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REVIEW ARTICLE

ENDODONTIC EMERGENICES: A REVIEW

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ABSTRACT
Endodontic emergencies usually result from inflammatory reactions in pulpal or periapical tissues. They constitute a major part of all dental emergencies [1,2] and require immediate diagnosis and treatment. In general, emergencies are unscheduled visits by patients in severe pain, under emotional distress and seeking immediate relief. Although the endodontic emergency is disruptive and often inconvenient, proper management is satisfying to the dentist and much appreciated by the patient; improper treatment is frustrating and stressful.
Keywords: Emergencies, Pain, Flare-Ups, Pulpitis, Trauma.

INTRODUCTION

An endodontic emergency is defined as an
"An unscheduled visit associated with pain or swelling ensuing from pulpoperiapical pathosis requiring immediate diagnosis and treatment."
The fact that is associated with words like unscheduled and immediate, imply the emergency of the situation. Pain is the most common factor that motivates the patient to seek dental treatment. Approximately 90% of patients requesting dental treatment for the relief of pain have pulpul periapical disease and thus are candidates for endodontic therapy. Hence the alleviation of dental pain is one of the prime objectives of dental profession.

MANAGEMENT OF ENDODONTIC EMERGENCIES:

The management of endodontic emergencies can be summarized into the **3 P's** [3,4]
"Prompt, precise and polite"
Polite: the dentist's reaction to the patient is important for both pain and patient management. The clinician should understand the patients needs, fears about the immediate problem and defenses for coping with the situation. building a rapport with the patient goes a long way not only in treating but also preventing endodontic emergencies like flare ups.
Precise:" Heed to the needs of the patient"
The focus of the clinician should be on the chief complaint of the patient that drove him to the clinic. After a review of subjective and objective symptoms and determining a diagnosis, treatment of the tooth should be initiated first.

Prompt: an emergency often requires the dentist to be prompt in his action to relieve the suffering patient. This may also be of particular significance in severe traumatic cases where the time elapsed has a strong impact on the prognosis of the tooth.[5,6]
We shall divide our management into the following steps:

1. Proper attitude
2. Make an accurate diagnosis
3. Provide profound anesthesia
4. Render prompt and effective treatment

CLASSIFICATION

Endodontic emergencies can be classified according to the time when they occur as[7,8]:

1. **Pretreatment** emergencies
2. **During Rx** emergencies/ inter appointment 'flare ups'
3. **After Root canal Rx /** post-obturation emergencies

PRETREATMENT EMERGENCIES:

1. Acute reversible pulpits
2. Acute irreversible pulpits

Without apical periodontitis
With apical periodontitis

1. Acute apical periodontitis
2. Pulp necrosis with acute periapical abscess

Without swelling
With swelling: - localized
- diffuse

1.Acute periodontal abscess
2.Traumatic Injuries

I. Cracked tooth syndrome
II. Fracture

a. Crown

- Enamel
- Enamel and Dentin
- Enamel and Dentin with pulp exposure

b. Root

- Horizontal
- Vertical

III. Luxated teeth
IV. Avulsed tooth

ACUTE REVERSIBLE PULPITIS / HYPEREMIA

Definition: It is a mild to moderate inflammatory condition of the pulp caused by noxious stimuli in which the pulp can return to the uninflamed state following removal of stimuli [9]

Cause:

: Trauma from a blow /disturbed occlusion
: Thermal shock: cavity preparation / polishing
: Excessive dehydration
: Galvanic shock
: Chemical stimulus: food /cements
: Caries
: Systemic conditions: circulatory disturbances, sinusitis

