

Effect of Analgesic Pre-medication on post-operative Endodontic pain: An Explicit Review

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Abstract

Post-operative pain (POP) following endodontic treatment is a common occurrence and has been a matter of concern to endodontists since time immemorial. This abnormal sensory response is a sequela of periapical inflammation in response to instrumentation and irrigating solutions during the chemo-mechanical preparation of the root canal. A pertinent remedy to this is the pretreating of the patients with analgesic medication. This article thus explores the various analgesics mentioned in literature which was given to patients undergoing endodontic treatment as a preemptive measure to minimize the pain postoperatively.

Keywords—pre-medication; post-endodontic pain; POP; analgesic; NSAIDs; corticosteroids

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I. Introduction

The definition of Pain as proposed by the International Association for the Study of Pain in 2019 is “an aversive sensory and emotional experience typically caused by, or resembling that caused by, actual or potential tissue injury”.¹ The incidence and severity of postoperative pain are found to be the highest following endodontic therapy, ranging between 3%-58%.² The advent of newer file systems and improved irrigation devices have seen a paradigm shift towards single visit root canal therapy. There have been various articles published in the literature comparing the incidence of post-endodontic pain following a single and a multiple visit endodontic treatment. A consensus reached until now states that there have been no significant differences found between the two modes of treatments and reduction in postoperative pain levels. In either case, pain experienced by the patient postoperatively is undesirable, and managing the same is of paramount importance.

II. Factors responsible for post-endodontic pain

Nagendrababu and Gutmann in 2017³ have enumerated various preoperative and procedural factors that were responsible for peri-radicular tissue injury as a result of mechanical instrumentation, chemical irrigants, intracanal medicaments, and microbial effects, ultimately leading to post-operative pain. The factors are:

- a) Age- POP is experienced more in older age groups than young ones as a result of low pain tolerance, less vascularity, and delayed healing.
- b) Sex- Females have shown a higher prevalence of POP than the males which can be attributed to the hormonal and psychosomatic factors.⁴
- c) Tooth type and position- posterior teeth especially mandibular molars showed a higher incidence of POP due to their complex root canal anatomy and also a thicker cortical bone covering leading to delayed healing.⁵
- d) Presence of pre-operative pain- due to the presence of pre-operative infection triggering nociceptive signals.
- e) Pulpal status- teeth with non-vital pulps have a higher incidence of POP.⁶
- f) Teeth with a larger periapical radiolucency showed a decreased incidence of pain as a larger size acted as a buffering factor to decrease the pressure build-up by the exudates.⁴
- g) Instrumentation-multiple rotary Ni-Ti files tend to cause less POP than the single reciprocating files.⁷ This can be attributed to the fact that the periodontal ligament has a neurogenic component where the nerves control the vascular tone by neuropeptides such as Substance P and calcitonin gene-related peptide (CGRP). These substances were released by the PDL in response to the extruded debris. Substance P and CGRP were also seen to be increased during hand instrumentation with Stainless Steel files than rotary or reciprocating instrumentation.⁸
- h) Irrigation- NaOCl extruded peri-apically can be a triggering cause of POP. Also, negative pressure irrigation devices like EndoVac has been reported to cause less POP.⁹
- i) Obturation techniques- obturation with Thermafil (carrier-based obturator) showed a higher incidence of POP owing to the extrusion of the filling material peri-apically; than the cold lateral condensation technique.¹⁰

III. Mechanism of post-endodontic pain

Following an injury or cell damage, two main neurosensory events can occur- primary hyperalgesia and secondary hyperalgesia. Secondary hyperalgesia is indicative of central sensitization.¹¹

Peripheral sensitization occurs due to an increased sensitivity to an afferent nerve stimulus. Following an injury or cell damage to an area, a flare response occurs due to the production of the increased neuropeptide, by the nociceptors resulting in an increased sensitivity to even a heat or touch stimuli; and is referred to as primary hyperalgesia/ allodynia. The increased inflammatory response results in an up-regulation of receptors on the nociceptive terminals brought about by the various chemical mediators like bradykinin, histamine. Peripheral sensitization can also be brought about by the up-regulation of new receptors.

Central sensitization is an increased responsiveness of nociceptors in the central nervous system to either normal or even sub-threshold afferent stimuli, which can result in a hypersensitivity to the stimuli or even increased pain response to stimuli outside the area of injury. Activation of the N-Methyl-D-Aspartate(NMDA) receptor is an essential step in initiating and maintaining the sensitization. NMDA is a glutamate receptor, leading to a disproportionate and unpredictable pain pattern.

Pretreatment analgesia is providing analgesia to patients before the commencement of endodontic treatment. This measure can decrease the establishment of central and peripheral sensitization, besides carrying the advantage to reduce post-operative pain and postoperative analgesic intake.¹² This contexture has encouraged various authors to study the effectiveness of various oral pre-medications like NSAIDs and corticosteroids on POP following endodontic therapy.

