



Managing the Emergency Dental Patient During the COVID-19 Pandemic: Pain, Infection and Trauma



Joseph Best, D.D.S., Ph.D.
 josephbest@mac.com
 Adjunct Associate Professor
 Department of Surgical Sciences
 Marquette University School of Dentistry



Private Practice:
 Oral and Maxillofacial Surgery Associate of Waukesha

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What I plan to cover.....

- ▣ Dealing with the emergency dental call
 - Managing acute pulpitis
 - ▣ Local anesthetics
 - ▣ Analgesics
 - Managing odontogenic infections
 - Managing acute dental trauma

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What I don't plan to cover....

- ▣ Regulations regarding safe treatment of patients during the COVID-19 pandemic
 - See ADA and WDA websites for up-to-date information on this
- ▣ Business and tax implications of the CARE act
 - See your accountant and attorney for this

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So a call comes in.....

- ▣ What do you want to know?
 - When did the pain start?
 - Is there any swelling and where is it?
 - Fever/chills/diet/hydration?
 - Pain with swallowing?
 - If tooth avulsion, how long ago, how are you storing the tooth?
 - Do they have any upper respiratory symptoms?
 - ▣ Fever, cough, SOB, sore throat

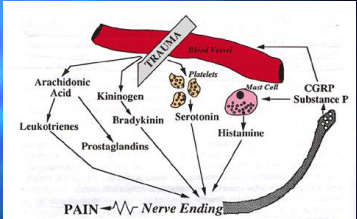
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Managing Acute Pulpitis



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Inflammation and pain



- Prostaglandin
- Bradykinin
- Leukotriene
- Serotonin
- Histamine
- Calcitonin GRP
- Substance P

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Why does this matter?

- Inflammatory mediators
 - Activate/sensitize nerve terminals
 - Increase in spontaneous activity
 - Decrease in threshold

All of this results in a situation referred to as **Hyperalgesia**

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Hyperalgesia

- Once tissue injury occurs there is a heightened responsiveness of the injured and surrounding tissue termed hyperalgesia
- The “hot” tooth

“Don’t come to a gunfight with a knife”

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Choosing a Local Anesthetic

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How do local anesthetics work

- Prevent the generation and propagation of nerve action potentials
- Blocking the sodium channel to prevent sodium influx

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Local Anesthetic Mechanism of Action

$$\text{RNH}^+ \rightleftharpoons \text{RN} + \text{H}^+$$
 hydrophilic $\xrightleftharpoons{\text{pKa}}$ lipophilic

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Why is the pKa of a local anesthetic important?

- To be effective, local anesthetics must penetrate the nerve
- pKa helps determine how well an anesthetic can penetrate a nerve
- Inflamed tissues tend to have decreased pH, therefore there is a tendency for local anesthetics to be in the charged (hydrophilic) form
- pKa determines the % of molecules that are charged

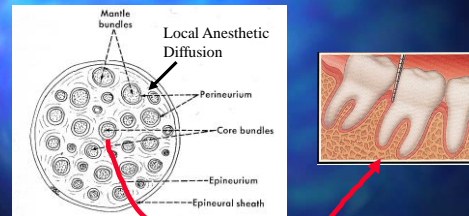
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pKa of selective agents

n Mepivacaine	7.6
n Lidocaine	7.7
n Articaine	7.8
n Etidocaine	7.9
n Prilocaine	7.9
n Bupivacaine	8.1
n Procaine	9.1

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We also must consider nerve anatomy



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Vasoconstrictors

- n Why?
 - Prolong duration
 - Antagonize vasodilation of local anesthetics
 - Decrease bleeding
 - Decrease systemic toxicity
- n How?
 - Alpha-1 agonists
 - Produces vasoconstriction

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Vasoconstrictors

- n Contraindications
 - **Untreated pheochromocytoma**
 - **Uncontrolled or unstable angina**
 - **Uncontrolled hyperthyroidism**
 - **MI within last 6 mo.**
- n Use with caution (limit use of epinephrine to 0.04 mg, 2 carpules of 1:100,000)
 - Moderate to severe cardiovascular disease
 - CVA history
 - Moderate to severe hypertension

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So what anesthetics are best in the acute pulpitis?



