“The Ten Commandments of Tooth Removal”

Saturday | March 20 | 2021

Dr. Jonathan Spenn

CHARLESTON, WEST VIRGINIA

The Ten Commandments Of Tooth Removal

West Virginia Academy of General Dentistry
March 20, 2021
Charleston, WV

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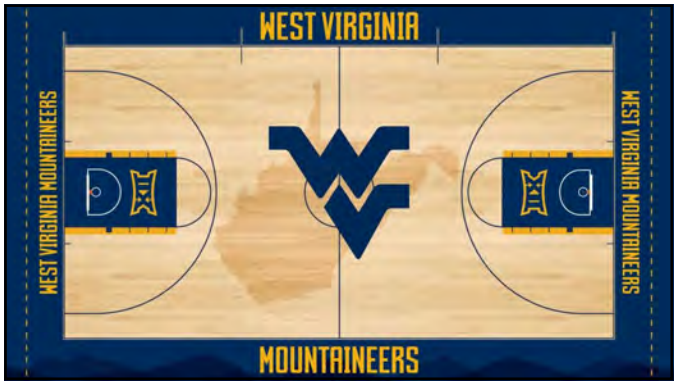

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Why Should You Listen To Me?

- I have no name to stand on, only the literature
- I am a general dentist like you, not a magician
- I still practice dentistry on a weekly basis
- The majority of my practice is exodontia
- I teach exodontia in the developing world
- I have made a lot of mistakes that you don't have to!

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Story Brand

- Hero
- External Conflict: Patients present with teeth that need to be extracted (problem for the provider)
- Internal Conflict: General dentists often feel uncomfortable performing/providing extractions
- Philosophical Conflict: General dentists want to be able to care for their patients in a timely manner but feel that they cannot
- Guide

Miller, Donald. *Story Brand*. Harper Collins, 2017.

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Never Stop Learning (Even From Your Mistakes)

- Stay connected with organized dentistry: ADA, AGD, etc.
- Read whatever comes your way
- Paid Publications: JADA, General Dentistry, ADA news, AGD Impact, etc.
- Free Publications: AAE Colleagues for Excellence, Decisions in Dentistry, Dental Economics, Dental Town, Dentistry Today, Inside Dentistry, etc.
- Find out why it failed!
- "The day you stop learning is the day your practice starts dying"

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Practice Evidence Based Dentistry

- "In those days Israel had no king; all the people did whatever seemed right in their own eyes" (Judges 17:6).
- We owe it to our patients to be current in our profession and to be practicing "by the book."
- Just because something is widely accepted (and practiced) in our profession does not mean that it is correct.
- Experience does not automatically mean competence.
- Anecdotal evidence can be dangerous!
- Nobody cares what you believe, they only care about what is true.

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Why Is This Important?

- 2.2 million visits to hospital emergency departments for dental conditions in 2015
- Cost of $2 Billion Dollars; average ER visit ~$1,000
- Definitive dental care is usually not given in the ER setting
- Rise of DHT's/DHT Legislation
- If general dentists don't take out teeth, someone else will
- General Dentists are the first line of defense
- Increased cost of specialty care
- Referrals often create unnecessary delay in care
- Practice builder

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Disclaimer

- While I am employed by the Florida Department of Health, I am not here in any official capacity with the FDOH.
- The views and opinions expressed in this lecture are my own and do not necessarily represent those of the FDOH or the WV AGD.
- References to manufacturers, model numbers, etc are for informational purposes only and do not imply endorsement.
- I do not receive financial compensation from any manufacturer.
- The clinical setting/patient demographic for me is different than most private practice situations.
- Procedures and techniques recommended in this lecture are only to be performed by qualified individuals for whom these procedures are within their skill level.

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Commandment #1: Always Obtain A Thorough Health History

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Past Medical History

- Head/Neck Radiation
- Bisphosphonate Use (Oral or especially IV)
- RANKL ligand inhibitors
- Antiangiogenic agents
- Cardiac Conditions
- Prosthetic Joints

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Osteonecrosis Of The Jaw (ONJ)

- Oral Bisphosphonate Therapy: Incidence of 0.02 to 0.06%
- IV Bisphosphonate Therapy: Incidence of 0.8 to 12%
  (>4 years=significantly higher risk)
- Radiation Treatment: Incidence of 2.6 to 18% in the mandible
  (>60 Gy=significantly higher risk)
- Teeth with poor or questionable prognosis should be extracted 3 weeks prior to starting radiation therapy

Mehra, Pushkar and Richard D'Innocenzo, eds. *Manual of Minor Oral Surgery for the General Dentist, Second Edition.* Wiley, 2016.

