



State-of-the-Art Dental Care in the Emergency Department

Patients with dental problems ranging from dental pain and abscesses to dental trauma frequently present to the emergency department. You will learn to identify these various problems and develop a plan of evaluation and treatment. You will learn to determine which dental problems require immediate referral, and the criteria to help you make your decisions will be discussed.

- Classify dental fractures, and identify traumatic dental injuries.
- Develop a plan of diagnosis and treatment of dental and oral emergencies.
- List criteria for immediate and delayed referral of dental and oral emergencies.

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Beyond Percocet^R and Penicillin
Dental Emergencies in Emergency Medicine

I. COURSE DESCRIPTION AND OBJECTIVES

Dental emergencies are commonly seen by Emergency Physicians, but more often than not, EP's feel uncomfortable in managing these disorders. This can usually be traced back to inadequate or limited exposure during their training as well as a limited working knowledge of dental anatomy and pathophysiology. By learning some basic treatment concepts and the basic anatomy, the emergency physician can limit morbidity as well as provide significant relief to these challenging patients.

II. ANATOMY

There are 32 permanent teeth and they are numbered as follows: starting with the right upper 3rd molar (#1) to the left upper 3rd molar (#16), then proceed down to the left lower third molar (#17) over to the right lower 3rd molar (#32). Figure 1.

This numbering system is not universal and besides, there's a much easier system to remember and describe dentition. From the midline, there is on the bottom and the top:

	central incisors(2)	
	lateral incisor	lateral incisor
canine (eye tooth)		canine
1st premolar		1st premolar
2nd premolar		2nd premolar
1st molar		1st molar
2nd molar		2nd molar
3rd molar (wisdom)		3rd molar

The following terms are useful when discussing dental problems with a consultant or colleague and should be part of the emergency physician's vocabulary.

1. **Facial**---that part of the tooth that faces the lips and buccal mucosa. The **buccal** surface refers to the facial surface of the premolars and molars. The **labial** surface refers to the facial surface of the incisors and canines.
2. **Oral, palatal, or lingual**---that part of the tooth that faces the tongue
3. **Approximal**---that part of the tooth that contacts other teeth
4. **Occlusal**---the biting surfaces of the premolars and molars.
5. **Incisal**---the biting surfaces of the incisors and canines.
6. **Apical**---toward the root of the tooth
7. **Coronal**---toward the crown of the tooth

The tooth itself is composed of the following components (figure 2) :

1. **Pulp**---the center of the tooth and the neurovascular supply. Also produces dentin.
2. **Dentin**---microtubular structure which hydrates the tooth and cushions during mastication.
3. **Enamel**---biting, chewing, grinding. Hardest substance in the body.

The periodontium consists of the gingiva and the attachment apparatus. The attachment apparatus consists of the following:

1. **Cementum**---covers the root of the tooth and serves to attach the tooth to the periodontal ligament.
2. **Periodontal ligament**---fibrous structure that surrounds the root of the tooth and anchors the tooth to the alveolar bone.

III. PAINLESS DENTISTRY

Odontalgia, or toothache, is a common presenting complaint. "Percocet and penicillin", although commonly used, probably aren't the best modalities for use in most patients with tooth pain, regardless of cause. Studies have shown that 24 hr. post-op dental pain is better relieved with a combination of NSAIDS/marcaine vs. hydrocodone/lidocaine. This should extrapolate into ED patients with caries, abscesses, fractures, subluxations, dry sockets, etc.

A. Regional and Local Anesthesia

Equipment

--Ringed aspirating syringe. These are available both in disposable or reusable models. Disposable syringes are usually easier to use in the ED and are available to accommodate standard anesthetic cartridges. Figure 3.

--Needles. Although it is intuitive to use the smallest gauge needle possible (27 or 30 gauge), studies have shown that a 25 gauge needle is less likely to break or be deflected by bone, thereby allowing better delivery of anesthetic to the desired location. Length is anywhere from 3/4" to 1⁵/₈ depending on the area being infiltrated.