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mepivacaine

(Carbocaine, Polocaine, Isocaine, Scandonest)

- n Class: Amide
- n Onset: rapid 1-2 min
- n Duration: 120-180 min Max dose: 4.4 mg/kg
- n Available as:
 - 3.0% without vasoconstrictor
 - 2.0% with 1:20,000 neo-cobefrin (120-240 min duration)
- n Nice drug for cardiovascular compromised (less vasodilating) patients and infected tissues (pKa 7.6)

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articaine (Ultracaine, Septocaine)

- n Class: Amide
- n Onset: rapid 2-3 min
- n Duration: 180-300 min (+epi)
- n Max dose: 7 mg/kg
- n Available as:
 - 4% with 1:100,000 or 1:200,000 epi
- n Claims of better soft-tissue and hard-tissue diffusion
- n Contraindicated in patients with Sulfa allergy???
- n Methemoglobinemia/ neurotoxicity questions?

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Different anesthetics on the efficacy of inferior alveolar nerve block in patients with irreversible pulpitis

Juliana Leticia de Góes, DDS, MS, PhD; Jane Kenya Nogueira da Costa, DDS; Letícia Maira Wambier, DDS, MS, PhD; Bianca Medeiros de Melo, DDS, MS, PhD; Alexandre Dourado Loguercio, DDS, MS, PhD; Alessandra Reis, DDS, PhD

Conclusions and Practical Implications. The use of articaine can increase the IANB success rate in patients with irreversible pulpitis. Among the anesthetic solutions, lidocaine was the least effective.

JADA 2020;151(2):87-97

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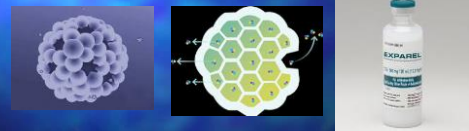
bupivacaine (Marcaine, Sensorcaine)

- n Class: Amide
- n Onset: 2-10 min
- n Duration: 240-540 min
- n Max dose: 1.3 mg/kg
- n Available as:
 - 0.5% +/- 1:200,000 epinephrine (9 mg per 1.8 cc)
- n May not be ideal for pediatric patients
- n Great for procedures with significant post-operative pain (3rd molars)

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Bupivacaine impregnated liposomes

- Used as an infiltration to give long acting analgesia after third molar surgery as an alternative to opiate analgesics



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Exparel (bupivacaine liposome)

- Currently ongoing clinical investigation into the efficacy
- Expensive
- Not approved for use as a block
- This type of approach shows tremendous promise, but is it something I will give a patient today?

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Analgesics for Acute Pulpitis

I heard Bourbon kills Coronavirus.

Probably not true, but why take a chance?

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Classes of Analgesics

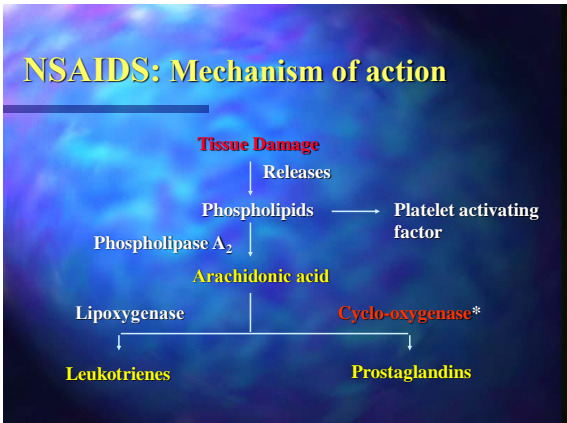
- Non-opioid analgesics
 - Salicylates
 - Nonsteroidal anti-inflammatory drugs (NSAIDs)
 - Acetaminophen
 - "Peripherally acting"
- Opioid analgesics
 - Agonists
 - Mixed agonist-antagonist
 - "Centrally acting"