Diagnosis: is by patients' symptoms and clinical tests.
Subjective symptoms: The patient reports of a pain which is sharp, lasts a few seconds and disappears on removal of stimulus such as cold, sweet or sour foods. It does not occur spontaneously. Although the paroxysms of pain are of short duration they may continue for months.
Dental examination may reveal caries, large restorations, fracture and deep wear facets, recently placed restorations, exposed dentin
Pulp vitality tests:
Thermal tests: helps to locate the offending tooth. Cold test is preferable. Percussion, palpation and radiographs give normal status.
Electric pulp test may give a slightly early response
Radiographic examination is normal[10]
Treatment: removal of noxious stimuli normally suffices**.**
If a recent restoration ah a high point**,** recontouring the high spot will relieve the pain.
If persistent painful episodes occur following cavity preparation, chemical cleansing of the cavity or leakage of the restoration, one should remove the restoration and place a sedative dressing such a s zinc oxide eugenol.
If symptoms don't subside then pulpul inflammation should be regarded irreversible and pulpectomy should be done.[11]

ACUTE IRREVERSIBLE PULPITIS

Definition: It is **a persistent** inflammatory condition of the pulp, symptomatic/ non-symptomatic, caused by noxious stimuli [12]
Cause:
1) Bacterial involvement of pulp because of caries
2) Deterioration of reversible pulpitis
3) Chemical, mechanical, thermal insults

WITH NO APICAL PERIODONTITIS

DIAGNOSIS

Subjective symptoms: Pain is more severe, sharp or shooting which lingers even after removal of stimulus. Pain may be spontaneous, intermittent or continuous and may increase on lying down or a bending over i.e. change of position exacerbates pain. Pain may get referred as well to the temples or sinus when an upper posterior tooth is involved. In later stages the pain may become dull boring and gnawing.
Pain is increased by heat and sometimes relieved by cold.
Dental examination may reveal a deep cavity with or without pulp exposure/ a fractured restoration / tooth etc.
Radiographs may not show anything that is not already known clinically. Of course, it will help to disclose interproximal caries / a pulp horn involvement / caries below a filling.

THERMAL STIMULUS

In the early stages it may elicit pain that persists after removal of stimulus. In late stages, when pulp is exposed it may respond normally to thermal stimulus but generally it reacts feebly to heat and cold.

ELECTRIC PULP TESTER

In the early stages it gives an early response while once an exposure has occurred it will respond to more current and give a delayed response.[13]

Thus, it is essential to differentiate an acute reversible pulpitis from an acute irreversible pulpitis without apical periodontitis. The difference between the tooth is generally quantitative. In reversible pulpitis the cause pain can generally be traceable whereas in irreversible it can come from any stimulus. The treatment varies for both, the latter will require a more aggressive emergency Rx than the palliative Rx used for the hyperemic tooth.

TREATMENT

Pulpectomy is the Rx of choice but according to some authors in case minimal time is available, then a pulpotomy can be performed on a multi- rooted tooth. The latter Rx is justified in acute cases as the radicular pulp is probably relatively normal Hence, the removal of tissue in the pulp chamber will eliminate the site of inflammation that precipitates the painful response.

PROCEDURE

a) Administer LA and open the access cavity.
b) With a spoon excavator and a large round bur remove the coronal pulp.
c) Place a cotton pellet with formocresol in the pulp chamber for 1minute.
d) Discard this pellet and place a new pellet in the chamber
e) Close the access with ZOE
f) Check occlusion and make needed adjustment
g) Fix appointment for continuation of root canal therapy

For single rooted teeth total pulpectomy is done whenever possible pulpectomy should be the Rx of choice

With apical periodontitis: it is one of the most difficult emergencies to be treated

Diagnosis: Besides pain, symptoms well include tooth tenderness on vertical percussion and radiographs will show a widening of the periodontal ligament space or a small periapical radiolucency

TREATMENT

- Anesthesia is administered in a heavy dose but even this may not give sufficient relief. This “hot” tooth will require additional supplemental injections. The proper approach is to be sympathetic towards the patient and ask him to bear a few minutes of discomfort till LA can be administered directly into the pulp tissue. Once roof of pulp chamber is removed, LA is given intra- pulpaly
- As the inflammation has progressed apically, a total pulpectomy is performed. Some authors believe that pulpectomy of only the largest canals i.e. palatal of upper molars/distal of lower molars which may house more toxins can be done due to the time constraints. Although, same patients may get relief from this, the best option is always complete debridement of all canals along with profuse irrigation. Radiographs should be evaluated carefully to prevent missing out an extra canal.
- A closed dressing would be given to prevent ingress of contaminants, which will further aggregate the situation.
- Occlusal reduction should be done[14]

ACUTE APICAL PERIODONTITIS

Definition: It is a painful inflammation of the periodontium as a result of trauma / infection through root canal regardless of whether pulp is vital (reversible pulpitis)/non vital (irreversible pulpitis).