--Injectable anesthetic. Pre-filled dental anesthetic cartridges are the easiest to use because you don't contaminate entire bottles of anesthetic and they fit easily into the disposable ring aspirating syringes. Many anesthetics are available for ED use, however, the most appropriate is usually a long acting anesthetic which will provide the patient with relief long after they leave the department. A good choice is 0.5% Bupivocaine (trade name Marcaine), an amide anesthetic, which comes prepared with a vasoconstrictor (epinephrine) and if used as instructed, is excellent for dental anesthesia. It's duration of action is anywhere from 2-10 hours, depending on location used. The toxic dose is 225 mg (~25 cartridges), but the recommended maximum use in the oral cavity is 90 mg. (10 cartridges). For the rare patient who is allergic to amide anesthetics, you can use procaine (Novocain) which is of the ester class, however, the duration of action is much shorter (tables 1 & 2).

--Topical anesthetics. There are many topical formulations on the market to provide oral mucosa/soft tissue anesthesia. These may be used for a variety of reasons including needle insertion, gingival curettage, gingival abscess drainage, wounds or other inflammatory conditions. Preparations consisting of sprays, gels, liquids or ointments are available. Although there are many topical anesthetics to choose from (benzocaine, tetracaine, cocaine, lidocaine, dyclonine), I use 20% benzocaine gel as it sets up in a few minutes, provides deep mucosal anesthesia and is safe. It is supplied in various colors and flavors, (mmm, mmm, Coca-Cola flavored anesthetic!!).

Infiltration Techniques

General Principles:

1. Seat pt. in a comfortable reclining position.
2. Position yourself correctly to optimize access and vision.
3. Apply topical anesthetic when appropriate.
4. Retract mucosa to enhance vision and minimize needle insertion trauma
5. Dry injection site with sterile gauze.
6. Penetrate the mucosa using distraction to minimize insertion pain.
7. Insert the needle gently and slowly to its intended position.
8. Aspirate prior to injection.
9. Inject solution at a rate of 2 cc/min or slower.

Specific Blocks:

Supraperiosteal Infiltrations (Apical Block)--ideally suited for anesthesia of a single tooth or circumscribed portion of the maxilla.

Landmarks --mucobuccal fold--area where hard gingiva joins the soft mucosa.

Technique --local infiltration of 1.5-3cc of anesthetic at the root of the tooth (usually about 3-4mm.).

Aspirate first. Figure 4.

Tips--You only have to anesthetize the oral side of the tooth to get adequate analgesia, however, for palate injuries, etc. the supraperiosteal infiltration will not numb the palate.

Inferior Alveolar Nerve Block--ideal for all mandibular teeth on that side, lower lip and chin. Affects the inf. alveolar nerve and also accessible is the lingual nerve.

Landmarks --A. retromolar fossa and the anterior border of the ramus of the mandible (coronoid notch)
B. contralateral 1st and 2nd premolars

C. middle of physician's thumbnail in the coronoid notch

Technique --deposit 2-5 cc of anesthetic near the inferior alveolar nerve where it enters the mandible. This is most easily accomplished by orienting the needle axis from the opposing lower premolars. Gently advance the needle thru the mucosa, buccinator muscle, and areolar tissue in pterygomandibular fossa about 2-3 cm until you contact bone (the ramus of the mandible). Withdraw slightly, aspirate, and inject. Figure 5.

Tips -- This block is easy and safe if you follow your landmarks. Approach from the opposite premolars and leave your non-injecting thumb in the coronoid notch, on the anterior surface of the mandible.

Mental Nerve Block--provides anesthesia to the lower lip, chin and anterior mandibular teeth from the 1st premolar to the central incisor.

Landmarks -- The target is the mental foramen which is situated immediately below the apex of the mandibular 2nd premolar.

Technique -- local infiltration of 2-3cc near the opening of the mental foramen. Figure 6.

Tips --You may need to also do a supraperiosteal infiltration of the involved tooth because of cross-innervation of the contralateral mental/incisive nerve.

Infraorbital Nerve Block--provides anesthesia to the upper lip, nose, lower eyelid, canine to central incisors and variably to the 1st two premolars.

