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Review Article

ENDODONTIC PAIN: CAUSE AND CLINICAL STRATEGIES FOR THE MANAGEMENT: A REVIEW ARTICLE

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ABSTRACT

Root canal treatment [RCT] is one of the most common dental procedures. Experience of root canal associated pain is a major cause of fear for patients and a very important concern for dentists. Pain control and infection management is the main aim while performing the endodontic therapy. Therefore, analgesics and antibiotics plays a fundamental role of dental procedures as they not only treat the dental infections but also provide pain free procedures. This article provides treatment strategies based on the current scientific evidence for pain management.

INTRODUCTION

Root canal treatment [RCT] is the dental procedure which aims to remove infected pulpal tissue followed by cleaning of root canal and filling it with a non – reactive inert material. Patients often evaluate and perceive RCT as one of the painful dental treatment. [(1)]The purpose of endodontic therapy is to perform and to preserve the natural dentition and to eliminate pulpal and peri-radicular microorganisms.[(2)]

Patient mostly complains of pain and/or swelling in odontogenic origin, e.g., dental caries with or without pulpal involvement. Most conditions can be treated by operative procedures, e.g. dental filling, nonsurgical root canal treatment, e.g. pulp extirpation, instrumentation, and intracanal medication. In certain cases, antibiotics and/or analgesics are indicated as a necessity to conventional endodontic procedures. [(3)]

Etiologic Factors for Endodontic Pain

Dental Caries

Pulpal inflammation is seen in the pulp at the initiation of carious process. Dentin becomes permeable which leads to entrance of bacterial toxins into the pulp long before there is pulp exposurealong with symptoms.

As caries progresses and the inflammatory process builds, it results in pulpal tissue damage.

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There are certain vascular and cellular reactions taking place along with increased vasodilation caused by the release of vasoactive mediators including histamine. The initial cellular response of the pulp to carious exposure includes the infiltration of polymorphonuclear neutrophils (PMNs) and monocytes followed by acute inflammation and tissue destruction, latter the formation of micro abscesses and necrotic foci in the pulp, and lastly results in total pulp necrosis. [(4)]

Dental Trauma

Injury of the dental structures in the oral cavity is seen in dental trauma. It is mostly caused due to accidents in both adolescent and adult patients. Studies have shown that adult men have more chances of trauma as compare to women. The most frequent type of injury was a simple crown fracture of the maxillary central incisors in the permanent dentition causing rupture of the pulpal tissues which would need endodontic treatment to regain their form and function. [(5)]

Host–Microbe Interactions

Multiple complex reactions take place which involves repair and breakdown of tissue. It may be asymptomatic or cause mild to moderate pain. Microorganisms like *porphyromonas endodontalis, porphyromonas gingivalis, prevotella* species are responsible for condition like pulpitis.

The genetic factors are also involved in host response that are only now being demystified. Age of the patient, prior dental experiences are also a factor.

A tooth with periodontal disease and/or deep restorations often has a chronically inflamed pulp. [4]

Non-Microbial Cause

Mechanical and chemical injury to the peri radicular tissue would also result in inflammatory reactions causing pain. Mechanical irritation caused by mainly over instrumentation and overextended filling materials leads to peri radicular inflammation. The larger the amount of overextended material, the greater is the intensity of damage to the peri radicular tissues. Chemical irritation can be due to apical extrusion of irrigants or due to intracanal medications. [5]

Necrotic Pulp

Necrotic pulp is a dead tissue which has vascular system and provides structural integrity. It provides an ideal culture medium for bacteria to form colonies either at a rapid or slow pace.

Histologically, we commonly find with in the same pulp, areas of acute inflammation, chronic inflammation, and necrosis. [5] Sensibility tests of a tooth with a carious exposure should be considered to find out any dynamic tissue change. [5] The pulp is considered vital if it shows positive response to sensibility test. It is considered non vital / necrotic if no response is seen in sensibility test.

