

**PAIN CONTROL IN CONSERVATIVE DENTISTRY AND ENDODONTICS – AN
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ABSTRACT

Understanding pain for better management is very crucial for any healthcare practitioner. Dental pain can be caused by several factors and can be of different types. The first step for managing dental pain is acquiring an accurate diagnosis. Assessment of pain is done using rating scales like Visual Analog scales and in the form of Questionnaires. Once diagnosis is made, there are various options that can be used alone or in combination for better management of pain. Unless the underlying cause of pain is removed none of the methods of pain control would work. There are many pharmacological and non-pharmacological approaches for relieving dental pain. Dental Anxiety can also lower threshold of pain in patients for which behavioural management should be attempted. Premedication before administering anaesthesia has also shown to make management of pain easier. The keystone of pain management is prescribing analgesics like NSAIDS, aspirin, and few opioids like morphine. Another method commonly used is the use of anaesthetics which can be given either topically or in injectable forms. Analgesia or conscious sedation can help overcome dental phobia and is used profoundly in children. Other alternative methods like hypnosis, acupuncture and audio-analgesia have also proven to be efficient for pain management. Recently, lasers have been studied for pain control too. Use of virtual reality for distraction methods has also shown to be effective. Various time-honoured home remedies are also used for the management of pain. Therefore, one must understand that approach to pain management is multidimensional.

KEYWORDS: Anaesthetics, Analgesics, Dental pain, Endodontics, Home remedies, Pain Management**INTRODUCTION**

The experience of pain can be very daunting and steer a person to become fearful. It is this pain, that chiefly brings a patient to visit a dentist, usually looking for an immediate pain relief. International Association for the Study of Pain defines pain as “An unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage.”^[1] Pain can be classified into different types such as acute subacute or chronic pain; inflammatory, nociceptive, or neuropathic pain; slow or fast pain; odontogenic or non-odontogenic pain; or could be a referred pain.^[2] There are various factors which can influence pain: Developmental factors like age and sex, physiological factors like genes, neurological function

and fatigue, social factors like attention, previous experience, family and social support, spiritual factors, psychological factors like anxiety, fear, apprehension, coping styles and emotional status of the patient.^[3]

Physiology and Causes of Dental Pain

Progressing dental caries causes an inflammation of the pulp thereby leading to a toothache, also known as odontalgia. Other stimuli like trauma, damaged restorations, parafunctional habits, poor oral hygiene, etc can also cause a toothache. Tooth pain can be a result of exposed dentine tubules. Any external stimuli would cause a movement of the dentinal fluid in both directions i.e. inwards and outwards. Inward direction is seen upon a hot stimulus while a cold stimulus would elicit and

outward flow.^[5] The fluid movements transfer the stimulation to the pulp via odontoblasts or nerve endings in close relations to the odontoblasts. The highly innervated dental pulp transmits the pain signals through fast conducting A-fibres and slow conducting C- fibres. This transmission is from the primary sensory neurons to the secondary order neurons located in the spinal cord and terminating in the thalamus from where next order neurons arise that terminate in the SI and SII areas in the cerebral cortex.^[4]

These nerve fibres have also been known to contain chemical mediators like neuropeptides in their cell bodies. One of the most important mediators is the Substance P and the other is calcitonin – gene related peptide, playing key roles in mediating two essential components of neurogenic inflammation, i.e., vasodilation, and vascular permeability. Increase in their levels are seen upon immunohistochemical analysis after irreversible pulpitis. The primary afferent fibres have also been seen to increase in number within the pulp upon a low intensity injury described by a phenomenon called as sprouting, which returns to normal after the stimuli is removed. The pulp being encased inside the hard tooth structure is unable to expand and thus the intrapulpal pressure is increased and the pain threshold of the nerve fibres are lowered. Few endogenous chemical mediators like histamine, prostaglandins, bradykinins, etc have also been associated with pain and inflammation.^[5]

Endodontic tooth pain can be classified as pain before, pain during and pain after treatment. The causes and mechanism of pre-endodontic pain have been discussed above. Inter appointment endodontic pain can be caused by mechanical or chemical or microbial injury to the root canals which can lead to severe pain and swelling. Mechanical injury is mostly because of over instrumentation and over-extended filling materials while chemical injury might be a result of irrigants or intracanal medicaments being extruded apically. Microbes like porphyromonas endodontalis, porphyromonas gingivalis and prevotella species have been found to be associated with inter appointment endodontic pain. The most common complication of endodontic treatment is the post endodontic pain. Factors causing the post endodontic pain may include uninstrumented remnants of pulp tissue, improper or insufficient irrigation, missed canals, working length misdetermination, extrusion of debris beyond the apex or even the type of obturation technique like lateral condensation.^[6]

Assessment of pain

The first step towards management of dental pain is understanding of the patient's pain for which an accurate diagnosis is of utmost importance. Certain characteristics of pain should be assessed for forming a diagnosis including the following (mnemonic SOCRATES):

Site – Localization. i.e., where is the location of pain?