Landmarks --the target is the infraorbital foramen which lies in a straight line connecting the pupil and the corner of the mouth. The injection site is the oral mucosa adjacent to the 2nd premolar.

Technique --With the index finger firmly palpating the infraorbital depression and the thumb retracting the lip, advance the needle over the canine fossa to the foramen. After negative aspiration, inject 2-3 cc of anesthetic near the foramen. Figure 7.

Tips --avoid entering the orbit. This rarely occurs unless the needle is directed very far posteriorly.

Ballooning of the lower eyelid by anesthetic can be prevented by keeping your finger firmly placed at the lower orbital rim.

The majority of the maxillary teeth can be best anesthetized by supraperiosteal infiltration. The infraorbital block is better if many anterior teeth are involved.

Nasopalatine and Greater Palatine Nerve Block --These are rarely used in the ED but can be helpful to augment individual tooth blocks or to anesthetize the palate for palate injuries or lacerations. The nasopalatine nerve supplies the 6 anterior maxillary teeth from canine to canine. The greater palatine nerves anesthetize the mucoperiosteum of the posterior 2/3 of the hard palate. Along with the nasopalatine block, the G.P. nerve block will complete the palatine mucosal anesthesia.

Landmarks --The bilateral nasopalatine nerves exit the incisive foramen which is usually midline behind the central incisors approximately 5 mm. The greater palatine nerves emerge onto the hard palate via the greater palatine foramen which is situated on the lateral aspect of the hard palate, generally opposite the 2nd or 3rd molar.

Technique --For the NP nerve block, insert the needle at the lateral edge of the incisive papilla and direct superiorly. Deposit 0.3-0.6 cc of anesthetic 3-5 mm into the mucosa, after a negative aspiration. Inject slowly as the mucosa in this area is tightly adherent. For the GP nerve block, approach the injection site from the opposite side of the mouth, advance the needle approx. 5 mm or until you hit bone and slowly, after a negative aspirate, deposit 0.3-0.6 cc of anesthetic near the greater palatine foramen. Figures 8 & 9.

Tips -- The palatine nerve blocks are uncomfortable and the following should be adhered to in order to maximize patient comfort.

A. Use topical anesthetic. B. Overlying pressure with a cotton tipped applicator for 20-30 seconds prior to injection will decrease sensation. C. Inject slowly.

Until the above injection techniques are mastered, use a standard procedure reference text for anatomical landmarks and approaches.

Summary of Dental Blocks for ED use.

Upper Teeth

- Supraperiosteal infiltration
- Greater palatine infiltration
- Nasopalatine infiltration
- Infraorbital nerve infiltration

Lower Teeth

- Inferior alveolar nerve infiltration
- Mental nerve infiltration
- Supraperiosteal infiltration

IV. DENTAL TRAUMA

A. Examination

- Vitals
- Thorough head and neck exam
- TMJ and oral cavity, including buccal mucosa
- Remove dentures and splints, account for each tooth and percuss each surface.

B. Fractured Teeth

- Very common. Pt age and extent of fracture determine care.
- Ellis classification—not really used by dentists/OMF's/most consultants you'll be talking to.
- more important to know anatomy in describing fractures, such as fxs. thru the enamel, dentin, pulp, root, etc.

Ellis Class I aka Uncomplicated Crown Fx involving only Enamel

- Involves only enamel, not any deeper structures.
- No percussion or temperature sensitivity.
- < 3% chance of developing pulp necrosis or abscess

Ellis Class II aka Uncomplicated Crown Fx involving Enamel&Dentin

- Involves the enamel and the dentin.
- Sensitive to temperature, percussion, and forced air.
- Dentin is visible-pink tinged or yellowish.
- Younger patients (primary teeth) have less dentin, therefore, the pulp is closer to the enamel and is at greater risk of injury and infection. Treat these aggressively.
- The chance of pulp necrosis/abscess is up to 7%.