Restorative Factors

Restorative procedures can be the cause of pulpal problems because of microbial micro leakage. Penetration of microbes within dentin and pulp can cause pain often leading to misdiagnosis. The durability of bonding and clinical success of adhesive restorations is least understood and requires more clinical studies and research. Iatrogenic factors during restorative procedures such as inadequate coolant and generation of heat are also potential causes of pulpal breakdown. [6]

Post Endodontic Pain

Post endodontic pain is most commonly seen. It can be caused due to many preoperative factors like phoenix abscess, non-vital tooth, previously opened canal, extension of either the filling material or overinstrumentaion and apical leakage in temporary or permanent filling done after endodontic treatment. [5]

Position of the apical foramen, pulp tissue between two canals which cannot be easily instrumented, missed canal, inaccurate working length determination can lead to over instrumentation. Extrusion of root canal debris in periapex during instrumentation, irrigants like sodium hypochlorite and hydrogen peroxide may lead to periapical discomfort and obturating techniques like lateral condensation leads to immediate post-operative pain than single cone obturation technique. [5]

Diagnostic Sequence

Chief complaint

The chief complaint should be in patients own words. Clinician should establish good rapport with patient and gather diagnostic information.

History of chief complaint

When did the pain begin? Pain of pulpal etiology generally has a rapid onset, and is localized.

Is the pain spontaneous? spontaneous pain is the sign of irreversible pulpal inflammation.

Does anything make it worse? If the inflammation is limited to the pulpal tissues, it may be difficult for the patient to localize the involved tooth, due to the limited distribution of the proprioceptors in the pulp. [7]

Medical History

The conservation of dental health is an integral part of the overall health of patients. Studies have shown that approximately 30% of the population will present to the dental office with at least one medical condition. [8]

The medical information attained may alter the treatment procedure, for e.g., the need for S.B.E. prophylaxis, and/ or may impact the opinion.e.g., referred pain from carotid artery disease[7]

Dental History

The report of events that lead up to the chief complaint is recorded as the *dental history*. The chief complaint includes present symptoms, as well as any previous dental experiences or trauma that might have elicited.

Clinical examination

It includes examination of the soft tissues for any sign of swelling, inflammation or sinus tracts that may be related to periapical pathosis. Check the teeth precisely for any sign of caries, cracks, exposed dentin, or faulty restorations, etc. There has to be an etiologic factor for pulpal pain. In absence of any etiologic factor non-odontogenic source should be considered. [7]

Palpation

Palpation is performed by applying firm digital pressure to the mucosa and vestibule. It helps in detecting an active periradicular inflammatory process. This does not indicate whether the inflammation is of endodontic or periodontal origin.

Percussion

Pain to percussion indicates inflammation in the periodontal ligament (i.e., symptomatic apical periodontitis). There are various etiologic factors for inflammation namely physical trauma, occlusal prematurities, periodontal disease, or endo-perio lesion.

Periodontal probing

It helps to assess the general periodontal health of the teeth. Probe the periodontal attachment by 'walking' the probe around the sulcus, so as to determine the area of attachment loss that may be secondary to a vertical root fracture or a sinus tract which may be draining through the sulcus. [7]

Pulp Testing

The principal of Pulp testing is that it helps to produce the response of pulpal sensory neurons. Thermal or electrical stimulation of a tooth are involved in order to obtain a subjective response from the patient.

Heat Testing is mainly indicated when the patient has intense dental pain on contact with any hot liquid or food. When a patient is unable to identify which tooth is sensitive, a heat test is preferred. Heated gutta-percha or compound stick is applied to the surface of the tooth.

Cold Testing

It is especially useful for patients presenting with porcelain jacket crowns or porcelain-fused-to metal crowns where no natural tooth surface is accessible.

Frozen carbon dioxide (CO2), also called as dry ice or carbon dioxide snow, or CO2 stick, is considered to be reliable in eliciting a positive response if vital pulp tissue is present in the tooth.

Electric

Electric pulp testing helps in assessment of pulpal neural response. It denotes that someviable nerve fibers are present in the pulp and are capable of responding.[9]Electric pulp testing should be performed when the results of thermal testing are inconclusive.[7]

This test is contraindicated in patients with cardiac pacemakers.

Treatment Strategies

Pharmacological treatment

The **antipyretic-analgesics** and NSAIDs are more commonly used in case of tissue injury and inflammation due to tooth abscess, caries, tooth extraction, etc. These are major cause of acute dental pain.