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Current Medical History

- Blood Pressure
- Current Medications
  - Anticoagulants
  - Antiplatelet Medications
- Bleeding Disorders
  - Hemophilia (A&B)
  - vWD
  - Thrombocytopenia
- Diabetes
- HIV
- Pregnancy

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How to Accurately Measure Blood Pressure

Box 2. Basic steps for accurate blood pressure (BP) measurement.[2,3,5,22]

- Ask the patient to refrain from smoking cigarettes, drinking caffeinated coffee, and participating in strenuous physical activity such as exercising for at least 30 minutes before measurement.
- Ask the patient to urinate before the BP is taken.
- Have the patient take a sitting position with feet flat on the floor (legs uncrossed) in a seat that provides back support.
- Ask the patient to relax for 5 minutes before the BP is taken.
- Ensure that the patient's arm is bare; no clothing should be on the arm.
- During BP measurement, ask the patient not to:
  - Talk.
  - Move the arm.
  - Use a mobile phone.
  - Read.
- Minimize background noise.
- Have the manometer positioned at the clinician's eye level.
- Use the correct cuff size.

Weinberg, et al. "How to accurately measure blood pressure." General Dentistry, September/October 2019

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Canceling Dental Procedures Due To Elevated Blood Pressure: Is It Appropriate?

Results:

To the authors' knowledge, there are no professionally accepted criteria or study evidence indicating a specific BP elevation at which to prohibit oral health care. Researchers of a 2015 review on management of comorbidities in ambulatory anesthesia failed to find increased morbidity from hypertension in the outpatient setting.

Conclusions:

To the authors' knowledge, there are no prospective study investigators that have addressed whether or when to cancel dental procedures due to office-measured elevated BP. The authors recommend using current anesthesiology guidelines based on functional status and past BP measurements to prevent unnecessary cancellations.

Practical Implications:

It is seldom necessary to cancel dental procedures on the basis of BP measured before a planned procedure for patients under a physician's care.

Yarows et al. *JADA* April 2020

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Elevated Blood Pressure (Continued)

- A preoperative BP reading less than 180/110 mm Hg without angina pectoris or acute congestive heart failure signs and symptoms is not an indication for canceling or postponing a dental procedure.
- For patients whose correctly measured BP is greater than 180/110 mm Hg, risk assessment should be addressed, as suggested in Box 2. If the patient has at least 1 affirmative answer from both category A and category B, the procedure may proceed. Lacking an affirmative answer from category A and category B, immediate discussion with the primary care provider is suggested to discuss the risks of cancellation versus the benefits of proceeding with the treatment.
- Regardless of the above, all patients with BP greater than 180/110 mm Hg need to follow-up with the health care provider managing their HTN

Yarows et al. *JADA* April 2020

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Box 2. Risk stratification for patients whose correctly measured blood pressure is greater than 180/110 millimeters of mercury.*

RISK STRATIFICATION CATEGORY

Category A
- Is the patient taking antihypertensive medication, and did he or she take it this day?
- Does the patient have a health care provider managing his or her hypertension and has he or she been seen in the past 6 months?
- Does the patient appear anxious, acknowledge anxiety about the procedure, or have a heart rate > 100 beats per minute?

Category B
- Did the patient take public transportation or drive and walk in for the procedure?
- Does the patient take care of his or her own house or apartment?
- Does the patient state he or she can walk up a flight of stairs?

* Adapted with permission of the publisher from Fleisher and colleagues.[3,4]

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HIV

- Antibiotic prophylaxis not indicated as a routine practice
- Neutropenia (neutrophil counts <500 cells per mm^3)
  - ATB prophylaxis indicated
  - 0.12% CHX 2-3 days pre-operatively
- Prevention of developing pneumocystis pneumonia (CD4 count <200 cells/mm^3)
- Prevention of developing *Mycobacterium avium* complex (CD4 count <50 cells/mm^3)

Chavali, et al. "Oral Healthcare for the HIV-Infected Patient." *Inside Dentistry*, vol. 14, no. 3, 2018.

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HIV (Continued)

- Routine procedures (including simple procedures) can be performed when:
  - Platelet counts >60,000/mcL
  - PT/PTT values are no more than 2x what is considered normal
- Conservative Tooth-by-tooth Approach when:
  - Increased bleeding tendency in past medical Hx
  - Platelet count <60,000/mcL
  - Hemoglobin levels are <7g/dL
- No Tx if platelet count <20,000/mcL
- Platelet values should be within 1-2 days (or same day) of procedure

Chavali, et al. "Oral Healthcare for the HIV-Infected Patient." *Inside Dentistry*, vol. 14, no. 3, 2018.

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Pregnancy

- Dental Treatment is safe during pregnancy
- 2nd trimester ideal time for treatment
- Emergency care should not be delayed
- Lidocaine and Prilocaine are Pregnancy B drugs; all others are Pregnancy Category C drugs
- Lidocaine safest for lactating mothers
- Radiographs are safe during pregnancy
  - Digital pano 14.1 micro Sieverts (or less)
- Avoid NSAIDS and Steroids

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Commandment #2: Always Take Adequate Pre-, Intra-, and Post-Operative Radiographs

"If a blind man leads a blind man, they both will fall into a pit" (Matthew 15:14).