Onset – when did the pain begin?

Character –Description of the pain

Radiation – If the pain is felt spreading to any other area?

Associations – Other than the pain if any problems exist alongside?

Time course – How much time does the pain prevail for and if it follows any patterns?

Exacerbating or relieving factors – Factors that might aggravate or lessen the pain?

Severity – How intense the pain is? ^[7]

Other than these, the family history, drug history, past and present medical history should also be obtained. An extraoral examination, intraoral examination and the required investigations should be carried out. Assessment of pain can be done by using questionnaires and rating scales since it is subjective. There are different rating scales that can be used for eg, numeric rating scale, visual analog scale, categorical scales, etc. Amongst these, the visual analog scale (VAS) is the most commonly used scale. The VAS scale has a 10 cm line to indicate the intensity of pain in numbers from 0-10, 0 being no pain and 10 being worst pain possible. Other tools to assess pain based on more information include the initial pain assessment tool, brief pain inventory, and the McGill pain questionnaire.^[8]

MANAGEMENT OF PAIN IN DENTISTRY

As understood, pain is complex and therefore there can be various options or combination of options for the management of pain. None of the methods of pain control would work if the underlying cause of pain is not relieved. Therefore, correct diagnosis holds its importance. By removing the stimuli, the nerve endings will not be excited and thus there will not be any impulses generated. Management of pain would include pharmacological as well as non-pharmacological approaches as well as management of the patient's emotional status and stress levels. The following are the pain management strategies that can be followed:

1. Behavioural Management

Anxiety, fear of needles, previous painful dental experiences, etc all impact the pain experience of the patient. Reducing this anxiety can help increase the threshold of pain in these patients. Providing a caring clinical environment, assurances for the comfort of the patient when confidently and softly given are helpful in getting a more cooperative patient. The dentist's promise to prevent pain helps with the reduction of anxiety. Anxiety comes because of uncertainty, thus providing information regarding the procedure and enhancing the patients sense of control can help reduce the anxiety. Encouraging the patient to shift the focus of thinking to someplace else can also help for the same. Environmental changes like a lavender smell in the dental office has also been shown to be effective in reducing the patients fear. If the patient is a child, use of

rapport building, voice control, distraction, modelling, and memory reconstruction is suggested.^[9]

2. Premedication

Administering a medication prior to a treatment or procedure is known as premedication which is usually done before giving anaesthesia for any surgery. Intramuscular route is the traditional one, but oral route is preferred for premedication. It is to be given 20 mins to 3 hours preoperatively. Depending on the procedure, patient, and the aesthetic technique various choices of drugs are used for premedication.

Anxiety, sedation, and amnesia: Short acting Benzodiazepines (e.g. Temazepam) is commonly used to provide anxiety reduction, light sedation, and anterograde amnesia. Lorazepam, midazolam, clonidine, Dexmedetomidine are also alternatively used. Opioids such as morphine and fentanyl may also be used for the same.

Analgesia: Opioids, NSAIDs, and paracetamol are the choice of drug for premedication analgesia.

Antimuscarinics: Less commonly used but were more often used in the past to dry secretions in the mouth and reduce bradycardia and hypotension. E.g. Hyoscine or atropine.

Antiemetics and anti-acidity: To reduce side effects (Emetic) of anaesthesia, drugs such as H₂ receptor antagonists, sodium citrate, antihistamines can be used pre-operatively.^[10]

3. Analgesics

The most frequently used drug for the pharmacological management of pain are analgesics aiming to make pain tolerable to the individual. Analgesics can be of classified as opioids or non-opioids formerly known as narcotic and non-narcotic analgesics.