Cause:

1. Vital

a) Trauma
b) High pts
c) Wedging of foreign objects
2. Non-vital
a) Sequelae to pulpal disease
b) Iatrogenic over-instrumentation metal /overmedication/ root perforation

Symptoms: Pain and tenderness. The tooth is tender to percussion or slight pressure.
Diagnosis: Tenderness on vertical percussion will be positive, subjective symptoms, pain on palpation may/may not be there, R/G will show PDL space widening
Treatment It is important to know if the tooth is vital or not
Vital: Occlusal adjustments
Non-vital: RCT

ACUTE PERIAPICAL ABSCESS
Definition: It is the localized collection of pus in the alveolar bone at the root apex of a tooth following pulp necrosis with extension of infection through the apical foramen into the periradicular tissues.[15]
Cause:
- Progression of pulpitis to pulp necrosis and extension into periapical tissues
- Exacerbation of a chronic periapical lesion
- Endo-Perio lesion wherein a PD abscess secondarily affects the pulp and periapical tissues.
- Trauma leading to pulp necrosis and supplementary to abscess

It can present itself in 3 forms
- Without swelling
- With localized swelling
- With diffuse welling

Diagnosis: Is made from subjective history and clinical examination.
1) Symptoms may vary from mere tenderness of tooth relieved by continuous pressure on extruded tooth to severe local reaction, swelling and systemic toxicity. The swelling is edematous and diffused to begin with but then localizes and becomes fluctuant.
2) Vitality tests elicit no response
3) Apical palpation and percussion will give positive tenderness response.
4) Tooth may be mobile and extruded.
5) R/G ranges from no periapical change when inflammation is rapid to periapical radiolucency. in the latter case the acute abscess develops from a chronic lesion whereas in former the abscess is acute before it had a chance to destroy sufficient PA tissues for radiographic visualization.

TREATMENT[16]
a. In case of an **acute periapical abscess with no swelling**, pain may be quite severe and very tender due to pressure apically with nowhere to vent. Even though the pulp is necrosed, some amount of apical tissues may be vital but inflamed. Thus, anesthesia should be given, following which opening is initiated. Remember to stabilize the tooth with finger pressure to avoid painful movement of tooth.

A note about anesthesia:
- Block should be administered
- Infiltration is contraindicated because

- Insinuation of a needle into an acutely infected/ swollen area will cause more pain and also lead to spread of infection by dissemination of virulent organisms.
- As an acutely inflamed tissue has an acidic pH, anesthetics, which are effective is alkaline pH will not be effective.
- Once canals are debrided and irrigated copiously, partial canal preparation is done, and a close dressing given.
- In case of **acute PA abscess with localized swelling**, pain may be absent as the pressure which had build up by accumulation of toxic products has got relieved as the bone has perforated and the exudate has been able to expand through the soft tissues.
- Actually, this cannot be called as a true emergency as the patient may not have any subjective symptoms such as pain or any systemic toxicity. However, the patient may notice the swelling and request an emergency Rx or worse still, may attempt to incise the area himself or use local agents such as aspirin over the area leading to injury and burns. This can result in a serious condition.
- The proper Rx is biphasic- the 1st phase is canal debridement and 2nd phase are establishment of drainage
- Once pulp chamber is opened and purulent discharge is present, then confine instruments within the canal. Though Grossman recommends this in all situations, Walton and Wein say that that when no drainage is seen due to a narrow apical constriction, then the apical foramen should be penetrated with a small file #10,15,20 or #25 (not more) to initiate drainage. Drainage accomplishes 2 things:

- Release of pressure
- Removal of potentially irritating purulence.