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Pre-, Intra-, And Post-Operative Radiographs

- Pre-Operative Radiographs
  - Pano on every new patient
  - PA and BWX on every tooth with questionable restorability
- Intra-Operative Radiographs
  - PA to to firm root presence, size, or location
- Post-Operative Radiographs
  - PA to confirm complete removal of all root tips
  - Possible new pano after Full-mouth extraction

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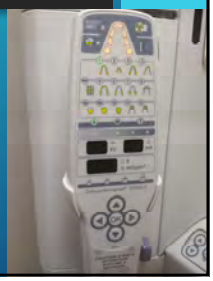
Panoramic Radiographs

- "Whole Picture" of overall dentition
- Relationship of maxillary teeth to sinus
- Relationship of mandibular teeth to IAN
- Pathology
- Impacted/Supernumerary teeth



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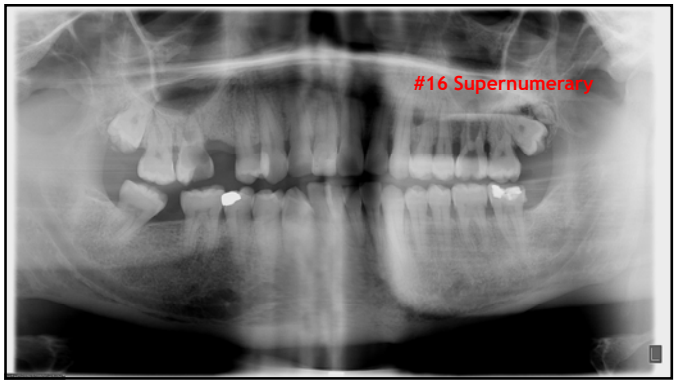

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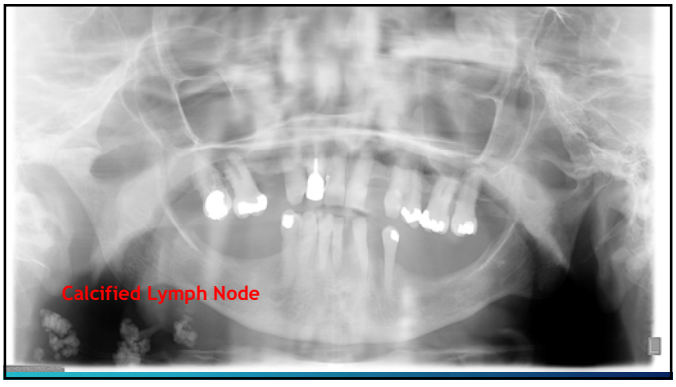

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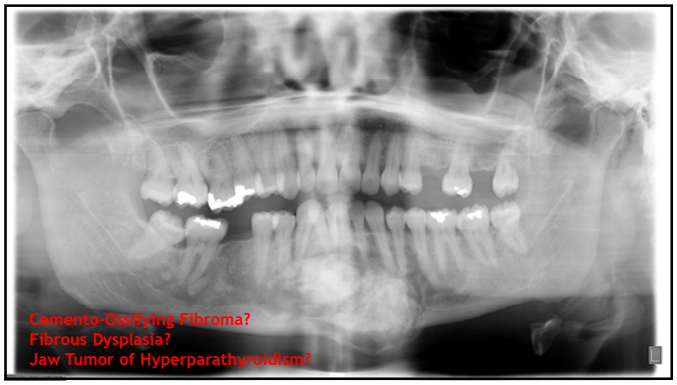

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Radiographs (Continued)

- Panoramic: Any time sources of infection are attempting to be identified/ eliminated, a panoramic film is ideal. Given that modern digital panoramic machines can give an effective dose as low as 6.3 micro Sieverts (daily background radiation is 8-9 micro Sieverts), a panoramic radiograph is safe even for the pregnant patient. First taking a panoramic film allows you to "hone in" on areas in which you would like more detail (i.e. through periapical films).
- Periapical: Allows for more detail of the tooth/teeth in question. Teeth causing an acute apical abscess (or beyond) have likely been necrotic for some time and should demonstrate radiographic changes in the bone making for easier identification of the offending tooth or teeth.
- Bitewing: Used to help determine the restorability of a tooth in question. If a tooth causing an acute pain/infection is non-restorable, it should be removed.

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CBCT

- Use it if you have it!
- Very valuable for evaluating bone thickness (Buccal plate, IA Cortex, Maxillary Sinus)
- Valuable information about root curvature

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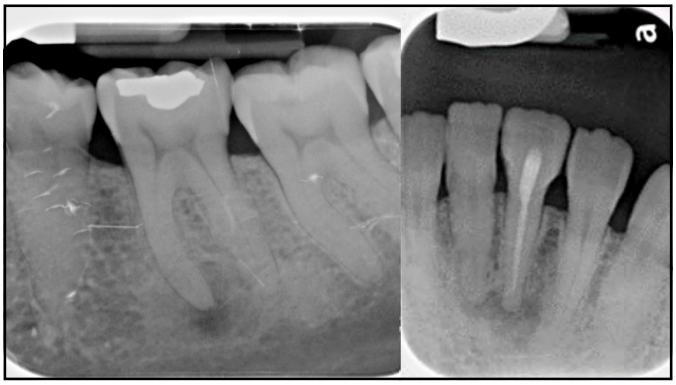