Mechanism of action of NSAIDs is blocking prostaglandin (PG) generation at site of injury.

Prostaglandins, prostacyclin (PG I2) and thromboxane A2 (TXA2) are produced from arachidonic acid by the enzyme cyclooxygenase which exists in a constitutive (COX-1) and an inducible (COX-2) serves physiological 'housekeeping' functions.

COX-2 is mainly seen in the brain and in juxtaglomerular cells.

Most NSAIDs inhibit COX-1 and COX-2 nonselectively.

Pretreatment with NSAIDS in cases such as irreversible pulpitis should have the effect of reducing pulpal levels of the inflammatory mediator PGE2. This would benefit in two ways: firstly, pulpal nociceptor sensitization would decrease an increase in resistance to local anesthetics. Secondly, the prostanoid-induced stimulation of TTX-resistant sodium channel activity may diminish; these channels also display relative resistance to lidocaine[7].

For example, pre treatment with ibuprofen (800mg) is effective for management of post-treatment pain. Some patients may not have NSAIDS tolerance. This includes patients with GI disorders (e.g. ulcers, ulcerative colitis), active asthmatics or hypertension (due to renal effects of NSAIDs as well as drug: drug interactions with numerous antihypertensive drugs). For those patients who cannot take NSAIDs, pre treatment with acetaminophen (1000mg) is also effective for reducing post-treatment pain [7].

Corticosteroids

Most of the patient during root canal treatment exhibit inter appointment or postoperative pain because of the existing inflammation. It has been advised that a combination of steroids and antibiotics be used as local drug delivery in the root canal for the management of inter appointment pain during root canal treatment.

Steroids that are used in dentistry are glucocorticoids, corticosteroids, ledermix, dexamethasone, prednisolone and triamcinolone acetonide. [10]

Clinical Treatment

This includes primary dental treatment procedures to relieve pain like pulpectomy and pulpotomy.

Pulpotomy

The pulpotomy is a method to remove the coronal pulp tissue in the chamber without penetrating pulpal tissue in the root canal systems. In cases of acute pain of pulpal origin when there is insufficient time to do a complete pulpectomy this procedure is performed. The procedure should be done under adequate isolation with rubber dam being to prevent further microbiological contamination. After access is done, slow speed round diamond burs are used to remove pulp tissue to the level of the canal orifice. Bleeding is 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.[11]

Therefore, pulpotomy procedure is preferable only when time does not permit a complete pulpectomy.[11]

Pulpectomy

Pulpectomy is the course of treatment with active symptoms of irreversible pulpitis, or pulp necrosis with or without swelling. It involves complete debridement of pulp tissue. Later, the closed dressing to avoid any microbial contamination.

Open dressing is advised in teeth with pus exudates, weeping canals. A cotton pellet or porous material can be used as a barrier to avoid any type of contamination. The goal is to close the tooth as soon as possible in order to prevent further bacterial penetration.[11]

Management of Inter Appointment Endodontic Pain: During endodontic treatment During endodontic treatment there is arousal of pain due to inter appointment flare ups can be treated by means of various methods like

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

Non-Pharmacological Pain Management

Non-pharmacological therapies are typically categorized into

Physical (sensory) interventions

This procedure works by inhibiting nociceptive input and pain perception. It is also patient specific. Some like massage, positioning, transcutaneous electrical nerve stimulation (TENS), hot and cold treatment, acupuncture and progressive

muscle relaxation reduces pain intensity and improve the patient quality of life

Psychological interventions

Continuous pain may lead to development of unstable status and behaviours that worsen day to day function, increase the distress, or enhance the experience of pain. Depression, anxiety disorders and posttraumatic stress disorder is seen in patient suffering from pain. Eg. cognitive behavioural therapy, acceptance and commitment therapy (ACT), mindfulness-based stress reduction, guided imagery and biofeedback.

Others

Spirituality, religion and music therapy in pain management.[12]

CONCLUSION

The success of root canal treatment depends on eliminating the etiologic factors. Pre-operative medications which include both antibiotics and analgesics have a very significant impact on pain management during and after the treatment procedure and in the treatment outcome.

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