- Gentle finger pressure on mucosa overlying the swelling plus positive aspiration of the pulp chamber will aid in the drainage.[15,16]

IRRIGATION

- Is done initially using saline / warm sterile water while inducing drainage. Sodium hypochlorite has a tendency to clump the exudate causing apical constriction plugging and halting of drainage. Once patency is maintained, NaOCl can be used for further canal preparation.
- At times drainage via the tooth cannot be established due to presence of post and core and crown / sectioned silver point / calcified canal/ intercommunicating abscesses. In these situations, drainage must be established via apical soft tissue and frequently apical bone by a process called **trephination or artificial fistulation**. These options should be considered as the last resort (even though it takes lesser times) because

- Area of incision is unnecessarily damaged
- Relief is short lived
- These procedures should be performed only when swelling is sufficiently localized to permit adequate drainage following incision. Diffuse swelling can become localized and by fluctuant by doing hot mouth rinses.

PROCEDURE

- A stab is made with #11 scalpel just below the most dependent point of the swelling. Once a purulent exudate is obtained, the apical bone is probed with an explorer to locate the perforation and it is enlarged with a spoon excavator/ file to ensure proper venting. The incision is left open with a 20x20 strip of H/ tube/triangular shaped rubber dam placed under the flap attached to the un-retracted edge of the flap via a suture. This ensures further drainage. Antibiotics are prescribed and patient recalled after 4-7 days.

- If “artifistulation” fails to relieve the pressure; then “trephination” i.e. cutting a hole in the bone is done. The flap is increased for better visualization of apical bone. Using a fissure bur, the periapical bone is removed till the root tip is uncovered. Again, a rubber dam drain is placed & antibiotics prescribed.
- At the end of the procedure, tooth is dissoccluded.

b) A periapical abscess can be associated with a diffuse swelling

- which spreads through adjacent soft tissues, dissecting the fascial planes and turning into a medical emergency. This can be potentially life threatening. A more aggressive approach is needed. The pulp chamber is opened, canals are debrided, I & D performed and if systemic toxicity is seen, then an oral surgeon is contacted.
- In mild cases of acute alveolar abscess, the tooth may be sealed with a mild obtundent antiseptic medicament. The debate over leaving a tooth open in such situations still goes on. Grossman strongly believes and supports the method of leaving a tooth open for drainage to reduce the possibility of continued pain and swelling and thus eliminating the need for a surgical intervention.
- On the other hand, some others believe that a close dressing is better once drainage has subsided as this would prevent introduction of any new type of micro-organisms / food particle into the already infected periapical tissues. But these same people also say that if the exudation does not halt then canals should be left open. Another school of thought says**: “If you file, don’t close and if you close, don’t file”,** meaning a tooth which has been opened, irrigated and minimally instrumented can be closed while teeth in which complete canal enlargement has been done should be left open. The reason given is that during canal enlargement mass contaminants within the canals are inoculated into the periapical areas and closing will not allow venting of these elements leading onto flare ups.

ANTIBIOTIC COVERAGE

It is an aid to drainage. If the patient is afebrile and sufficient drainage has occurred, then antibiotic coverage is not needed but if minimal drainage is seen and the patient has systems of systemic toxicity then antibiotics are a must. Culture tests of the exudate will also aid in selecting the right type of antibiotics if symptoms don’t subside.[15,16]

ACUTE PERIODONTAL ABSCESS

It is a disease of the periodontium associated with infection and pus formation in an existing infra-bony pocket. It can occur in a vital as well as a non-vital tooth. It is often confused with an acute alveolar abscess.

Rx: Vital= curettage and drainage via sulcular crevice

Non-vital= RCT + curettage[15]

TRAUMATIC INJURIES

Emergency endodontic Rx may be required as a result of a traumatic injury. These include:

- Cracked tooth syndrome
- Crown fracture
- Root fracture
- Avulsion

The treatment of impact injury due to automobile accidents, household mishaps, assault etc. is further complicated by local edema, bleeding etc. Accurate evaluation of the exact pulpal status is difficult via routine diagnostic tests due to temporary paresthesia of the pulp nerves.

It is wiser to assume that the pulp is vital as this enhances the prognosis for healing. If later evidence indicates pulpal necrosis, extirpation can be carried out.

