



Received on 12 November 2014; received in revised form, 24 January, 2015; accepted, 28 February, 2015; published 01 July, 2015

## ENDODONTIC PAIN - CAUSE AND MANAGEMENT: A REVIEW

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### Keywords:

Endodontic pain, Cause, Management, Inter appointment pain, Post endodontic pain.

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**ABSTRACT:** Pain is the most predominantly associated symptom with patients visit to the dental office. The pain may arise due to either an endodontic cause or a periodontic cause, but the endodontic pain type variant is the most commonly encountered by the dentists in their dental offices. Even though the endodontic pain is more common, there arises a dilemma in diagnosing and planning the treatment for the patient in day to day practice. This makes the proper diagnosis and adequate management of the endodontic pain as an important part of any dental practice. This article aims to review the importance of diagnosing the cause and adequate treatment for endodontic pain.

**INTRODUCTION:** The endodontic pain is mainly caused due to the inflammation of the pulp tissue occurring as a result of dental caries progressing deep into the tooth. This pain arises in response to either reversible or irreversible pulpitis. The reversible pulpitis can be characterised by acute pain unlike the steady chronic pain in case of irreversible pulpitis. The acute pain is what brings the patient to a dental clinic due to its intolerable nature and so the precise diagnosis and systematic treatment would only relieve pain from the patient. The causes of endodontic pain contains of a broad spectrum which needs to analysed properly before arriving at a diagnosis. The endodontic pain can be characterised as pain before endodontic treatment, pain during endodontic treatment and even pain after endodontic treatment. Analysing these parameters also would help a dental practitioner to plan the treatment systematically.

### Etiology of endodontic pain:

The endodontic pain arises as a result of the pulp tissue response to any causative agents like dental caries or other irritants. The pulp tissue responds to any external stimuli like dental caries, trauma or even restorative procedures. The pulp tissue bacterial interaction plays a vital role in pain progression. Dental caries have various microbial and other components which have the capacity to interact with pulp tissue and produce a response. Various studies have shown that endodontic pain between two appointments can be due to preoperative pain, absence of periapical lesions or cysts, fractured roots, retreatment cases and patients prescribed with analgesics. Pain after endodontic treatment can also result from the acute exacerbation of chronic lesion<sup>1, 2</sup> non-vital tooth<sup>3</sup>, previously opened canal, extension of either the filling material or instrument beyond the apex of the tooth and any leakage in temporary or permanent filling done after endodontic treatment.

### Pre Endodontic pain:

#### Dental caries:

During early stages of caries progression, there may be some changes seen in the pulp tissue in the form of inflammation of the pulp tissue<sup>4</sup>. The

<b>QUICK RESPONSE CODE</b>	<b>DOI:</b> 10.13040/IJPSR.0975-8232.6(7).2723-27
	Article can be accessed online on: <a href="http://www.ijpsr.com">www.ijpsr.com</a>
DOI link: <a href="http://dx.doi.org/10.13040/IJPSR.0975-8232.6(7).2723-27">http://dx.doi.org/10.13040/IJPSR.0975-8232.6(7).2723-27</a>	

bacterial toxins or endotoxins may reach the pulp long before its exposure because of the permeability of dentine. The carious progression continues and in turn results in the inflammatory process building up. There is limited repair of pulp due to very thin capillaries which collapse due to increase in intra pulpal pressure. In case of a long standing carious lesion the pulpal response stops and there occurs calcification of the pulp tissue as a defensive mechanism against irritants. Many studies have proved that endotoxins are present in carious lesions of symptomatic and asymptomatic teeth. The amount of endotoxin was significantly greater in the superficial compared to the deep layer of carious dentine. More endotoxins are present in caries of painful teeth compared with those without symptoms<sup>5</sup>.

#### **Dental trauma:**

Trauma in dentistry is also a very important cause for pain to occur. Dental trauma is seen as an injury to the dental structures of the oral cavity mostly caused due to accidents in both adult and adolescent patients. Studies conducted have proved that male patients in the adult age group tend to experience more injuries to their permanent dentition especially the maxillary central incisors resulting in severe pain. The most frequent type of injury was a simple crown fracture of the maxillary central incisors in the permanent dentition causing rupture of the pulp tissues which would need endodontic treatment to regain their form and function<sup>6</sup>.

#### **Inter Appointment Endodontic Pain:**

Severe pain and swelling following an endodontic treatment like root canal treatment which may arise as a result of mechanical injury or chemical injury or microbial injury to the root canal system<sup>7,8</sup>. The mechanical and chemical injuries are mostly of iatrogenic origin, but the inter appointment pain due to microbial injury is the predominant factor.