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Non-opioid analgesics (NSAIDs)

- Excellent oral efficacy
- Relatively low incidence of side-effects
- Low abuse potential
- Low cost
- **First line drugs for post-operative dental pain**

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NSAIDs: Mechanism of action

- Cyclo-oxygenase (two isoforms)
 - **COX-1**
 - ubiquitous, formed in normal quiescent
 - **COX-2**
 - inducible form
 - expressed in cells after trauma
 - role in inflammation

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COX selectivity

Drug	Ratio of COX-1 to COX-2 inhibition
aspirin	>1
ketoprofen	≈1
diclofenac	≈1
naproxen	≈1
ibuprofen	<1
etodolac	<1
Coxib family	<<1

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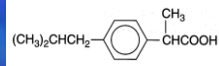
Cox-2 selective agents

- These agents are likely to have fewer G.I., renal, and platelet related side effects
- Expensive
- Acute vs. Chronic pain
- Excellent dosing schedules
- Same contraindications as other NSAIDs
- Increased risk for stroke or M.I.
 - JAMA 2001 Aug 22-29;286(8):954-9

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Propionic acids

- n Ibuprofen (Motrin, Advil, others)
 - 400-800 mg Q 4-6 hours
- n Ketoprofen (Orudis, Actron)
 - 50-75 mg Q 8 hours
- n Flurbiprofen (Ansaid)
 - 50-150 mg Q 8 hours
- n Fenoprofen (Nalfon)
 - 200-600 mg Q 8 hours
- n Naproxen (Naprosyn)
 - 250-500 mg Q 12 hours
- n Oxaprozin (Daypro)
 - 1200 mg Q day



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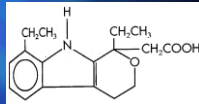
Propionic acids

- Adverse reactions
 - G.I. upset
 - Inhibition of platelet function
- Contraindications
 - History of allergy to aspirin or NSAIDs
 - Peptic ulcer disease
 - Severe Asthmatics
 - Pregnancy
 - Liver disease
 - Renal disease

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Indole

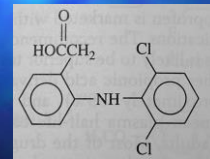
- n Etodolac (Lodine)
 - More Cox-2 selective?
 - Has been shown to be an effective analgesic in dental pain models
 - 200-400 mg BID OR TID



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Pyrroles

- Diclofenac (Voltaren)
 - Similar to etodolac, but has even more Cox-2 selectivity
 - 50 mg TID or 75 mg BID



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Cox-2 selective agents

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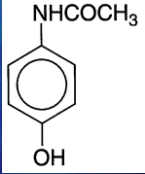
Cox-2 selective agents

- Coxib family
 - Celebrex (celecoxib)
 - 200 mg QD or 100 mg BID
- Oxicam family
 - Mobic (meloxicam)
 - 7.5 mg QD

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Para-aminophenol

- acetaminophen (Tylenol)
- Weak anti-inflammatory
- Analgesic/anti-pyretic
- Note dose change:
Max dose now 4 gm in 24 hours



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Opioids

- Agonists
 - codeine
 - hydrocodone (Vicodin)
 - hydromorphone (Dilaudid)
 - meperidine (Demerol)
 - methadone (Dolophine)
 - Morphine (MS Contin)
 - oxycodone (Percodan, Percocet)
 - propoxyphene (Darvon, Darvocet)
 - tramadol (Ultram)* *not a controlled substance


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tramadol (Ultram)

- Mechanism of action
 - Weak opioid agonist (but still poses addiction risk)
 - Serotonin/NE reuptake inhibitor
- 100 mg = two Tylenol #3 in dental pain study
- Dosage 50-100 mg Q 4-6 hours
- Cannot be used in patients with seizure history
- Excellent in patients with long list of drug sensitivities
- Also available in combination with acetaminophen (Ultracet)

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How do we dose opiates?