CRACKED TOOTH SYNDROME

It is an incomplete fracture of a tooth with a vital pulp.

Symptoms: Include pain on chewing and especially on release of pressure. Varied patterns of referred pain may be present and sensitivity to thermal changes may also be present.

Diagnosis: Is based on subjective symptoms and by reproduction of the stimulus

- Rubber polishing disc / cotton rolls are used
- Tooth slooth
- Fibre- optic light
- Methylene blue staining

Urgent Rx: Reduction of occlusal contacts by selective grinding

Stainless steel band may be cemented temporarily using ZOE

Definite Rx: Full occlusal coverage to present further propagation of crack [17]

EMERGENCY DURING RX / MID - RX FLARE UPS

The American Association of Endodontics **defines** a flare up as "an acute exacerbation of peri- radicular pathosis after the initiation / continuation of root canal treatment. [18]

TYPES OF FLARE-UPS INCLUDE

1. Apical periodontitis secondary to Rx

= It is upsetting to both patient and dentist when a tooth involved in root canal therapy becomes sensitive to percussion during the course of Rx especially is the tooth was asymptomatic earlier. Throbbing / pounding pain is experienced. Cause is over-instrumentation / over- medication.[19]

2. Recrudescence / Phoenix abscess:

= Is an acute exacerbation of a chronic lesion after the initiation of Rx The reason is still unknown but some say that facultative anaerobes multiplying slowly in the low oxygen environment of the periapical tissues suddenly receive air on access opening and react violently producing an acute reaction. Though this theory is still under dispute, one thing is for sure that a sudden change in environment has definitely something to do with this recrudescence. As multiple stains are harbored in a lesion, access opening and instrumentation can lead to reduction of some organisms and probably an increase in a virulent strain leading to an acute reaction.[20]

3. Recurrent periapical abscess:

= refers to a tooth with an acute abscess relieved by emergency Rx after which the acute symptoms return. Even if the tooth is left open to drain, food debris / foreign objects like segments of toothpick may block the drainage resulting in exudate collection again. Abscesses can recur more than once due to highly virulent microorganisms or poor host resistance. When 2 such exacerbation is seen, it is better to do a periapical surgery and antibiotic coverage.[21]

According to Walton flare ups can occur in any type of tooth i.e. teeth which were:

- Vital, with no swelling and complete debridement.
- Necrotic, no swelling
- Swelling

The causes of flare ups are often multi- factorial. The contributing factors include:

1. Inadequate debridement = presence of residual pulp tissue in adequately instrumented canals or still undetected canals allow bacteria and their toxins to remain and act as

continuous irritants. It is seen that teeth with necrotic pulps are more prone to flare-ups than vital teeth.

2. Debris extrusion = Pulp tissue fragments, necrotic tissue, microorganisms, dentinal shavings, canal irrigants are extruded beyond the apical foramen leading to periapical inflammation and pain. Conventional hand instrumentation has been shown to extrude more debris while coronal- apical preparations have shown to extrude lesser and sonic instrumentation is the least.
3. Over instrumentation = Moderate to severe pain is reported if instruments go beyond the apical foramen. Gross over-instrumentation & perforation can cause acute apical periodontitis, profuse exudation & inflammatory pain.
4. Re-Rx cases = show higher incidence of flare-ups. These cases have been associated with periapical pathosis with symptoms that increase the likelihood of flare ups
5. Presence of periapical lesions = The pulps of teeth that have large periapical radiolucency have more bacterial strains and are more infected. These bacteria may cause an acute problem if inoculated periapically. On the other hand, presence of a sinus tract may pose fewer problems because of the potential space available for pressure release. In teeth with intact PDL, the increased pressure that develops, has nowhere to vent leading to pain.
6. Host Factors = The intensity of pre-operative pain and the amount of patient apprehension are co-related to degree of post-operative pain. The patient's dental phobias, lower pain threshold etc can complicate Rx and increase the incidence of flare ups. [22]

PREVENTION OF FLARE-UPS

1. Accurate working length determination to prevent over instrumentation
2. Complete debridement is preferable to placement of medicaments
3. Lengthen time of exposure to irrigants, when opening tooth with periapical lesion
4. Close dressing should be given unless a until excessive exudation is present.
5. Always inform the patient of the possibility of a flare- up. This reduces fear and anxiety[23,33]

TREATMENT

Usually post-operative pain diminishes within 72 hrs.