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Commandment #3: Always Obtain A Pulpal And Periapical Diagnosis For The Tooth In Question

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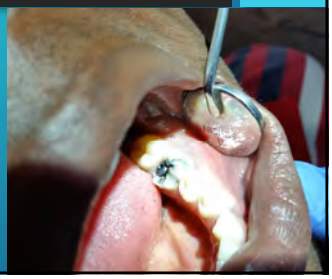
Pulpal Diagnosis (D0460)

- Normal Pulp
- Reversible Pulpitis
- Symptomatic Irreversible Pulpitis
- Asymptomatic Irreversible Pulpitis
- Pulp Necrosis
- Previously Treated
- Previously Initiated Therapy



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Pulpal Diagnosis: Normal Pulp

A clinical diagnostic category in which the pulp is symptom-free and normally responsive to pulp testing. Although the pulp may not be histologically normal, a "clinically" normal pulp results in a mild or transient response to thermal cold testing, lasting no more than one to two seconds after the stimulus is removed. One cannot arrive at a probable diagnosis without comparing the tooth in question with adjacent and contralateral teeth. It is best to test the adjacent teeth and contralateral teeth first so that the patient is familiar with the experience of a normal response to cold.

American Association of Endodontics. Endodontic Diagnosis. *Endodontics: Colleagues for Excellence.* Fall 2013.

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Pulpal Diagnosis: Reversible Pulpitis

Based upon subjective and objective findings indicating that the inflammation should resolve and the pulp return to normal following appropriate management of the etiology. Discomfort is experienced when a stimulus such as cold or sweet is applied and goes away within a couple of seconds following the removal of the stimulus. Typical etiologies may include exposed dentin (dentinal sensitivity), caries or deep restorations. There are no significant radiographic changes in the periapical region of the suspect tooth and the pain experienced is not spontaneous. Following the management of the etiology (e.g. caries removal plus restoration; covering the exposed dentin), the tooth requires further evaluation to determine whether the "reversible pulpitis" has returned to a normal status. Although dentinal sensitivity per se is not an inflammatory process, all of the symptoms of this entity mimic those of a reversible pulpitis.

American Association of Endodontics. Endodontic Diagnosis. *Endodontics: Colleagues for Excellence.* Fall 2013.

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Two One-Minute Applications of Glutaraldehyde

- Gluma (Kulzer)
- G5 (Clinician's Choice)
- Glu/Sense (Centrix)
- MicroPrime G (Zest)

All the above contain similar chemistry:
5% glutaraldehyde and 35% hydroxyethyl methacrylate

Christensen, Gordon. "Preventing Recurrent Caries on Restorations." Dental Economics, April 2020.

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Pulpal Diagnosis: Symptomatic Irreversible Pulpitis

Based on subjective and objective findings that the vital inflamed pulp is incapable of healing and that root canal treatment is indicated. Characteristics may include sharp pain upon thermal stimulus, lingering pain (often 30 seconds or longer after stimulus removal), spontaneity (unprovoked pain) and referred pain. Sometimes the pain may be accentuated by postural changes such as lying down or bending over and over-the-counter analgesics are typically ineffective. Common etiologies may include deep caries, extensive restorations, or fractures exposing the pulpal tissues. Teeth with symptomatic irreversible pulpitis may be difficult to diagnose because the inflammation has not yet reached the periapical tissues, thus resulting in no pain or discomfort to percussion. In such cases, dental history and thermal testing are the primary tools for assessing pulpal status.

American Association of Endodontics. Endodontic Diagnosis. *Endodontics: Colleagues for Excellence.* Fall 2013.

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Pulpal Diagnosis: Asymptomatic Irreversible Pulpitis

A clinical diagnosis based on subjective and objective findings indicating that the vital inflamed pulp is incapable of healing and that root canal treatment is indicated. These cases have no clinical symptoms and usually respond normally to thermal testing but may have had trauma or deep caries that would likely result in exposure following removal.

American Association of Endodontics. Endodontic Diagnosis. *Endodontics: Colleagues for Excellence.* Fall 2013.

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Asymptomatic Irreversible Pulpitis?

- "These findings indicate that the pulpal diagnostic term asymptomatic asymptomatic irreversible pulpitis needs to be updated."
- "Therefore, the pulp of a carious tooth that responds normally to cold testing should be diagnosed as normal pulp, not asymptomatic irreversible pulpitis."
- "A more pertinent use of the diagnostic term asymptomatic irreversible pulpitis would be for cases involving a pulp polyp or internal resorption of a vital tooth."

Bahcall, et al. "Pulpal Diagnosis and Treatment" Inside Dentistry, February 2020.