- Higher dosage higher risk
- Measured in Morphine Milligram Equivalents (MME)
- Over 50MME/day poses significant risk for OD

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How Much is 50 MME/Day

- 50 mg of hydrocodone
 - 10 tabs of Vicodin 5/300 in one day
- 33 mg of oxycodone
 - 7 tabs of oxycodone 5/325 in on day

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New Analgesic Strategy

Pain	NSAID	Opioid?
Mild	ibuprofen 400-600 mg Q.I.D. naproxen 200-400 mg T.I.D. etodolac 200-300 mg T.I.D.	None
Moderate	ibuprofen 600-800 mg Q.I.D. naproxen 300-400 mg T.I.D. etodolac 300-400 mg T.I.D.	None
Severe	ibuprofen 800 mg Q.I.D. naproxen 500 mg T.I.D. etodolac 400 mg T.I.D.	Hydrocodone 5 mg, Tylenol 325 mg Q4h?

Can supplement NSAIDs with Tylenol to improve analgesia (Clin Exp Rheumatol 2004; 22: 110-117)

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Systematic Approach to Evaluation of Patients with Infections

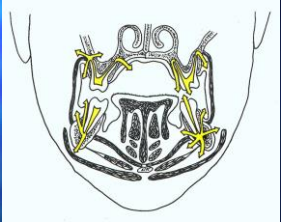
- n Take a history
 - When did the symptoms start
 - n Cellulitis vs. space abscess
 - Pain
 - n Infections nearly always painful
 - Fevers/Chills
 - n Sign of systemic effects
 - Dysphagia
 - n Concern about airway embarrassment
 - Drainage
 - Hydration/Diet
 - Medical Contingencies



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How do infections spread?

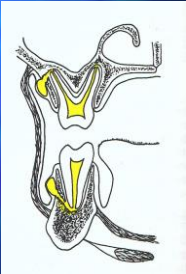
- Bacteria from infections can break-down connective tissue
- Inflammatory cells also can be tissue destructive
- This allows bacteria to cross anatomic barriers and spread



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Anatomic Spaces and the clinical presentation

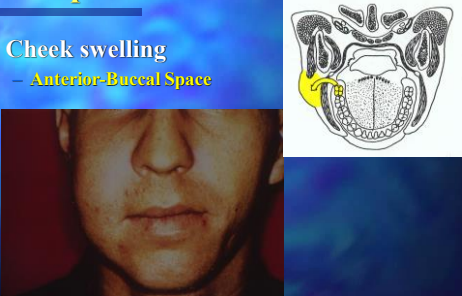
- n Localized swellings of the alveolus
 - Subperiosteal space/Mandibular space



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Anatomic Spaces and the clinical presentation

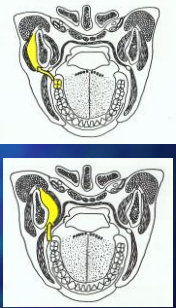
- o Cheek swelling
 - Anterior-Buccal Space



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Anatomic Spaces and the clinical presentation

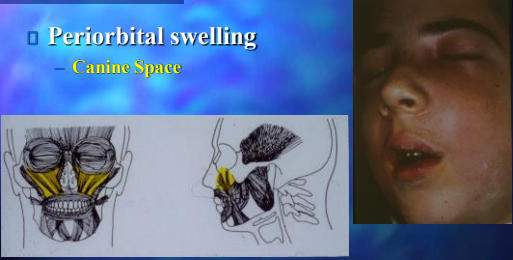
- Trismus
 - Masticator space
 - Submasseteric space
 - Pterygomandibular space
 - Deep temporal space



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Anatomic Spaces and the clinical presentation

- Periorbital swelling
 - Canine Space



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Anatomic Spaces and the clinical presentation