IV. Effect of Oral pre-medications

- Non-Steroidal Anti-inflammatory Drugs forms the most common group of drugs usually prescribed post-endodontic treatment, which includes ibuprofen, ketorolac, and piroxicam, often synergized with acetaminophen.

Cyclooxygenase-1(COX-1) and Cyclooxygenase- 2(COX-2) are the enzymes involved in the metabolism of arachidonic acid. These enzymes enhance the production of prostaglandins which play a key role in mediating inflammation and the production of pain. COX 1 and COX 2 are blocked by NSAIDS.¹³ The extensive and prolonged usage of NSAIDS leads to gastrointestinal ulcers(reversing the gastro-protective action of prostaglandins), renal & hepatic disorders, and also platelet aggregation. Although the use of selective COX inhibitors has provided a tentative relief to these problems.

Studies have compared Ibuprofen with other pre-medications such as tenoxicam and rofecoxib. Ibuprofen showed an increased ability in decreasing POP when used preoperatively in the first 2 hours post-treatment which can be attributed to its shorter half-life. However, a systemic review reported by De Geus J.L et al.¹⁴ stated that no significant difference was found between Ibuprofen and other pre-medications and in certain studies even with placebo. Wali A et al.¹⁵ in 2012 conducted a randomized controlled clinical trial to compare the effectiveness of premedication with analgesics for the success of inferior alveolar nerve block in irreversible pulpitis. Piroxicam, Diclofenac Potassium, and Naproxen Sodium were the drugs used in the trial and it showed a success rate of 90%, 75 %, and 35 % respectively in reducing pain intensity when given an hour before injecting anesthesia and rendering an effective nerve blockade.

- The use of a corticosteroid to reduce pre-operative, intra-operative and post-operative endodontic pain was described as early as 1956 by Stewart.¹⁶ Since then Several Randomized Controlled Trials has been reported in the past, propagating the use of corticosteroids as premedication to control post endodontic pain. Corticosteroid has a wider range of actions in controlling pain as it blocks the phospholipase A₂ enzyme preventing the conversion of arachidonic acid from phospholipids. Corticosteroids have been ranked superiorly in reducing pain at 6,12 and 24 hours.¹⁷ Another mechanism by which steroids have an anti-inflammatory effect is by activation of cytoplasmic glucocorticoid receptors which regulate the transcription of some primary response.¹⁸ At this cellular level, regulation of the immune system takes place, including regulation of several pro-inflammatory cytokines.^{18,19} This mechanism is helpful in the suppression of glucocorticoids on COX-2 thus prolonging the time required for the changes in the gene expression, all of which are responsible for its delayed action. Dexamethasone, thus having a plasma half-life of 1.5-4 hours exhibits its actions for 24-36 hours. As a result of which, 8 mg of Dexamethasone is usually advised to be taken 1 hour before the procedure compared to 400 mg of Ibuprofen which can be taken 15 mins before the procedure.²⁰

Jorge-Araújo ACA et al.²⁰ compared the efficacy of Dexamethasone with Ibuprofen and placebo as premedication and found no significant difference between Dexamethasone and Ibuprofen in controlling

post-operative pain. Furthermore, the corticosteroid can cause adverse effects like fluid retention, muscle weakness, and delayed healing to name a few.

- Recently, an anti-cough medication, Dextromethorphan was evaluated for its usage as an oral premedication to control POP following Endodontic treatment. Dextromethorphan is a methylated dextrorotatory analog of levorphanol and has a slight affinity for μ opioid receptors. Though it might cause a little sedation, it doesn't cause dependence, unlike codeine. It is the non-competitive antagonist of the N-methyl-D-aspartate receptor and is effective for abolishing central hypersensitivity.²¹ ZareJahromi M et al.²² assessed the efficacy of premedication with dextromethorphan compared to ibuprofen for pain relief following the endodontic treatment. They concluded that although Ibuprofen showed a faster effect than Dextromethorphan due to its lesser plasma half-life and also due to its action on peripheral pain receptors unlike the later which acts on the central nervous system like NMDA receptors; no significant difference was found between the two drugs. Talakoub and Molaeinasab²³ in 2005 evaluated the efficacy of premedication with dextromethorphan if it could decrease the need for morphine during surgery and inferred that oral dextromethorphan decreased pain and the need for morphine injection during surgery. Also, it caused a maximum reduction in systolic blood pressure during the procedure.

V. Conclusion

The findings from the literature give a clear indication that oral premedication does have a role to play when it comes to reducing the post-endodontic pain. However, studies are scarce to prove the same. Thereby, further research is required to bridge the gap of knowledge addressing the effectiveness of pre-medications to control pain post-operatively in Endodontics.

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