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Pulpal Diagnosis: Pulp Necrosis

A clinical diagnostic category indicating death of the dental pulp, necessitating root canal treatment. The pulp is non-responsive to pulp testing and is asymptomatic. Pulp necrosis by itself does not cause apical periodontitis (pain to percussion or radiographic evidence of osseous breakdown) unless the canal is infected. Some teeth may be nonresponsive to pulp testing because of calcification, recent history of trauma, or simply the tooth is just not responding. As stated previously, this is why all testing must be of a comparative nature (e.g. patient may not respond to thermal testing on any teeth).

American Association of Endodontics. Endodontic Diagnosis. *Endodontics: Colleagues for Excellence*. Fall 2013.

44

Pulpal Diagnosis: Previously Treated

A clinical diagnostic category indicating that the tooth has been endodontically treated and the canals are obturated with various filling materials other than intracanal medicaments. The tooth typically does not respond to thermal or electric pulp testing.

American Association of Endodontics. Endodontic Diagnosis. *Endodontics: Colleagues for Excellence*. Fall 2013.

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Pulpal Diagnosis: Previously Initiated Therapy

A clinical diagnostic category indicating that the tooth has been previously treated by partial endodontic therapy such as pulpotomy or pulpectomy. Depending on the level of therapy, the tooth may or may not respond to pulp testing modalities.

American Association of Endodontics. Endodontic Diagnosis. *Endodontics: Colleagues for Excellence*. Fall 2013.

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Periapical Diagnosis

- Normal Apical Tissues
- Symptomatic Apical Periodontitis
- Asymptomatic Apical Periodontitis
- Chronic Apical Abscess
- Acute Apical Abscess

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Periapical Diagnosis: Normal Apical Tissues

Are not sensitive to percussion or palpation testing and radiographically, the lamina dura surrounding the root is intact and the periodontal ligament space is uniform.

As with pulp testing, comparative testing for percussion and palpation should always begin with normal teeth as a baseline for the patient.

American Association of Endodontics. Endodontic Diagnosis. *Endodontics: Colleagues for Excellence*. Fall 2013.

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Periapical Diagnosis: Symptomatic Apical Periodontitis

Represents inflammation, usually of the apical periodontium, producing clinical symptoms involving a painful response to biting and/or percussion or palpation.

This may or may not be accompanied by radiographic changes (i.e. depending upon the stage of the disease, there may be normal width of the periodontal ligament or there may be a periapical radiolucency). Severe pain to percussion and/or palpation is highly indicative of a degenerating pulp and root canal treatment is needed.

American Association of Endodontics. Endodontic Diagnosis. *Endodontics: Colleagues for Excellence.* Fall 2013.

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Periapical Diagnosis: Asymptomatic Apical Periodontitis

Is inflammation and destruction of the apical periodontium that is of pulpal origin. It appears as an apical radiolucency and does not present clinical symptoms (no pain on percussion or palpation).

American Association of Endodontics. Endodontic Diagnosis. *Endodontics: Colleagues for Excellence.* Fall 2013.

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Periapical Diagnosis: Chronic Apical Abscess

An inflammatory reaction to pulpal infection and necrosis characterized by gradual onset, little or no discomfort and an intermittent discharge of pus through an associated sinus tract. Radiographically, there are typically signs of osseous destruction such as a radiolucency.

To identify the source of a draining sinus tract when present, a gutta percha cone is carefully placed through the stoma or opening until it stops and a radiograph is taken.

American Association of Endodontics. Endodontic Diagnosis. *Endodontics: Colleagues for Excellence.* Fall 2013.

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Periapical Diagnosis: Acute Apical Abscess

An inflammatory reaction to pulpal infection and necrosis characterized by rapid onset, spontaneous pain, extreme tenderness of the tooth to pressure, pus formation and swelling of associated tissues. There may be no radiographic signs of destruction and the patient often experiences malaise, fever and lymphadenopathy.

American Association of Endodontics. Endodontic Diagnosis. *Endodontics: Colleagues for Excellence.* Fall 2013.

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Commandment #4: Exhaust Conservative Treatment Options Before Moving To Aggressive Ones

"Sir," the man replied, "Leave it alone for one more year, and I'll dig around it and fertilize it. If it bears fruit next year, fine! If not, then cut it down" (Luke 13:8-9).

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Tooth Conservation Principles

- Preserve Tooth Structure
- Preserve Pulpal Vitality
- Preserve Teeth
- Preserve Bone
  - Atraumatic extraction
  - By placing implants
- Preserve Function
  - RDP
  - FDP
  - Implants

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Let's Save Teeth!

- Adequate diet and oral hygiene throughout life
- Adequate evaluation of dental caries
- Conservative restoration of teeth (small diameter, round-ended burs)
- Use the best materials for specific situations
- Use crowns conservatively
- Keep occlusion healthy
- Use root canal treatment only when needed
- Use implants as a last resort

Christensen, Gordon. "Let's Save teeth." Dental Economics, March 2020.