- Tongue elevation
 - Sublingual space infection



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Anatomic Spaces and the clinical presentation

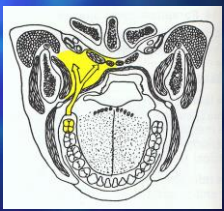
- Swelling below the inferior border of the mandible
 - Submandibular space



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Anatomic Spaces and the clinical presentation

- Swelling of the pharyngeal wall
 - Lateral pharyngeal space



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Order of importance when treating odontogenic infections

- 1. Removal of source
 - Pulp extirpation
 - Extraction
- 2. Prompt surgical drainage
- 3. Antibiotics

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What are the goals of antibiotic therapy?

- To prevent or treat odontogenic infections
 - Choice of antibiotic is typically empiric, a best guess of the typical bacteria known to cause odontogenic infections
 - Odontogenic infection change with time

Gram + → Gram -
Aerobic → Anaerobic

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Choosing antibiotics

- Consider what bacteria your covering
 - **Early mild odontogenic infection**
 - Mixed with Predominantly aerobic Alpha-hemolytic gm + strep
 - **Mild to moderate odontogenic infection**
 - Mixed aerobic gm + cocci and anaerobic gm - rods
 - **Severe multi-space occupying odontogenic infection**
 - Mixed with Predominantly anaerobic gm - rods
- Consider patient medical situation
- Consider expense

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Penicillin V

Advantages

- **Bactericidal**
- Pen V is appropriate spectrum for the majority of simple odontogenic infections
- Clearly the drug of choice for most dental applications
- generally cheap, well tolerated

Disadvantages

- resistance, hypersensitivity, rare neurotoxicity

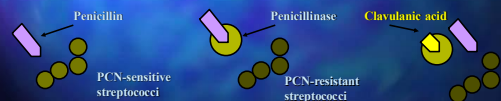
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Amoxicillin (Ampicillin)

- first line drug in treating infections involving the maxillary sinus

Augmentin

- Amoxicillin and clavulanic acid
- Broad spectrum- reserved for serious odontogenic infections (all anaerobes, all Strep., methicillin-sensitive *S. aureus*, *S. epidermidis*, *H. influenza* and Enterococcus)



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Cephalosporins

- Similar mechanism of action to penicillins
- 10% cross reactivity with true penicillin allergic patients
- Susceptible to beta lactamases
- In general:

First Generation	Second Generation	Third Generation
Gram +	Gram-/+	Gram-
Cefadroxil (Duricef)	Cefaclor (Ceclor)	Cefixime (Suprax)
Cefazolin (Ancef)	Cefotetan (Cefotan)	Ceftriaxone (Rocephin)
Cephalexin (Keflex)	Cefuroxime (Ceftin)	

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Cephalexin (Keflex)

- Tolerated well orally
- Inexpensive
- Similar coverage to Pen V with addition of Staph coverage
- Good alternative in patients with **questionable** pen allergy

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Cefuroxime (Ceftin)

- Mechanism
 - Inhibit crosslinking of cell wall components
 - bactericidal (gram + cocci, some gram -)
- Advantages
 - Broader coverage (*some gram - and anaerobic*)
 - Sinus coverage in PCN allergic
 - Staph coverage
- Disadvantages
 - 10% cross-reactivity with PCN allergic

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Macrolides

- Mechanism of action
 - prevent translocation of polypeptide chain by binding the 50s ribosomal subunit
 - Bacteriostatic
 - Effective in bacteria lacking cell walls (mycoplasma, legionella, chlamydia)
 - Effective against gram + aerobes and some gram- aerobes

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Azithromycin (Zithromax)

- Similar coverage to erythromycin but fewer resistant strains (better gm - coverage, H. flu)
- Well tolerated orally, less GI side effects
- Q 24 hour dosing, high compliance
- Expensive
- Equipotent in periapical abscess to Amoxiclavulanic acid (J Int Med Res 26:275)

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Clindamycin (Cleocin)

