Influence of Endodontic Procedure on Postoperative Pain – Evidence from Systematic Reviews*

**SUMMARY**

Pain control, during and after root canal treatment is one of the important issues in endodontic practice. Occurrence of pain after intervention often presents considerable distress to both patient and dentist. In many studies influence of different endodontic treatment factors on incidence of postoperative pain has been investigated. However, different and inconsistent results between studies and growth in number of published papers each year made professional updating and clinical-decision making challenging. Systematic reviews synthesized and combined data from relevant studies to find the answer to a research question providing the highest level of scientific evidence. Thus, their use may facilitate decision making in clinical practice. The aim of this article was to present results from systematic reviews about the influence of endodontic treatment on postoperative pain.

**Key words:** Postoperative Pain, Root Canal Therapy, Systematic

**Introduction**

Pain control, during and after root canal treatment is one of the important issues in endodontic practice. Occurrence of pain after intervention often presents considerable distress to both patient and dentist, especially in situation where patient was symptom-free before the treatment. Any degree of pain that occurs after the endodontic treatment is defined as postoperative pain. According to the literature, its prevalence ranges between 3% and 58% of all endodontic patients. A subset of postoperative pain characterized by a high degree of pain and/or swelling after treatment which require patients unscheduled visit for treatment is known as flare-up.

Postoperative pain occurs as a result of acute periapical inflammation in response to mechanical, chemical and/or microbial injury of periapical tissues during the root canal treatment. As a complex multifactorial process postoperative pain is influenced by many factors involving patient- and tooth-related factors as well as endodontic intervention. Many studies investigated influence of different procedural factors during endodontic treatment on occurrence and intensity of postoperative pain including instruments design and instrumentation technique, chemical irrigants and irrigation techniques, intracanal medicaments, number of visits, and obturation material and techniques. Considering inconsistent results from various studies, and growth in number of published studies each year, systematic reviews may help professionals in keeping up to date and facilitate clinical-decision making. Namely systematic reviews synthesize and combine data from relevant studies to find the answer to a research question, providing the highest level of scientific evidence. Therefore, the purpose of this article was to present results from existing systematic reviews about the influence of endodontic treatment on postoperative pain and summaries available evidence.

**Overview of systematic reviews**

The literature searches were performed in PubMed/MEDLINE and Cochrane Database of Systematic Reviews, until March 10, 2019. Systematic reviews related to pain after different root canal treatment...
procedures and references included in systematic reviews were searched. The search criteria included key words appropriate to the study (endodontic postoperative pain, postendodontic pain, endodontic treatment, root canal treatment). Studies were included if they were systematic reviews, published in English language only, and linked to postoperative pain related to root canal treatment.

Instrumentation

For root canal instrumentation hand instruments or engine driven nickel-titanium instruments can be used. Engine driven instruments can operate in continuous rotary and reciprocating motion. According to number of files used for instrumentations, engine driven instruments can be divided in single- and multiple-file systems. Different root canal instruments may produce different amounts of extruded debris, affecting the postoperative pain incidence. Two recent systematic reviews and meta-analysis assessed influence of type of instruments on postoperative pain. According to Hou et al., use of rotary instruments was related to lower incidence of postoperative pain in comparison to reciprocating instruments in single visit root canal preparation, but difference was not statistically verified.

The authors further investigated difference in pain degree between two types of instruments and found that rotary instruments were associated with lower incidence of moderate and severe postoperative pain while reciprocating instruments were associated with higher incidence of mild postoperative pain. Sun et al. compared incidence and intensity of postoperative pain between hand and rotary instruments, as well as between rotary and reciprocating instruments in single visit root canal treatment. According to review and meta-analysis results multiple rotary instruments contributed to significantly lower incidence and intensity of postoperative pain in comparison to hand files. When the types of hand instruments and shaping technique of rotary instruments were included in analysis, rotary instruments using crown-down technique were associated with lower incidence of postoperative pain than K-files. When rotary and reciprocating instruments were compared, multiple rotary instruments were associated with significantly lower incidence of postoperative pain, and may contribute to lower intensity of pain.