Non-opioids analgesics like NSAIDs and aspirin have not only analgesic, but anti-pyretic, anti-platelet and anti-inflammatory properties as well. There is no physical dependence or addiction seen with these types of analgesics. They have a ceiling effect above which there is no increase in the analgesic effect. Their doses should be given on a regular clock-based time interval. NSAIDs work by reducing the production of prostaglandins by inhibiting the cyclo-oxygenase enzyme.^[11] Ibuprofen 400mg is the safest NSAIDs that is used. However, there can be side effects of NSAIDs usage such as gastrointestinal toxicity. Also, NSAIDs inhibit the cyclooxygenases in platelets thereby reducing synthesis of thromboxane A₂ responsible for platelet aggregation. So, NSAIDs should be avoided in patients with bleeding disorders and those taking any anticoagulant medications. NSAIDs should also be avoided in pregnant patients because the patency of ductus arteriosus is maintained by prostaglandins during foetal

development.^[12] In cases where it is contraindicated, acetaminophen is considered as an alternative. Hepatotoxicity is known to be its most significant adverse effect. The site of action of acetaminophen differs from that of NSAIDs and that is why it can be combined with NSAIDs for a synergistic effect. Other than Ibuprofen, most commonly used NSAIDs for pain by dentists include Diclofenac potassium 50mg, Naproxen sodium 500/550mg, etoricoxib 120mg, etc.^[13] Advances in NSAIDs would include the administration by a transmucosal or transdermal route which is relatively painless. E.g. Ketorolac tromethamine (KT) incorporated into a buccoadhesive film applied to the oral mucosa maintains therapeutic levels for at least 6 hours.^[14]

Opioids Analgesics includes morphine and morphine like drugs. They produce their therapeutic effects by acting as agonists at opioid receptors. Opioids are seen to demonstrate greater efficacy when the dose is increased as contrary to the ceiling effect seen in non-opioid analgesics. But they should not be the 1st drug of choice for dental pain. Opioids are generally used for managing severe acute dental pain. When the dose of NSAIDs and/or acetaminophen have been optimized, but the pain is persisting, the use of opioids may be considered. Morphine when mediated by neural mechanisms is seen to inhibit the release of bradykinin. It produces its effect by acting as agonist on kappa and mu receptors, thereby producing analgesia. There is a dependency and addiction seen with opioid analgesics and patients may experience withdrawal symptoms. This can be avoided by slowly tapering the doses. 10mg morphine, 120mg codeine and 75mg meperidine all are seen to have equivalent analgesia and side effects. Tramadol is another drug which inhibits the reuptake of serotonin and norepinephrine. The action of tramadol is seen on the mu receptors providing efficacy of approximately 60mg of codeine.^[15] Opioids should be avoided during pregnancy as it increases the risk for serious birth defects in the brain, heart, and spine.

The clinician should therefore develop a variety of safe and effective analgesic regimens that use sound pharmacological principles based on the intensity of pain anticipated.

4. Anaesthetics

Anaesthetic agents can be used for pain management as well as diagnosis. It is available as topical and in injection form.

Topical Anaesthetics

Available as sprays, solutions, and ointments. Best formulation for topical anaesthesia is the gel or paste form. Topical anaesthetics work by altering the pain thresholds upon blockage of signals transmitted from the peripheral nerve fibres in the superficial layers of the mucosa. Topical Anaesthetics in dentistry are used to mask discomforts during injection, to lower pain of

operative dental procedures and also to relieve any pain due to superficial mucosal lesions like ulcers.^[16] The more concentrated anaesthetics without vasoconstrictors show better mucosal permeability. Lidocaine or benzocaine are used in concentrations of 7.5% to 20% which provide surface numbness in around 3 mins. The desired mucous membrane or area of skin is dried, and a cotton swab is used to apply the gel to limit the area of application. The effect of topical anaesthesia lasts for around 10 minutes. Other examples of topical anaesthetics are the eutectic mixture of 2.5% lidocaine and 2.5% prilocaine a.k.a EMLA cream and a tetracaine based 4% water-in-water gel a.k.a Ametop. The latter has been found to be superior in lowering pain after needle insertions. Recently, for faster onset of actions, the use of a patch containing 70mg lidocaine and 70mg tetracaine have also been considered as alternatives. Not many side effects are seen on using topical anaesthesia, but a temporary altered sense of taste and tissue stimulation are seen sometimes. The patient should also be checked for local anaesthetic allergy prior to application of the same.^[17]

Injectable Local Anaesthetics (L.A.)