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Cracked #19

A Case Study
W. Bradley Perrett, DDS
Colorado Springs, CO

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Case History

- Occlusal amalgams placed ~25 years ago
- Patient had noted pain upon biting #19 a year or two earlier
- Pain appeared to be from ML cusp #19
- Patient exhibited intermittent symptoms LLQ
- Pt concerned that might be having irreversible pulpitis-type symptoms
- Pt had endodontist evaluation 30 DEC 2019
- Cold testing indicated nothing more than reversible pulpitis for either #18 or #19

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Pre-Operative 22 JAN 2020

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Pre-Operative Bitewing

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After Amalgam Removal

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Significant Crack At Lingual Wall

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Chasing The Crack, Followed By Air Abrasion

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Chasing The Crack/Reducing Lingual Wall

63

Removing Crack From Dentin

64

Ribbond Application/Dentin Sealing

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Biomimetically Restored Occlusal Resin #18
CADCAM Milled eMax MODL Onlay #19

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Lessons Learned

- Conservative preparation: "We don't do extension for prevention, we do restriction with conviction" -COL Grant Perrine
- Bond all restorations (amalgam, composite, indirect)
- Beware of occlusion (especially eccentric contacts on non-functional cusps)
- Teeth do well in compression, not tension

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Practice Minimally-Invasive Dentistry

- At-home Fluoride Rinses
- Prescription Toothpastes
- Sealants on molar pits/fissures
- Fissurotomy burs/Preventative Resin Restorations (D1352)
- Don't treat "Board Lesions," watch them!
- Good BWX radiographs with open proximal contacts
- Resin Infiltration?
- No "Extension for prevention!"
- Instead, "Restriction with conviction."

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Commandment 4a: Give The Pulp A Chance

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Indirect Approach: David Clark's Modified Hall Technique

- Always perform pulpal testing
- Asymptomatic teeth
- Step-wise removal of decay
- Remove infected dentin
- Make sure outer 2-3mm of preparation is clean
- Leave affected dentin, especially if removal would expose pulp
- Place bonded restoration

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MCHD Approach: "SDF-Modified Modified Hall"

- Pulp testing
- Step-Wise removal of decay with spoon excavator and/or slow-speed HP and progressively larger round burs
- Remove all infected dentin
- Place SDF and let it sit for ~5 minutes
- Continue to remove stained tooth structure at outer 2-3 mm of preparation
- Place bonded restoration

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Malterud Indirect/Direct Approach

- To date, my practice has performed 254 direct and indirect pulp capping procedures (at a ratio of almost 1:1) utilizing ozone therapy.
- Only 10 teeth have required retreatment: 5 underwent endodontic treatment, and 5 were extracted at the patient's request.
- To date, the average length of service for teeth treated with this approach is 3.5 years, and the success rate is about 96%.

Malterud, Mark. "Dental Knowledge is an Evolution." General Dentistry, September/October 2019

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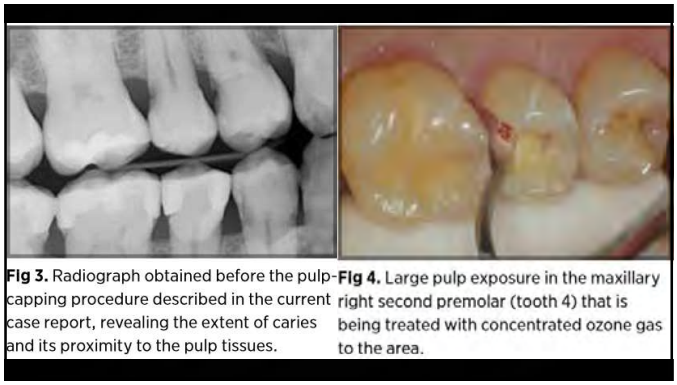

Fig 3. Radiograph obtained before the pulp-capping procedure described in the current case report, revealing the extent of caries and its proximity to the pulp tissues.

Fig 4. Large pulp exposure in the maxillary right second premolar (tooth 4) that is being treated with concentrated ozone gas to the area.

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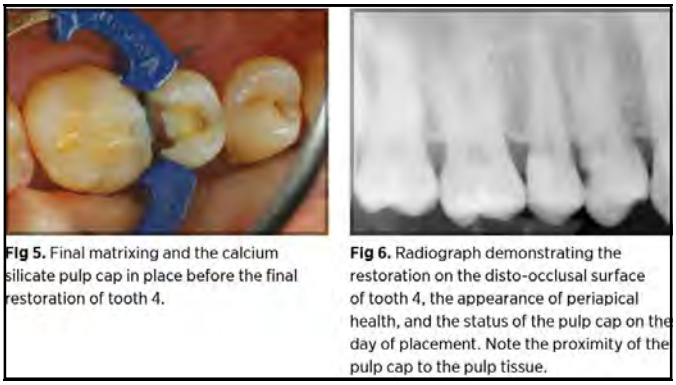

Fig 5. Final matrixing and the calcium silicate pulp cap in place before the final restoration of tooth 4.