Working length/Foraminal enlargement

It has been proposed that root canal preparation and obturation should be terminated within 1 to 2 mm of the radiographic root apex, in vital and non-vital teeth, including teeth with periapical lesion. In order to improve disinfection of apical part of root canal and facilitate healing of periapical lesions, foraminal enlargement was proposed. This means that apical preparation is terminated at apical foramen. However, foraminal enlargement may cause injury to the periapical tissue and extrusion of infected debris leading to pain. In systematic review and meta-analysis Borges Silva et al. showed that foraminal enlargement was associated with significantly higher postoperative pain in the first, second, fourth, sixth and seventh day after treatment in comparison to conventional endodontic treatment of both necrotic teeth and teeth with apical periodontitis.

Apical patency

Apical patency is a preparation technique in which the apical region of the root canal is maintained as free of debris and tissue remnants by insertion of K file size #10 or #15 1 mm longer than the working length, without binding and widening apical constriction. Despite advantages of apical patency concept, repeated passing of instrument beyond the apex can lead to inflammatory reaction in periapical tissue due to extrusion of infected debris secondary to mechanical instrumentation beyond the apical foramen. Yaylali et al. in recent systematic review of randomized controlled trial concluded that maintaining apical patency did not increase postoperative pain regardless of tooth vitality and number of visits. Moreover, apical patency did not cause flare-ups. In meta-analysis published shortly after previous, Abdulrab et al. also concluded that apical patency was not associated with an increased incidence of postoperative pain after root canal treatment, as trend of less postoperative pain for apical patency teeth was observed. Furthermore, significantly more postoperative pain can be expected in no patency teeth than in teeth where apical patency was performed five days after intervention, but not after other days.

Irrigation

In endodontic therapy range of antibacterial irrigating solutions are available: sodium hypochlorite (NaOCl), chlorhexidine (CHX), ethylenediaminetetra-acetic acid (EDTA), as well as recently developed combined irrigation solution, such as MTAD and QMiX. Root canal irrigation can be performed with either conventional manual syringe irrigation technique with needle or with different delivery and agitation techniques. Extrusion of chemically active solutions, secondary to debris, beyond the apex can result in postoperative pain. Considering the influence of type of root canal irrigants on postoperative pain, Fedorowicz et al. found from the underpowered studies that postoperative pain after root canal treatment is not influenced by irrigant solutions. Namely, incidence of postoperative pain did not differ between 5.25% NaOCl and 5.25% NaOCl combined with 3% hydrogen peroxide, and between 5% of NaOCl used alone or in combination with proteolytic enzyme. In the very recent systematic review and meta-analysis Decurcio et al. assessed influence of different machine-assisted irrigation agitation methods on postoperative pain during root canal treatment. Authors found that use of agitation technique by ultrasonic or sonic devices and negative
apical pressure device reduced postoperative pain with respect to syringe needle irrigation at 24 and 48h after root canal treatment. Subgroup analysis showed similar effect of agitation techniques on postoperative pain when only teeth with symptomatic irreversible pulpitis, with moderate to severe preoperative pain, instrumented with rotary files, were analyzed.

**Intracanal medication**

Different intracanal medicaments are used during endodontic treatment to improve disinfection, facilitate healing and prevent or reduce postoperative pain. Anjaneyulu and Niveditha investigated effectiveness of calcium hydroxide as intracanal dressing in reducing the postoperative pain, and found that calcium hydroxide was not effective. However, when used in combination with other intracanal medicaments (chlorhexidine, camphorated monochlorophenol) its effectiveness in reducing postoperative pain can increase.