Ellis Class III aka Complicated Crown Fracture

- True dental emergency
- Pulp is exposed. There may be frank blood from the pulp cavity or just a pink blush from the dentin.
- May or may not be painful. Forces great enough to cause Ellis three's may disrupt the entire periodontal ligament as well as the alveolar nerve.
- Pulp necrosis/abscess is likely if dentist can't be seen within 3 hours.

Treatment

Ellis Class I/Uncomplicated Crown Fx involving Enamel

- No emergent treatment required.
- File sharp edges, if present, with an emory board.
- Reassure. Refer. Dentist may restore for cosmetic reasons.

Ellis Class II / Uncomplicated Crown Fr's involving Enamel & Dentin

- These fractures involve the dentin. If covered quickly, pulpal contamination can be prevented and subsequent root canal especially important in children where the dentin/pulp ratio is small. Covering the tooth discomfort from direct contact of liquids, foods, cold air, etc. may be avoided. This is likewise relieves the
- Calcium hydroxide paste is commercially available as a referral is adequate for adults, however, children should be referred the same day if possible.
- Remember, this injury may be very painful and blocking the tooth will make the application of caoh paste possible.
- Antibiotics are probably a good idea especially if next day referral is impossible.

Ellis Class III / Complicated Crown Fractures

- Enamel, dentin and pulp are involved. True dental emergencies. These may be excruciatingly painful or not painful at all secondary to neurovascular disruption. In primary dentition, the pulp can often be removed (pulpotomy) and the tooth can be restored to last the lifetime of the tooth. This is not effective in an adult and root canal usually is performed. In either case, definitive management is easier if there is little contamination. The patient should be seen that day if possible. If not, the tooth should be cleaned, covered with CaOH as above, treated with antibiotics and referred. A tooth block should be performed if there is significant pain.

C. Subluxation, Luxation, and Avulsion (Complete Luxation)

Subluxation--teeth which are loose in their sockets.

- Diagnose by moving teeth gingerly in sockets with fingers or tongue blades. A clue is blood in the gingival crevice.
- Minimally mobile teeth respond well to a soft diet for 1-2 weeks and follow up. Grossly mobile teeth require stabilization for 10 days to 2 weeks and should be done as soon as possible.
- Arch bars, ligature wires, enamel bonding plastics or a combination of these are used by the dentist, oral surgeon, etc. The EP can stabilize teeth temporarily by applying periodontal paste to the affected teeth. Periodontal pastes are available commercially under a number of trade names. Most come in resin/catalyst combinations which, when mixed, form a firm glue-like substance which is applied over the subluxed tooth and the accompanying teeth. This pack will stabilize teeth for up to 48 hrs until definitive fixation can occur.
- Approx. 15% of subluxed teeth develop pulp necrosis

Luxation— displacement of the tooth coronally (extrusive luxation), in the horizontal plane (lateral luxation) or apically (intrusive luxation).

- lateral and extrusive luxations should be treated by manually repositioning the tooth after local anesthesia. If the tooth is rigid and requires significant force to realign it, it is probably better left to the dental consultant. However, if it is easily repositioned, it should be realigned and stabilized with periodontal paste. See the discussion below on intrusive luxations (intruded teeth).
- Extrusive and lateral luxations of permanent teeth have a 55% and 77% chance of developing pulp necrosis, respectively.

Avulsion--tooth completely removed from the socket. True dental emergency.
 --"Where is the tooth?" Consider aspiration, intrusion into the gingiva, or entrapment into traumatized soft tissues.

--Management depends upon age of patient, length of time tooth has been absent from the oral cavity, and gingival health. Primary teeth never replaced because they are at risk of fusing or ankylosing to the alveolar bone. Cosmetic deformity is the result. The dentist can put in a prosthetic tooth for cosmesis if the patient/family desires.

--Permanent tooth avulsion requires prompt intervention. A 1% chance of successful reimplantation is lost for every minute the tooth is out of the oral cavity. Factors associated with non-successful re-implantation are time delays, age of the patient, soiling of the tooth, stage of root development, an uncooperative patient, poor gingival health or transport of the tooth in an unsatisfactory medium.