- Mechanism of Action
 - Binds to 50s ribosome and prevents chain elongation
 - bacteriostatic (gram⁺ s, most anaerobes)
- Advantages
 - Similar action to erythromycin, but broader coverage appropriate for odontogenic infections
 - Excellent bone penetration
- Disadvantage
 - Pseudomembranous Colitis (Antibiotic induced colitis)

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Metronidazole (Flagyl)

- Mechanism
 - Inhibit DNA synthesis
 - bactericidal against anaerobe
- Advantages
 - Adjunct to penicillin V for anaerobe coverage
 - PenV + Flagyl is roughly equivalent to Cleocin, but much cheaper ("poor man's clinda")
 - *C. diff* colitis treatment
- Disadvantages
 - reaction with alcohol
 - nausea, urtic changes

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Fluoroquinolones

- Mechanism of action
 - Inhibit DNA gyrase
 - Bactericidal
- Levofloxacin (Levaquin)
 - Third generation fluoroquinolone
 - Good bone penetration (?)
 - Relatively broad coverage (comparable to Augmentin)
 - Tendon rupture issues
 - QD dosing
 - Expensive

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Cost

Antibiotic	Frequency	Cost/day
Penicillin V 500 mg	QID	\$0.70
Cephalexin 500 mg	QID	\$1.21
Amoxicillin 500 mg	TID	\$1.23
Clarithromycin 500 mg	BID	\$6.98
Clindamycin 300 mg	QID	\$7.95
Augmentin 500 mg	TID	\$10.39
Azithromycin z-pak	QD	\$11.98
Levaquin 500 mg	QD	\$16.00

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Antibiotic Strategies

- Acute, mild odontogenic infection (PA abscess or local early single space)
 - Pen V 500 mg QID with 1gm loading dose
 - Keflex 500 mg QID with 1 gm loading dose for questionable Pen allergic patient
 - Zithromax, Z pack, 500 mg first day, with 250 mg each day for 5 days

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Antibiotic Strategies

- n Mild to Moderate Odontogenic Infections
 - Pen V 500 mg QID with 1 gm load and Metronidazole 500 mg TID
 - Clindamycin 300 mg QID with 450 mg load for pen allergic
 - Amoxicillin-clavulanate 500 mg TID with 1 gm load

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Antibiotic Strategies

- n Severe Odontogenic Infections with multi space involvement
 - Patient require IV antibiotics!!
 - Ampicillin and sulbactam, 3gm load with 1.5 gm Q6h
 - Clindamycin, 600 mg Q 8h for pen allergic

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How long?

- No hard and fast rules
- Generally 5 days after removal of the source
- Removal of source, drainage, adequate dose and frequency of antibiotics are keys to good outcomes
- Avoid antibiotic complications by not using long-term broad coverage

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Antibiotics: What's new?

- n Antibiotic resistance
 - Oxacillin resistant *Staph aureus* (ORSA)
 - Vancomycin resistant enterococcus (VRE)
 - Methicillin Resistant *Staph aureus* (MRSA)
- Antibiotics are not analgesics

“The truth of the matter is that you always know the right thing to do. The hard part is doing it.”
General H. Norman Schwarzkopf, 1991

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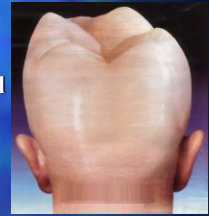
When to refer

- ❑ Refractory infections
- ❑ Worsening symptoms
- ❑ Airway compromise
- ❑ Multi-space involvement
- ❑ Crepitus
- ❑ Severe trismus
- ❑ Dysphagia

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REMEMBER: It's just a tooth

- ❑ Don't let your zeal for saving teeth cloud your judgement
- ❑ There comes a time when saving the tooth is not in the patient's best interest



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"Do not let the sun set on pus!"