**Obturation**

Several materials and techniques have been recommended for filling of root canals after chemomechanical debridement. Sealer composition and root canal filling methods may influence incidence of postoperative pain. In meta-analysis Peng et al. investigated outcome of root canal filling with warm gutta-percha (thermomechanical compaction, thermoplasticized injectable gutta-percha obturation, ultrasonic condensation of gutta-percha, and solid-core carry insertion technique) in comparison to cold lateral condensation, and found that incidence of postoperative pain was similar between the two groups, although the overextension was seen more frequent in the former technique. The results of systematic review and meta-analysis of Wong et al. indicate that postoperative pain of core-carrier obturation was comparable with that of cold lateral condensation in day 1 and 7 days after intervention. Moreover, no significant difference in the technical quality of root canal filling (overfilling or adequate adaptation) was found between techniques.

**Number of visits**

Endodontic treatment in a single visit, especially of infected teeth, is still controversial because it has been introduced as alternative to the conventional approach in multiple visits. Pain and other complications may influence adoption of single-visit approach. There were many systematic reviews published in the literature up to date investigating influence of number of visit not only on endodontic outcome but also on postoperative pain. In systematic-review with meta-analysis Figini et al. found no significant difference in postoperative pain up to 72h and one week after treatment between single- and multiple-visit root canal treatment, although one week postoperative pain was less common after multiple-visit treatment. None of patients had persistent pain at one month. In addition, frequency of swelling was less common in multiple-visit than in single visit treatment, but difference did not reach significance. When necrotic teeth were analyzed only, incidence of pain remained insignificant, although pain was less common after single-visit treatment. Sathorn et al. in systematic review also indicated no significant difference in prevalence of postoperative pain/flare-up between single- and multiple-visit root canal treatment. In systematic review with meta-analysis Su et al. investigated endodontic treatment in single or multiple visits of infected necrotic root canals only. Authors reported that prevalence of short-term postoperative pain (up to 72h) was significantly lower in single-visit treatment; incidence of medium-term postoperative pain (7 to 10 days) was not significantly different between two treatment approaches, but appeared slightly lower in single-visit treated teeth. In addition, none of patients reported longer-term of postoperative pain after one month. Wong et al. showed that both single and multiple-visit treatment induce similar postoperative complications, including pain. Updating the review of Figini et al., Manfredini et al. found no significant difference in postoperative pain up to 72h hours, one week and 18 months as well as in prevalence of flare-up or swelling after root canal treatment between participants treated in single or multiple visit, although patients undergoing single-visit treatment may experience a higher level of pain at one week after treatment. Similar results were obtained when subgroups analyses were performed regarding tooth diagnosis (vital or necrotic teeth). Schwendicke and Göstemeyer found that risk for postoperative pain or long-term complications were not related to number of treatment visits. However, risk for flare-up was significantly higher after single-visit in comparison to multiple-visit treatment. Moreira et al. in overview of systematic reviews concerning endodontic treatment in single and multiple visits found slightly lower incidence of postoperative complication in single visit treatment of teeth with necrosis, and apical periodontitis, with level of evidence qualified as high for this clinical approach.

**Overall clinical implications**

Postoperative pain is undesirable complication of root canal treatment. It can be affected by preoperative (patient and tooth) and procedural factors during the endodontic intervention. Knowing the risk factors may be of great help in clinical practice in order to identify patients with increased risk, and to conduct measures to reduce postoperative pain. This study highlights the evidence from systematic reviews about influence of procedural factors on postoperative pain occurrence. The relevant systematic reviews integrated into one document may help in clinical decision making and providing pain-free outcome. According to present results preparation
of root canal with hand instruments, or reciprocating files of engine driven instruments, performing foraminal enlargement, and use of conventional syringe irrigation technique during root canal treatment may increase risk for postoperative pain. On the other hand, procedural factor such as performing apical patency, although did not have significant impact, may decrease incidence of postoperative pain. Considering the influence of number of visit on postoperative pain, data do not able one to draw clear conclusion.

Conclusions

According to available evidence from systematic reviews it can be concluded that the use of hand instruments, or reciprocating files of engine driven instruments, performing foraminal enlargement, and conventional syringe irrigation technique during root canal treatment may increase risk for postoperative pain. However, more well-controlled studies with representative sample size are needed to gain the evidence about the influence of other endodontic factors on postoperative pain, in addition to influence of patient- and tooth-related factors.

References


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