationship of intracanal medicaments to endodontic flare-ups. Ledermix, Formocresol and calcium hydroxide were placed in a specific sequence irrespective of the presence or absence of radiographic signs or symptoms of apical periodontitis. No significant difference was found between the three medicaments in flare-up rate [30]

A combination of Ledermix with calcium hydroxide has also been recommended as an intra-canal medicament in necrotic teeth with incomplete root formation, perforations, inflammatory resorption, and in endodontically involved teeth with large periapical lesions [28]. Thong et al compared the effect of calcium hydroxide (Pulpdent) and Ledermix paste on root resorption and periodontal healing after replantation. Histomorphometrically, they found that inflammatory root resorption and periodontal ligament inflammation were markedly inhibited by both calcium hydroxide and the corticosteroid-antibiotic relative to untreated controls. Replacement resorption was lowest in the corticosteroid-antibiotic group, and significantly more normal periodontal ligament was present than in the calcium hydroxide and control groups [31] Chu et al compared the efficacy of disinfection of root canals with periapical radiolucencies when treated either with steroids/antibiotic as a medicaments (Ledermix or Septomixine). Ledermix demonstrated significantly superior disinfection of the root canals when compared to Septomixine or Calasept (Calcium hydroxide) [32]. Septomixine forte paste contains corticosteroids as anti-inflammatory agents. Septomixine forte contains two antibiotics ie, neomycin and polymixine B sulphate. Both of these antibiotics are not suitable to use against the commonly occurring endodontic bacteria because of their inappropriate spectra of activity [33]. Tang proposed that neomycin was not effective against bacteroides, fungi and related species but they are bactericidal against gram-negative bacilli. Polymixine B sulphate is effective against gram positive

bacteria. He demonstrated that application of septomixine for routine one week was not effective in inhibiting intra-canal bacterial growth and although the dexamethasone, anti-inflammatory agent is clinically effective, but triamcinolone is considered to have less systemic side effects [34].

CONCLUSION

Steroids are not widely used in endodontics because of its immunosuppressive effect, the use of steroids will suppress the defensive body mechanism. The literature says that a single dose (or) localized use of steroids (intra-canal medicament) will not have any specific harmful effects like immunosuppression, so we conclude that the wise use of steroids with the combination of antibiotics will not have any adverse effects like systemic doses.

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