Robert Shapiro, DDS
University of Rochester
Division of Oral and Maxillofacial Surgery



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Dental Trauma



"THAT'S ODD: MY FACEBOOK FRIENDS WHO WERE CONSTITUTIONAL SCHOLARS JUST A MONTH AGO ARE NOW INFECTIOUS DISEASE EXPERTS..."

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History

- ❑ When, Where, How did the injury occur?
- ❑ Any unconsciousness?
- ❑ Are all avulsed teeth and fragments accounted for?
- ❑ How does your bite feel?
- ❑ Numbness?



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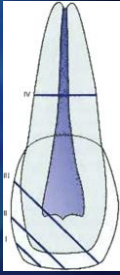
Physical Examination

- ❑ Soft Tissue—Intraoral and Extraoral
 - Buccal Mucosa
 - Tongue
 - Floor of Mouth
 - Hard and Soft Palate
 - Stenson's and Wharton's Duct

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Physical Examination

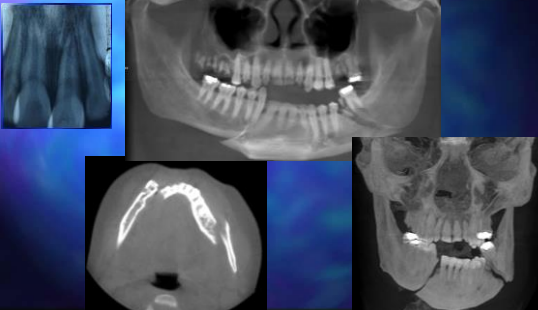
- Hard Tissue—
 - Teeth
 - Alveolus
 - Mandible
 - Midface
- Ellis Classification
 1. Enamel
 2. Dentin
 3. Pulpal involvement
 4. Root fracture



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Physical Examination


- Imaging—Periapical, Panorex, CBCT, CT



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Primary Dentition Trauma

- Intrusion—allow 4-8 weeks for re-eruption, and extract if necessary
- Avulsion—do not replant!!!
- Extrusion/Luxation—put in correct position and splint for 7-10 days
- Root fracture—remove coronal remnants and leave root to resorb during eruption of permanent tooth



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Could you please message “Hi” in the chat box to communicate your still watching



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Permanent Dentition Trauma


- Avulsion:
 - PDL cells become irreversibly necrotic after 60 minutes dry time
 - Storage media: saliva, saline(1tsp salt in 8oz H2O), milk, not tap water
 - Tx is with a non-rigid splint for 14 days to allow some movement of the tooth for the PDL to heal
 - Initiate root canal therapy 7-14 after injury and before splint removal
 - Failure after replantation—internal/external resorption



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Permanent Dentition Trauma

- Better → worse: Luxation → Extrusion → Intrusion
- Intrusion with closed apex—95% necrosis
- Intrusion with open apex—65% necrosis
- Reposition tooth with semi-rigid splint for 7-14 days



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Permanent Dentition Trauma

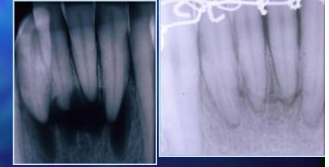
- ❑ Luxation/Extrusion: Reposition and splint for 7-14 days.
- ❑ Root fx's: the more apical the better prognosis
- ❑ Vertical root fx's require extraction



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Alveolar Fractures

- ❑ Tooth-bone segment displacement
- ❑ Requires semi-rigid splinting with arch bars or wires for approximately 4 weeks
- ❑ Reduction of the segment should be done via a closed approach whenever possible



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Postoperative Instructions

- ❑ Soft diet
- ❑ Luxated teeth out of occlusion
- ❑ Peridex bid
- ❑ Amoxicillin, Z-pack or Clindamycin x 5 days
- ❑ Analgesics
- ❑ Close follow up

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Final thoughts

- ❑ Respect hyperalgesia and the challenges it presents
- ❑ Lean on definitive treatment of pain and infection rather than medications
- ❑ Get after dental trauma quickly and perform RCT early

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Questions or Comments?



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