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Review / Derleme

Flare-up

Alevlenmek

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ABSTRACT

A continually and frequently bothersome problem in endodontics is the development of pain and swelling called "flare-up" during or after endodontic therapy. In this article, the causative factors and some therapeutic proposes have been researched. Some situations occur during and after endodontic therapy, such as debris extrusion, overinstrumentation, single visit, and periapical lesions. Various treatment regimens for the relief of pain in these situations, including premedication, establishment of drainage, antibiotics and analgesics, and occlusal reduction, have been suggested.

Keywords: Flare-ups, endodontic treatment, acute exacerbations

ÖZ

Endodontide sürekli ve sık sık rahatsız edici bir problem, endodontik tedavi sırasında veya sonrasında ağrının ve şişkinliğin, yani "alevlenme"nin gelişmesidir. Bu makalede, sebep olan faktörler ve bazı tedavi önerileri araştırılmıştır. Endodontik tedavi sırasında ve sonrasında debriz ekstrüzyonu, aşırı şekillendirme, tek ziyaret, periapikal lezyonlar gibi bazı durumlar vardır. Bu durumlarda ağrının giderilmesi için premedikasyon, drenajın kurulması, antibiyotik ve analjezikler ve oklüzal redüksiyon gibi çeşitli tedavi rejimleri önerilmiştir.

Anahtar Kelimler: Alevlenmeler, endodontik tedavi, akut alevlenmeler

INTRODUCTION

Many researchers and clinicians writing about endodontic flare-ups define this expected treatment complication differently. Interappointment flare-up is a true emergency characterized by the development of pain, swelling, or both that requires a scheduled patient visit and active intervention by the dentist. The American Association of Endodontics defines a flare-up as an acute exacerbation of periradicular pathosis after the initiation or continuation of root canal treatment (1).

Incidence: Studies report varying frequencies of flare-up (1.4 to approximately 45%). These variations may be due to different factors, such as age, gender, tooth type, pulpal status, allergies, presence of postoperative pain, and sinus tract stoma (2-13). The problems with most of these studies are that they are retrospective, lack controls, have relatively small numbers of patients, or have undefined variables. Prospective studies, which are better controlled, report an overall incidence of flare-ups of 1.4%-3%. Most postoperative discomfort is in the mild range (14).

Causative factors

The causes of flare-ups are many and often multifactorial. The causative factors of interappointment flare-ups comprise local adaptation syndrome; mechanical, chemical, and/or microbial injuries to the pulp; or periradicular tissues (8, 15). In response to this injury, inflammatory mediators, such as prostaglandins, leukotrienes, lysosomal enzymes, nitric oxide, bradykinins, platelet-activating factor, substance P, vasoactive intestinal peptide, and other neuropeptides, are released into the tissues surrounding the apical area of the tooth. As a result, pain fibers are directly stimulated or sensitized. In addition, increase in vascular dilation and vascular permeability and chemotaxis of inflammatory cells result in edema and increased interstitial tissue pressure (16, 17).

Chronic inflammation persists if the irritant is not removed; there is local adaptation. However, when a new irritant is introduced to the inflamed tissue, a violent reaction may occur. When endodontic therapy is performed, new irritants in the form of medicaments, irrigating solutions, or chemically altered tissue proteins may be intro-

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duced into the granulomatous lesion. A violent reaction may follow, leading to liquefaction necrosis, indicative of an alteration of the local adaptation syndrome. The pus, under pressure, is capable of evoking severe pain or swelling (15).

Mechanical and chemical injuries are often associated with iatrogenic factors. Inadequate debridement, debris extrusion, overinstrumentation, overfilling, one-appointment endodontics, retreatment, microbiology and immunology, periapical lesions, and host factors are examples of mechanical and chemical irritation causing periradicular inflammation.

Inadequate debridement: Persistent pain or onset of acute pain often signals the presence of residual pulp tissue in inadequately instrumented or still-undetected canals. Inadequate debridement of a pulp that has degenerated or is degenerating allows bacteria and their toxins to remain in the root canal and act as a continuous irritant (10). Teeth with necrotic pulps (presumably infected) are more prone to develop midtreatment flare-ups than those with vital pulp (presumably uninfected) (6).

Debris extrusion: Apical extrusion of infected debris to the periradicular tissues is possibly one of the principal causes of postoperative pain (15, 18). Despite strict length control of instruments during root canal preparation, pulp tissue fragments, necrotic tissue, microorganisms, dentin filings, and canal irrigants are extruded beyond the apical foramen (19, 20). There is a balance between microbial aggression (from infecting endodontic microbiota) and host defense in the periradicular tissues in asymptomatic chronic periradicular lesions associated with infected teeth.