The mainstay of pain control is an effective local anaesthesia. Local anaesthetics work by inhibiting the sodium ion influx through channels within neuronal membranes thereby interrupting neural conduction. The effectiveness of local anaesthetics depends on various factors such as how precise is the injection, what is the relative acidity of the injected tissue, the type of anaesthetic that is injected, the bone density, anatomy of the nerve and the stress levels of the patient.^[18] Amides are the most common form of injectable local anaesthetics. There can be 3 types of L.A. depending on its duration of action, namely short duration (30 mins), intermediate duration (60 mins) and long duration (>90 mins).^[19] For prolongation of anaesthesia, vasoconstrictors are added e.g. epinephrine. So, with epinephrine the anaesthesia would last for around 40-60 mins without which anaesthesia would have lasted only for 5-10 mins. There are different types of injection procedures that can be administered i.e. nerve blocks, field blocks, and local infiltrations. Lidocaine 2% with 1:100000 epinephrine is the most commonly used anaesthetic solution. Others include Mepivacaine 3%, Prilocaine 4%, Articaine 4%, Bupivacaine 0.5%. Some studies suggest that Articaine is seen to be superior to the conventional anaesthetics.^[20] Mandibular nerve blocks have also been seen to be less effective as compared to maxillary nerve blocks. These nerve blocks can be supplemented by using intraligamentary, intraosseous, intrapulpal, and infiltration injection techniques for a more potent control over pain and in cases of anaesthetic failures. A computer controlled local anaesthetic delivery system which controls the rate of delivery have also been efficacious in reducing pain of LA injections. The type of solution used, the size of the needle as well as the speed are all factors that affect the reduction of pain of injection. A 27-gauge needle used to administer

anaesthesia at the rate of 1ml in 1 minute has been said to be a good rule of thumb. Some dentists prefer using the 30-gauge needle in an attempt to reduce the pain on injection. While it may do so, there could be problems like not allowing aspiration or may deviate during injection. Local Anaesthesia should be avoided in patients with stage 2 or above hypertension and in patients who have known allergy to LA. Overdose of LA should be avoided. Other adverse effects of local anaesthesia would include CNS toxicity, cardiovascular toxicity, neurotoxicity, methaemoglobinaemia, etc.^[21] The maximum safest dose recommended by Malamed is 4.4mg/kg or 2mg/lb with an absolute maximum dose of 300mg. Any complications must be managed immediately to have a high change of success. The procedures for management of emergencies would be to place the patient in a supine position, summoning medical assistance, monitoring the patient's vital signs and applying basic life support if needed.^[20]

5. Analgesia (Conscious Sedation)

A Drug induced depression of consciousness where the patient can respond to verbal commands is known as conscious sedation. For apprehensive patients with low threshold of pain, inhalation sedation can be coupled with anaesthesia for raising the pain threshold.^[20] It can be administered through different routes like oral, intramuscular, intravenous, and inhalational. Commonly used sedative agents are nitrous oxide and oxygen, and benzodiazepines. Nitrous oxide has analgesic, sedative, and hypnotic properties. Concentrations of 30-50% are required and the patient can be maintained at this level for 5 min before injecting LA. After the treatment, the patient is to be put on 100% oxygen for 5 mins. Research has shown that the analgesic effect of nitrous oxide is by causing release of endogenous opiate peptides along with activation of opioid receptors. There is also an inhibition of the N-methyl-D-aspartate glutamate receptors seen.^[22] Sedation may possess risks like hypoventilation, apnoea, laryngospasm, respiratory obstruction as well as cardiopulmonary alterations. Special training is required for administering analgesia. Benzodiazepines like diazepam and midazolam, Ketamine, Propofol, and a few opioids may also be used in adjunct to nitrous oxide for conscious sedation. Conscious sedation should be considered only for dealing with dental phobia and not as an alternative to effective local anaesthesia.^[23]

6. Hypnosis

There is a long history of use of hypnosis for anaesthesia and pain management. Hypnosis may help control the fear of pain associated with dental procedures. When used in dentistry it is known as hypnodontia. During hypnosis, the patient is more relaxed as it involved learning how one can use their mind to manage stress. It consists of a 4-stage procedure: induction, deepening, suggestions, and debriefing. These procedures help the patient to change its focus away from the pain to something more relaxing. It is seen that some patients consider this as a trance-like state.^[24] When used along

with other well-established treatments for pain, hypnosis can enhance its efficacy. Hypnosis can help transform the mental states and improve cognition, can also change the perception of pain and help relieve stress as well as it can modulate neurovegetative reactions like heart rate, blood pressure, gag reflex, etc.^[25] Thus it can be seen that hypnosis would provide a pleasant experience, where the individual is more focused and absorbed in its experience, and is more comfortable and peaceful in the process.