#### **Microbial causes:**

There are some special circumstances in which microorganisms can cause interappointment pain as a result of imbalance in host-bacteria relationship induced by intracanal procedures<sup>9</sup>. Development of pain can be due to presence of pathogenic bacteria like *Porphyromonas endodontalis*,

*Porphyromonas gingivalis*, and *Prevotella* species<sup>10-14</sup>, this has been proved recently by various studies. The microbial load is also well recognized as an important factor for a microorganism to cause disease. If the host is faced with a higher number of microbial cells than it is used to an acute exacerbation of the periradicular lesion can occur<sup>9</sup>. The host resistance of an individual may also play a role in the occurrence of inter appointment pain because individuals who have reduced ability to cope with infections are more prone to develop clinical symptoms after endodontic procedures in infected root canals.

#### **Non Microbial Cause:**

Mechanical and chemical injury to the periradicular tissue would also result in inflammatory reaction causing pain. The intensity of pain will depend on several aspects, including intensity of the injury, intensity of tissue damage, and intensity of the inflammatory response. Mechanical irritation causing periradicular inflammation includes mainly overinstrumentation and overextended filling materials. Chemical irritation includes apical extrusion of irrigants or intracanal medications. The larger the amount of overextended material, the greater is the intensity of damage to the periradicular tissues<sup>9</sup>.

#### **Inflammatory causes:**

Interappointment pain is almost exclusively due to the development of acute inflammation at the periradicular tissues. Following injury to the periradicular tissues, a myriad of chemical substances are released or activated, which will mediate characteristic events of inflammation, such as vasodilatation, increase in vascular permeability, and chemotaxis of inflammatory cells. The chemical mediators of inflammation include vasoactive amines, prostaglandins, leukotrienes, cytokines, neuropeptides, lysosomal enzymes, nitric oxide, oxygen-derived free radicals, and plasma-derived factors (complement, kinin, and clotting systems)<sup>15</sup>.

#### **Post Endodontic Pain:**

Pain after endodontic treatment is one of the most commonly seen complication of endodontic treatment. It can be caused due to many pre-operative factors like acute exacerbation of chronic

lesion<sup>1, 2</sup>, non-vital tooth<sup>3</sup>, previously opened canal, extension of either the filling material or instrument beyond the apex of the tooth and any leakage in temporary or permanent filling done after endodontic treatment.

Various factors responsible for post endodontic pain are position of the apical foramen, pulp tissue between two canals which cannot be easily instrumented without proper care, presence of accessory fourth canal in case of maxillary first molars which may be left out without instrumentation, inaccurate determination of working length can lead to over instrumentation, extrusion of root canal debris beyond the apex during instrumentation, irrigants used like sodium hypochlorite and hydrogen peroxide may cause peri apical discomfort, obturating technique like lateral condensation causes immediate post-operative pain than single cone obturation technique<sup>16</sup>.

#### **Management of Endodontic Pain:**

Management of endodontic pain primarily depends on the accurate diagnosis of the cause of the pain. There are various methods by which an accurate diagnosis can be made, they are clinical examination, peri apical testing, pulp testing, radiographic examination and most importantly the practitioner must be able to differentiate odontogenic pain from non odontogenic pain. Among the diagnostic questions that must be resolved prior to treatment are<sup>17</sup>:

- Is the pain of odontogenic or non-odontogenic origin?
- Is the tooth vital or non-vital?
- Is the pain due primarily to an inflammatory or infectious process?
- Is the pain of pulpal or periradicular origin or both?
- Is there a periodontal component involvement

Answers to these questions are elicited from a combination of the medical and dental histories as well as highly subjective clinical tests including thermal, electrical and percussion. From the results of these tests, radiographs and the history, the clinician determines which procedure or

combination of procedures which would relieve pain more effectively.

Optimal endodontic pain management includes pharmacological and non-pharmacological treatment strategies.

#### **Pharmacological treatment strategies:**

Several pharmacological strategies for pain control have emerged over the last 10 years<sup>18</sup>. Some strategies used to relieve endodontic pain are to prescribe the right non-narcotic analgesics at the right dosages<sup>19-23</sup>.

Pre-treatment with NSAIDS for irreversible pulpitis should have the effect of reducing pulpal levels of the inflammatory mediator PGE2. This would benefit in two ways. Firstly, decreasing pulpal nociceptor sensitization would mitigate an increase in resistance to local anaesthetics<sup>24</sup>. Secondly, it may diminish a prostanoind-induced stimulation of TTX-resistant sodium channel activity; these channels also display relative resistance to lidocaine<sup>25</sup>. Double blind clinical trials have shown that the injectable nonsteroidal anti-inflammatory drug ketorolac tromethamine, when injected intraorally or intramuscularly, produces significant analgesia in patients with severe odontogenic pain prior to definitive treatment<sup>26, 27</sup>.