Debris extrusion is a problem with all instrumentation techniques; however, some techniques cause less extrusion than others (21, 22). Techniques involving a linear-filing motion usually create a greater mass of debris than those involving some sort of rotational action (21). The researchers found that sonic instrumentation extruded the least debris in comparing the mean weights of apically extruded debris. Conventional hand instrumentation was shown to extrude the most debris; shaping the canal in the coronal aspect before apical preparation may reduce debris extrusion.

Crown-down (1, 23-25) and balanced forces (26) instrumentation techniques have been shown to extrude significantly less debris than step-back techniques and should be elected for the instrumentation of infected root canal. Irrigation solutions may also be extruded during instrumentation. Forced irrigation of sodium hypochlorite beyond the apex of the tooth can cause violent tissue reactions and unbearable pain. In vital cases, the extruded irrigant has been found only in the space created by instrumentation. In necrotic cases, the irrigant may go beyond the instrumented areas.

When virulent clonal types of pathogenic bacterial species are present in the root canal system and are propelled to the periradicular tissues during instrumentation, even a small amount of infected debris will have the potential to cause or exacerbate periradicular inflammation (27).

Overinstrumentation

The correlation between endodontic overinstrumentation and postoperative pain has been shown. The incidence of moderate to severe pain is reported to be significantly higher if instrumentation occurs beyond the apical foramen.

Exacerbations as a result of overinstrumentation are more likely to develop as a result of mechanical injury to the periradicular tissues (the larger the files, the larger the tissue damage), which is usually coupled with apical extrusion of a significant amount of infected debris.

Overfilling

The extrusion of sealer or gutta-percha or both into the periapical tissues of the teeth with no periapical radiolucent areas is more likely to cause a higher incidence and degree of postobturation pain than similar teeth, filled flush or up to 1 mm short of their radiographic apices (28, 29). Even though overfilling with zinc oxide-eugenol sealers has been shown to cause chronic inflammation, it may be that a small overfill of gutta-percha and/or sealer is not the primary cause of postobturation pain. However, large overfills are a factor in postobturation pain. In addition, gross overfillings can cause nerve damage because of the chemical toxicity of the extruded material and mechanical nerve damage caused by compressing or crushing forces of the foreign material. A slight extrusion of gutta-percha is probably insignificant, affecting neither the incidence of postoperative pain (30) nor the long-term prognosis (31).

One-appointment endodontics

The reported incidence of postoperative pain following single- or multiple-visit endodontic treatments varies considerably. In some studies, single-visit procedures produced less pain (32). In other studies, the incidence was the same (33-35). In a few studies, single-visit procedures produced a much higher incidence of posttreatment pain (36, 37). Endodontic treatment of the posterior teeth also appears to produce more postoperative discomfort (33, 36), especially after single-visit procedures (32). Most patients experience less or no spontaneous pain after one-visit root canal therapy; only 2% may experience severe pain.

Oginni and Udoye (38) reported that single-visit endodontic therapy has been shown to be a safe and effective alternative to multiple-visit treatments.

In fact, the frequency of pain in single- or multiple-visit root canal therapy does not differ (3, 6, 12, 39, 40).

However, ideally, chemo-mechanical procedures should be completed in a single appointment. Maximum removal of irritants from the root canal system may reduce the risks of interappointment discomfort caused by surviving microbial species that either overgrow as a result of elimination of inhibitory species or become more virulent as a result of changes in the environmental conditions.

Use of an antimicrobial intracanal medicament between appointments in the treatment of infected cases

The use of an antimicrobial intracanal dressing is a valuable tool to control endodontic infections. Harrison et al. (41) showed that the use of an antimicrobial intracanal medicament and sodium hypochlorite irrigation can prevent postoperative pain, whereas some authors have reported that intracanal medications have no influence on the incidence of postoperative pain (5, 8). Evidence indicates that intracanal medicaments are required for maximum microbial elimination in the root canal system and for killing microorganisms not reached by the instruments and irrigants (42, 43). In addition, intracanal medicaments that temporarily fill the root canal especially based on calcium hydroxide deny space for microbial proliferation between visits and can play an important role in preventing the recontamination of the root canal between appointments. However, intracanal medicaments are highly unlikely to be effective in preventing flare-ups caused by extruded microorganisms during the chemo-mechanical procedures.