7. Acupuncture

Acupuncture or puncturing with a needle can be used to dentistry to manage orofacial pain. Acupuncture provides a new hope for some patients whose disorders could not be managed by conventional modalities of treatment. It works by stimulation of certain points which in turn stimulates the nervous system. Needle activation of nerve fibres like A delta and C fibres leads to inhibition of pain conduction. When the needle is inserted into the point, a feeling called De qui is felt presenting either as numbness, pain, distention around the area of insertion. This creates a small inflammatory process, and thus releases neurotransmitters like histamine and bradykinin. Acupuncture, when performed under proper training is a safe procedure. It is an adjunct to pain control and is effective as a symptomatic treatment of dental pain.^[26]

8. Audio Analgesia

Introduced by Gardner and Licklider, Audio analgesia involves the use of music and noise in suppressing pain. Earphones are given to patients who can then control the acoustic stimulation with the help of a control box. Whenever the patient feels any discomfort or pain during treatment, they can turn up the music volume to a maximum of 116 decibels above 0.0002 microbar. A waterfall like sound can be heard which has a calming effect. This music can help remove the conditioned anxiety patients face on hearing dental drill and therefor relax the patient. Audio analgesia has been a poorly understood phenomenon. It seems to not have any dangerous side effects if proper sound intensity limits and durations are followed.^[27]

9. Lasers

Lasers were first introduced in dentistry by Maiman and have been used for various purposes ever since. Lasers have been recently found to reduce acute inflammatory pain. This is brought about by lowering levels of prostaglandins, interleukin, TNF alpha etc. It is seen that lasers can inhibit nociceptive signals in the peripheral nerves and gave also been found to reduce oedema. It can also increase the lymphatic drainage and increase the release of histamines. Lasers have also been seen to reduce postoperative pain in endodontics.^[28] Diode lasers offering a low-level-laser therapy are seen beneficial for pain control. Wavelengths from 600-950nm are used for the same. This process is also known as photobiomodulation. The use of lasers has been approved as an adjunct method for temporarily reducing

pain. Further research on the mechanism of action and use of laser for reducing dental pain is required.^[29]

10. Virtual Reality

A novel procedure helping to provide distraction while dental procedures is by using Virtual reality. Virtual reality is a 3D space made by a computer technology creating a sensory immersion, transporting the user to appealing and interactive environments. It has been shown to be an effective distraction method engaging the patients during dental treatment and thus reducing pain and anxiety and improving cooperation. Studies have shown virtual reality to be more appealing to children than adults. Although effective, the assessment of efficacy is somewhat difficult during the use of virtual reality. The large device may hinder with the dentist's work and limit his area of operation. Further studies to assess the role of virtual reality in controlling pain and anxiety is needed.^[30]

11. Home remedies for pain management

Heat and cold can be an effective method for treating pain. After surgery, application of ice and help reduce the blood flow, which in turn reduces the inflammatory pain.

Rinsing with warm saltwater reverses osmosis and thus reduces inflammation. The higher concentration of saline causes the fluid in the oedema to come out of the cells.

Eugenol containing clove/clove oil in the concentrations of 80-90% is also effective in numbing the pain and reducing the inflammation. This takes 10 mins for the pain to be relieved. Clove gel has also been seen to be equally effective as a topical benzocaine gel.^[31]

Black tea bags containing tannic acids can also help reduce pain and swelling. Keeping the bag in the mouth and biting on it for 15 mins is recommended for pain control.^[32]

Ginger with cayenne pepper made into a paste is also effective since ginger can decrease the inflammation and swelling and cayenne pepper has capsaicin that is extensively used in the management of pain.

Chewing on a clove of garlic is also a time-honoured remedy for controlling pain.

CONCLUSION

Pain is a complex phenomenon and cause unpleasant consequences disrupting the quality of life of individuals. Therefore, approach to pain management must be multidimensional. A comprehensive assessment of pain should be carried out to reach a proper diagnosis. Understanding of pain is most essential for the management of pain. Pain can then be managed using pharmacological or non-pharmacological methods as well as use them in conjunction for a synergistic effect.

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