--If a call is received that a patient has lost a tooth and it is a permanent tooth, the tooth should be rinsed off in water or saline and reimplanted into the socket until a firm pop is heard. If this cannot be performed due to pt. condition or unfamiliarity/uncomfortableness with the procedure, then the tooth and the patient should come to the hospital.

--The tooth should be transported to the hospital in the appropriate medium. Saliva (in a cup or under the tongue) or milk is acceptable, however, water or a dry cloth is not. Commercial mediums and Hank's solution, which are ph balanced cell culture media, should be used if available. The patient and the nursing/triage staff should understand that vigorous wiping off of the tooth to "get it clean" is deleterious because this destroys the periodontal ligament that the tooth needs to adhere to the alveolar bone. Once the pt. is in the ED, the tooth should be implanted immediately or stored in the appropriate media until it can be. Handle the tooth by the crown only and firmly reimplant the tooth into the socket until it is firm. Stabilize the reimplanted tooth as described above with periodontal paste, prescribe antibiotics, liquid diet and refer. Don't worry if the tooth is not perfectly aligned. It is most important to get it into the proper environment and then the dentist can do adjustments later.

D. Intrusion

Intruded teeth are teeth which are forcefully pushed into the supporting alveolar structures. They can be easily missed or misdiagnosed as a fractured tooth. Intruded primary teeth are observed for 6 weeks to see if they will erupt on their own. They often do provided there is no fracture of the tooth present. Intruded permanent teeth must be repositioned by the dentist. 100% of permanent teeth which are intruded undergo pulp necrosis. All intruded teeth require next day referral.

V. SOFT TISSUE TRAUMA

A. Examine wounds for debris and tooth fragments and debride and irrigate tissues vigorously. Repair soft tissues after teeth are repaired as soft tissue manipulation is necessary to repair teeth. Gingival lacerations can be closed with silk and mucosal lacs can be closed with chromic. Small lacs do not need to be repaired as they heal quickly. Lacs large enough to have food get caught in them or thru and thru lacerations should be repaired. Penicillin should be prescribed for oral lacerations and a good mucosal topical antibiotic, such as ORA-5, can be applied to decrease infection and smoothen rough surfaces. The patient should rinse with saline 5-6 times a day and follow up obtained in 2-3 days.

VI. POST EXTRACTION COMPLICATIONS

A. Dry Socket--formally known as **alveolar osteitis**. This is excruciating pain which usually occurs 2-3 days post extraction. It is a result of the loss of the blood clot in the socket covering the alveolar bone and the secondary localized osteomyelitis which sets up. It frequently occurs in people who smoke or who use straws because of the negative intraoral pressure which is created. The pain is accompanied by a foul odor and is generally unrelieved by narcotics.

Treatment consists of first deadening the pain with a tooth block, gently irrigating any debris out of the socket and applying a medicated packing to the socket. There are several commercial packings

available, many of which contain eugenol. If a paste is used, this usually holds until the patient can see the dentist, but eugenol soaked gauze needs to be changed every day. Thus, the patient may have to return to the ED for a gauze change. Antibiotics are of no known value.

B. Post-Extraction Hemorrhage--My normal routine for post-extraction bleeding can be applied to all causes of bleeding from an odontogenic cause. If the pt calls from home, biting down on a moist tea bag often will work because of the nicotinic acid which is released from the tea. The nicotinic acid is a vasoconstrictor and often provides hemostasis. If that fails and the pt comes to the ED:

1. Have the pt bite into a dental gauze roll held in place by a 4x4 for 15 minutes. If that doesn't work:
2. Infiltrate the surrounding gingival tissue with lido with epi until it blanches. Be generous. Reapply the gauze and have the pt bite for another 15 minutes. If still not successful:
3. Sew a small piece of surgicell or gelfoam into the bleeding socket with 3 or 4-0 silk using the gingival tissue as your suture anchors. Again, have the pt bite into a gauze pad for 15 minutes and if this still doesn't work, you can apply topical thrombin to the surrounding gingival tissue and on top of the gelfoam.
4. If these measures don't do it, check the bleeding times, platelets, coags, etc and call for help.

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