Moreover, establishment of drainage followed by complete chemo-mechanical preparation, placement of an antimicrobial intracanal medication, and coronal closure at the same appointment result in a reduced risk of persistent symptoms, as well as in fewer appointments to complete therapy when compared with teeth left open for drainage (44).

Asepsis is paramount in endodontic therapy to prevent infection in vital cases or introduction of new microbial species in cases of infected necrotic pulps. Thus, clinicians should be aware of the need to perform endodontic treatment under strictly aseptic conditions as some cases of secondary infections may even be more difficult to treat than primary infections and may cause flare-ups, persistent symptomatology, and/or failure of the root canal treatment (11).

Microbiology and immunology

Local adaptation syndrome, changes in periapical tissue pressure, and microbiological and immunological factors for endodontic flares up have been described in the literature (15), including the association between certain microorganisms and clinical signs and symptoms.

Prevention and treatment of flare-ups

Studies have shown that postoperative pain will diminish to low levels within 72 h (28). This is a stressful time for the patient consumed by pain, as well as for the practitioner, whose job is to help the patient. During this critical period, clinicians must know how to alleviate patients' pain quickly and effectively and prevent its recurrence. For this reason, the use of long-acting anesthetic solutions, total cleaning and shaping of the root canal system, relaxing the patient, and analgesics will decrease interappointment symptoms (45).

Root canal treatment is one of the most anxiety-inducing dental procedures. Therefore, the patient must feel relaxed and comfortable before treatment can begin and proceed smoothly and efficiently. General anesthesia and conscious intravenous sedation are excellent adjuncts for treating such patients. A useful alternative is oral sedation with anxiolytic medication. When triazolam 0.25 mg and diazepam are compared, diazepam has a shorter half-life and produces significantly more intraoperative amnesia, to the point where patients cannot recall local anesthetic administration, whereas triazolam has a greater anxiolytic effect when administered sublingually rather than orally (46).

Pharmacological approach for pain management is the use of long-acting, local anesthetics. Clinical trials indicate that long-acting, local anesthetics not only provide anesthesia during the procedure but also significantly delay the onset of posttreatment pain as compared with lidocaine-containing local anesthetics (47-49).

Complete cleansing and shaping of the root canal system during the initial treatment visit is the most effective method to reduce flare-ups. Moreover, the decision to use an intracanal medicament should be guided by the antibacterial efficacy, toxicity, and specificity of the drug.

In a double-blind clinical trial, the intracanal placement of a 2.5% steroid solution or saline placebo upon completion of instrumentation resulted in a significant reduction of the incidence of postoperative pain in teeth in which the pulp is vital (50).

Calcium hydroxide intracanal dressings are therapeutic in the prevention or treatment of flare-ups. Application of calcium hydroxide is intended to reduce bacterial colonies and their toxic by-products. Sjögren (51) has shown that the antimicrobial effects of calcium hydroxide are best achieved if calcium hydroxide remains in the root canal system for at least 1 week. The possibility of calcium hy-

droxide reducing postoperative pain may depend on its ability to kill bacteria and neutralize their by-products. Placement of calcium hydroxide between appointments is recommended for all teeth. Its therapeutic value is especially evident for symptomatic teeth, during long interappointment delays when periapical infection is present (52).

Leaving teeth open is incoherent and detracts from the sound biological principles of endodontic therapy. Therefore, it is best to close all teeth immediately after treatment to prevent contamination by the oral cavity and to prevent future problems. Establishment of drainage followed by complete chemo-mechanical preparation, placement of an antimicrobial intracanal medication, and coronal closure at the same appointment result in reduced risk of persistent symptoms, as well as in fewer appointments to complete the therapy when compared with teeth left open for drainage (43).

It is worth pointing out that even in the presence of diffuse swelling without any purulent discharge, the tooth should not be left open to await drainage. If the tooth is left open, more microbial cells, species, products, and substrates are allowed to gain access to the root canal and the periradicular tissues. Treatment of an interappointment or postoperative swelling is similar to the treatment of a preoperative swelling: The toot is opened, and the canal is slowly recleaned and irrigated with sodium hypochlorite. If possible, drainage should be established. After opening, if there is active drainage from the tooth, the rubber dam is left in place, and the patient is allowed to rest pain-free for at least 30 min or until drainage stops. Then, the canals are dried, calcium hydroxide paste is placed, and the access is sealed. If there is no drainage, the tooth should also be gently instrumented and irrigated, then medicated with calcium hydroxide paste, and closed.