1. Occlusal reduction
2. If operator knows that the apex has been violated in the first appointment itself, then place corticosteroid – antibiotic paste.
3. $Ca(OH)_2$ therapy to reduce bacterial colonies and their toxic by- products. This is does by:

a) Hydrolyzing the lipid moiety of bacterial lipopolysaccharide, rendering it incapable of producing biologic effects such as toxicity, pyrogenicity macrophage complement activation.
b) Absorbing CO_2, thus starving capnophilic bacteria in the root canal system.
c) Obliterating the root canal space to minimize ingress of tissue exudate which is a nutrient source of micro-organisms.
d) Protein denaturation, leading to soft tissue dissolution due to its alkalinity. This enhances action of hypochlorite & better debridement occurs.
e) Reducing substrate adhesive capacity of macro phages, thereby reducing inflammation.

4. Incision and drainage for swelling in case apical blockage has occurred.
5. Periapical surgery may have to be done if procedural mishaps/ failing re-Rx prevent non-surgical means from being effective.
6. Antibiotics and analgesics may be needed.[24,34]

HYPOCHLORITE ACCIDENT

Refers to any event where NaOCl is expressed beyond the apex of a tooth and the patient immediately manifests some combination of the following:

- Severe, extreme pain (ever after induction of anesthesia)
- Swelling within minutes
- Profuse, prolonged hemorrhage through tooth and interstitially

CAUSES

- Forceful injection of irrigating solution
- Wedging / binding of needle
- Large apical foramen / apical resorption / immature apex

SYMPTOMS

Apart from the initial symptoms most patients have several days of increasing

- Oedema
- Ecchymosis
- Tissue necrosis
- Possible paresthesia and secondary infection

The ultimate outcome depends upon the volume, concentration and the practitioner's timely response to the incident.[25,35]

MANAGEMENT

- Don't panic understand that Hypochlorite accident has occurred
- Administer regional block with a long acting anesthetic. An IM injects of sedative and analgesic will help too. If available, nitrous oxide sedation will help the patient cope with the rest of the emergency.
- allow the bleeding to continue as it is the body's response to dilute the toxic fluid. High volume evacuation will aid further drainage.
- Home care instructions to the PT includes cold compresses for the 1st 6 hours to bring down the pain and swelling and then warm compresses to aid healing.
- Antibiotic, analgesic and corticosteroid coverage should be considered.

This type of an incident is totally avoidable by doing the following:

- Bend the irrigating needle at the center to confine the tip to higher levels within the root canal.
- Never let the needle bind to the walls.
- Oscillate the needle in and out while delivering the irrigant passively. [25,26,36,37]

POST ENDODONTIC EMERGENCIES

These emergencies occur after the root canal system has been obturated. Patient may complain of pain or swelling.

These occur due to: [27,38]

1. Over- obturation with gutta-percha/ sealer extrusion
2. Poor obturation i.e. poor apical/ coronal seal
3. High points causing premature occlusal contacts
4. Obturating when tooth is tender / if wet canal
5. Single- sitting endodontics [28,29,39,40]

RX INCLUDES

- Reassuring the patient.
- Re-Rx if obturation is inadequate or wherever possible.

- If Re- Rx not possible or pain is persistent then periapical surgery should be considered.
- Incision & drainage in case swelling is present and obturation looks adequate.
- Occlusal reduction. [30,31,]
- If all the above fail, then the last resort unfortunately, is extraction. [32,]

CONCLUSION

Handling an emergency is not easy. If a sincere effort is made at proper diagnosis and effective Rx, you can "emerge" out of this "emergency" as a true hero. Making the right judgment, the right decision, at the right time and in the right manner will definitely guarantee you success and friend for life.

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