#### **Non Pharmacological treatment strategies:**

These strategies include primary dental treatment procedures to relieve pain like pulpectomy and pulpotomy.

#### **Pulpotomy:**

The pulpotomy is a treatment method done to remove the coronal pulp tissue in the chamber without penetrating pulpal tissue in the root canal systems. It is often performed in cases of acute pain of pulpal origin when there is insufficient time to do a complete pulpectomy. The procedure should be done under adequate isolation with rubberdam being the recommended mode to prevent further microbiological contamination. After access is achieved, slow speed round diamond burs is used to remove pulp tissue to the level of the canal orifice. Slow speed burs are used to prevent obliteration of the natural funnel at the

mouth of a canal that makes initial penetration easier. High speedburs can easily destroy that anatomy. Bleeding is typically managed by a cotton pellet placed firmly against the coronal orifices. The pulpotomy, including sealing of sedative and antibacterial dressings in the pulp chamber has been advocated in emergency situations for many years<sup>28-30</sup>.

The success of a pulpotomy in relieving pain, particularly in the vital case, would seem to be due to a venting of the chamber with a concomitant reduction in local tissue pressure, inflammatory mediator concentrations and the severing of the terminal endings of nociceptive sensory neurons. Clinicians frequently note the dramatic effect of opening a chamber and observing the rapid relief that often follows. It seems reasonable to assume that these factors constitute the biological basis for its highly predictable effect of reducing pain in patients with irreversible pulpitis. Furthermore, by avoiding the canal system, the clinician avoids performing a partial pulpectomy which might traumatize already inflamed tissue. Partial pulpectomy may result in profuse haemorrhage due to the rupture of wide diameter vessels in the central part of the pulp. Less haemorrhage often results when the extirpation of the pulp is made to the apex of the tooth<sup>17</sup>.

A clinical study found a higher incidence of postoperative pain in cases where partial pulpectomy was performed<sup>31</sup>. Thus in treating patients with pain due to irreversible pulpitis, a pulpotomy procedure is preferable when time does not permit a complete pulpectomy a partial pulpectomy should be avoided in these cases.

### **Pulpectomy:**

Pulpectomy is the course of treatment often used in patients who present with symptoms of irreversible pulpitis, or pulp necrosis with or without swelling<sup>17</sup>. Since it is impossible for the clinician to precisely determine the apical extent of pulpal pathosis, a pulpectomy offers the advantage of complete removal of the pulp. Following the pulpectomy it is best to close dressing must be given in order to prevent contamination from the oral cavity<sup>32</sup>. Teeth left open to the environment are often involved in exacerbations during

treatment<sup>33</sup>. If there is a flow of exudate from the canal following instrumentation and irrigation, it is best to wait to close the tooth until the flow stops. Infrequently, the flow will continue and, in those instances, a cotton pellet or porous material can be used as a barrier until the patient returns, preferably the next day. The goal is to close the tooth as soon as possible in order to prevent further bacterial penetration<sup>17</sup>.

### **Management of Inter Appointment Endodontic Pain:**

Pain during endodontic treatment arising due to inter appointment flare ups can be treated by means of various methods like<sup>9</sup>

- Re-instrumentation
- Trephination
- Incision and drainage
- Intracanal medicaments
- Occlusal reduction.

It can also be treated pharmacologically by antibiotic and non-narcotic analgesics administrations.

### **Management of Post Endodontic pain:**

Managing post endodontic pain is of prime importance because the incidence of patients returning to endodontist with discomfort is on the rise. This pain can be relieved by being more careful during the endodontic treatment procedure. Each step of root canal treatment must be done with utmost perfection some examples like accurate working length determination, disoccluding the opposing teeth<sup>34</sup>, proper cleaning and shaping with adequate sequencing of instruments, optimum use and judicious selection of irrigants<sup>35</sup> and use of magnifying devices like dental loupes and endodontic microscopes<sup>36</sup>, would be more helpful in identifying the most commonly missed accessory canals which when left untreated result in post endodontic pain. Near perfection in these iatrogenic factors would drastically reduce the incidence of post endodontic pain.

**RESULTS AND DISCUSSION:** The pain in endodontics has various dimensions and their causes may be similar or may even vary, but for effective management of endodontic pain the above discussed causative factors and treatment methods



should be taken into proper consideration to help the patient get relieved of the unpleasant sensation of pain.

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### How to cite this article:

Nivethithan T and Raj JD: Endodontic Pain - Cause and Management : A Review. *Int J Pharm Sci Res* 2015; 6(7): 2723-2727. doi: 10.13040/IJPSR.0975-8232.6(7).2723-27.

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