For most flare-ups, nonsurgical root canal therapy is the preferred treatment method because the root canal contents can be thoroughly cleaned in a non-invasive manner. However, in some cases, surgical trepanation can be used as a palliative measure.

The use of prophylactic antibiotics to prevent a flare-up in asymptomatic, necrotic teeth has been investigated. Morse et al. (4, 7, 53) concluded that prophylactic antibiotics significantly decrease the incidence of flare-up. However, Walton and Chiappinalli (54) concluded that posttreatment symptoms are not affected by the prophylactic administration of penicillin. Various studies have provided evidence that prophylactic doses of antibiotics may be used to prevent infections. Especially, if bacteria are responsible for endodontic flare-up, perhaps prophylactic antibiotics could prevent their occurrence. Penicillin has been preferred owing to its bactericidal action and efficacy.

Glucocorticosteroids are known to reduce the acute inflammatory response by suppressing vasodilatation, polymorphonuclear leukocyte migration, and phagocytosis and by inhibiting the formation of arachidonic acid from neutrophil and macrophage cell membrane phospholipids, thus blocking the cyclooxygenase and lipoxygenase pathways and respective synthesis of prostaglandins and leukotrienes (53). Therefore, corticosteroids are too important to effect on the prevention or control of postoperative endodontic pain or flare-ups.

Corticosteroids appear to have their greatest effect in the first 24 h postoperatively. For patients with serious pain, it may be beneficial to prescribe or administer some form of corticosteroid. Various corticosteroids have been incorporated into calcium hydroxide cements or pastes to prevent or reduce pulpal inflammation and to relive pain. Uitto et al. (55) recorded that corticosteroids cause degenerative changes in the tissue and reduce the pulpal ability to form a hard tissue barrier in the presence of calcium hydroxide. No biologically acceptable histological results have been reported thus far with regard to the addition of corticosteroids to calcium hydroxide-containing pulp-capping agents. Conventional infiltration or block local anesthetic injections may not achieve complete anesthesia in the presence of acute inflammation. In teeth with irreversible pulpitis, this means that total removal of the dental pulp is not always possible because the patient feels pain. In these situations, a sedative dressing, such as the corticosteroid/antibiotic mixture Ledermix® (Blackwell Supplies, Gillingham, UK), is often applied to the inflamed pulp and removal completed at a subsequent visit (56).

Oral methylprednisolone is effective in reducing postoperative symptoms when administered prophylactically (with penicillin) to patients in moderate to severe pain (44). Methylprednisolone also reduces the frequency and intensity of postobturation pain after single-visit treatment, and the effect of intramuscular injections of corticosteroids on postoperative pain is also similar (57).

The disadvantages of using corticosteroids in endodontic therapy are derived from their effects on inflammatory cells. Although the density of the inflammatory infiltrate in the periodontal ligament may be reduced by corticosteroids (58), they interfere with phagocytosis and protein synthesis. As a result, infections may become rampant, and repair may be impaired or delayed.

Tryptophan is an essential amino acid. In a controlled study, Shpeen et al. (59) reported that when 3 g of tryptophan is given daily to 25 patients, there is a significant

reduction in postendodontic treatment pain after 24 h, compared with the control group.

Inflammation alters the response properties of nociceptors through the action of inflammatory mediators, such as prostaglandins. Nonsteroidal anti-inflammatory drugs, such as ketorolac (60), are potent inhibitors of prostaglandin synthesis but have mainly been dispensed as oral tablets or by intramuscular injection. Ketorolac has been administered by intraoral injection for endodontic pain (61), and it has also been used as an intracanal medicament in endodontics (62).

The use of pretreatment and posttreatment analgesics may significantly reduce the incidence of flare-ups, especially for patients in moderate to severe pain.

Another treatment regimen is acupuncture. Acupuncture has been used for dental analgesia with good success in a number of dental procedures (63, 64). The effects of acupuncture are possibly due to the central release of endorphins (65). However, currently, acupuncture is not used to treat endodontic flare-ups since most endodontist are not familiar with the technique.

Eitner et al. (66) described a newly developed dental treatment concept for patients with a distinctive gag reflex. They reported that "hypnopuncture" is a combination therapy of hypnosis and acupuncture. It is a simple, fast, and effective application autonomous of the cause, making it a valuable tool for dental-emergency treatment procedures. Physiological and psychological aspects of gagging are influenced at the same time. Necessary and effective therapeutic measures from both acupuncture and hypnosis are portrayed.

In spite of all of these, if cleaning and shaping of the root canal system is made carefully with effective irrigation and crown-down techniques, flare-up rate is lower.

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