Fig 6. Radiograph demonstrating the restoration on the disto-occlusal surface of tooth 4, the appearance of periapical health, and the status of the pulp cap on the day of placement. Note the proximity of the pulp cap to the pulp tissue.

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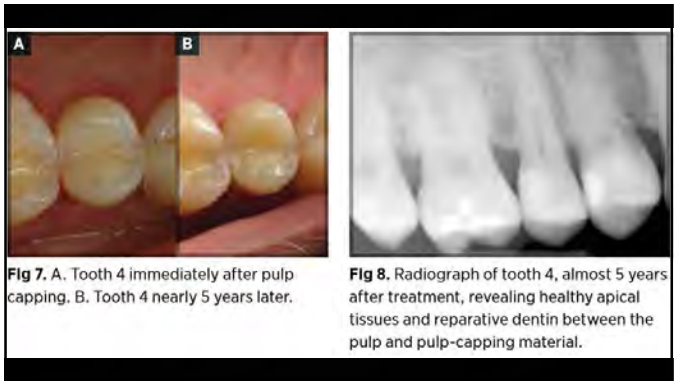

Fig 7. A. Tooth 4 immediately after pulp capping. B. Tooth 4 nearly 5 years later.

Fig 8. Radiograph of tooth 4, almost 5 years after treatment, revealing healthy apical tissues and reparative dentin between the pulp and pulp-capping material.

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Malterud Indirect/Direct Approach (Continued)

- "Historically, a tooth such as tooth #28 in this case report would receive RCT, followed by a post, core, and crown."
- "However, the time has come to take a step back and consider some new pulpal treatments that may give the tooth a chance to remain vital."
- "The practice has been able to follow this case for more than 6 years since its completion, and the tooth has remained comfortable and vital to thermal pulpal testing with no adverse responses to percussion or palpation."

Malterud, Mark. "Re-Treating a Hyperemic Tooth With Deep Caries." Inside Dentistry, December 2020

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Malterud Indirect/Direct Approach (Continued)

- " . . . new products have changed the way that a hyperemic tooth is approached."
- "Rather than following the traditional route of RCT, post, core, and crown, in some cases, it may be possible to maintain tooth integrity and even maintain pulpal health using updated materials and techniques."
- "To date, this author's practice has restored more than 250 direct and indirect pulpal exposures using the protocol described in this case report, maintaining greater than 96% pulpal vitality."

Malterud, Mark. "Re-Treating a Hyperemic Tooth With Deep Caries." Inside Dentistry, December 2020

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Direct Approach: Torabinejad et al

- Rubber dam isolation
- Remove all caries
- Blot bleeding with cotton pellet/NaOCL (1-5 minutes)
- Place MTA directly on pulp exposure and fill with at least 2-3mm of MTA
- Return in 1 week and remove outer MTA
- Final restoration

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Reversible Pulpitis

Closed Apex:
- Vital Pulp Therapy (VPT)
- Pulp Capping
- Pulpotomy

Open Apex: Apexogenesis
A. Pulp Capping
B. Shallow Pulpotomy (Cvek)
C. Pulpotomy

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Irreversible Pulpitis/Necrotic

Closed Apex: RCT

Open Apex: Root End Closure
A. Apexification
B. Apical Barrier
C. Regenerative Endodontics

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Bioactive Endodontics

- Vital Pulp Cryotherapy
- Regenerative Endodontics

Bahcall, et al. "Reassessing Current Endodontic Treatment" Dentistry Today, November/December 2020.

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Vital Pulp Crytotherapy

- Done on teeth requiring a pulp cap or partial pulpectomy
- Contraindicated when a tooth has pretreatment periradicular diagnosis of the following:
  - Asymptomatic Apical Periodontitis
  - Acute Apical Abscess
  - Chronic Apical Abscess
- Contraindicated when the pretreatment pulpal diagnosis is necrotic or partially necrotic
- Done using the following treatment regimen:
  - Sterile Ice placed over a direct or indirect pulp exposure
  - EDTA irrigated over the direct or indirect pulp exposure
  - Direct or indirect pulp exposure is covered with a bioceramic material
  - Glass ionomer placed directly over the bioceramic pulp cap
  - Permanent Restoration (composite or amalgam)

Bahcall, et al. "Reassessing Current Endodontic Treatment" Dentistry Today, November/December 2020

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Regenerative Endodontics

- More biological approach than the current clinical methodology
- Can be done on the following teeth:
  - Both vital and necrotic pulps of immature and mature permanent teeth
  - Teeth with persistent apical periodontitis after conventional RCT
  - Traumatized teeth with external inflammatory resorption
  - Teeth with horizontal fractures
  - Avulsed teeth
  - Teeth with pretreatment diagnosis of symptomatic irreversible pulpitis

Bahcall, et al. "Reassessing Current Endodontic Treatment" Dentistry Today, November/December 2020

83

Regenerative Endodontics (Continued)

- Uses periradicular blood to fill a prepared canal
- Uses various irrigation techniques and devices
- Eliminates the use of warm vertical and cold lateral compaction techniques, along with carrier-based root-filling materials for canal obturation
- Tissues generated in the canals after a regenerative endodontic procedure have been shown to be cementum-like, bone-like, and PDL-like tissues with blood vessels and nerves
- Although these tissues are not true pulpal tissue, they are the host's own vital tissue as opposed to foreign obturation materials (gutta-percha and sealer).

Bahcall, et al. "Reassessing Current Endodontic Treatment" Dentistry Today, November/December 2020

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Regenerative Endodontics (Continued)

- Canals flushed with 17% EDTA irrigation after canal preparation
- Bleeding induced with a hand file 1-2 mm beyond the apical foramen
- Bleeding is stopped at level of CEJ
- Resorbable collagen matrix is placed over the blood clot
- A bioceramic sealer is placed over the collagen matrix
- A glass ionomer is placed over the bioceramic material
- A final composite or amalgam restoration is placed over the glass ionomer

Bahcall, et al. "Reassessing Current Endodontic Treatment" Dentistry Today, November/December 2020

85

Regenerative Endodontics (Continued)

- Patient placed on 3-month recall for up to 3 years
- The following goals:
  1. Elimination of symptoms
  2. Radiographic healing
  3. Positive response to sensitivity testing (Cold/EPT)

Bahcall, et al. "Reassessing Current Endodontic Treatment" Dentistry Today, November/December 2020

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Commandment 4b: Give The Tooth A Chance

87

We Were Meant To Save Teeth

- "Every man I kill, the further away from home I feel."
  —Tom Hanks (Captain John Miller) in Saving Private Ryan
- Something within us should die every time we extract a tooth: "This is not the way things ought to be."
- If in group practice, have a colleague confirm diagnosis that a tooth should be extracted if restorability is borderline.
- We can always extract teeth, but can't put them back in.
- Keeping the tooth gives us more options; once the tooth has been extracted, our options decrease.

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Endodontic Considerations

- How much peri-cervical dentin remains?
- Diagnosis at time of Initial treatment: Vital or non-vital?
- Initial treatment or retreatment?
- Not all endodontists are created equal!
- Conservative Access
- Apicoectomy?

89

Minimally Invasive Endodontics (MIE)

Figures 14a, 14b, and 14c: An example of multiple access points made with X-Nav is shown here, courtesy of Dr. Charles Maupin.

American Association of Endodontics. A New Look at the Endo-Restorative Interface. *Endodontics: Colleagues for Excellence.* Fall 2020.

90

Figure 5: An example of what is possible, in a tooth treated by Dr. Steve Baerg. The final radiograph is a six-year recall.

91

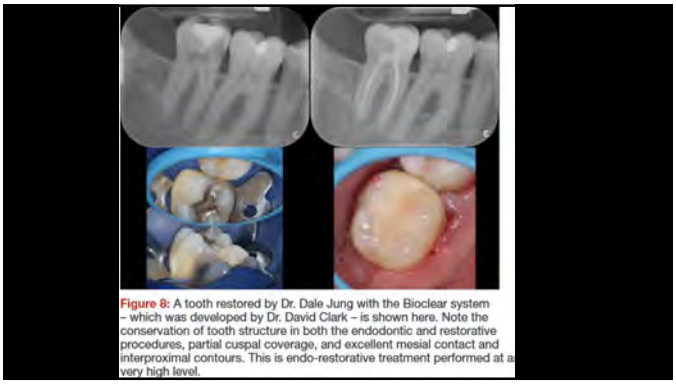

Figure 8: A tooth restored by Dr. Dale Jung with the Bioclear system – which was developed by Dr. David Clark – is shown here. Note the conservation of tooth structure in both the endodontic and restorative procedures, partial cuspal coverage, and excellent mesial contact and interproximal contours. This is endo-restorative treatment performed at a very high level.

92

Endodontic Treatment Options After Unsuccessful Initial Root Canal Treatment: Alternatives To Single-Tooth Implants

Conclusions

- The first-line treatment option after failure of initial root canal treatment is nonsurgical retreatment.
- Endodontic surgery, intentional replantation, and autotransplantation should be considered before extraction and replacement by a single-tooth implant

Torabinejad & White. "Endodontic treatment options after unsuccessful initial root canal treatment." JADA March 2016

93

Clinical Decision-Making Regarding Endodontic Therapy vs Extraction And Implant Assisted Replacement

Conclusion:

- Within the limitations of this review, it can be concluded that both endodontic treatment/retreatment and implant therapy are viable and predictable treatment options.
- Although both approaches result in similar treatment outcomes, endodontic therapy could be considered the first option for treatment because implant therapy is an irreversible treatment requiring more follow-up examinations and interventions.

Sayed, et al. "Clinical decision-making regarding endodontic therapy vs extraction and implant-assisted replacement: a systemic review and meta-analysis." General Dentistry, January/February 2021

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Implant Considerations

- Excellent option for replacing missing teeth, but not a "cure all"
- Soft tissue esthetics can be a challenge, especially in the anterior
- Peri-Implantitis is a real concern
- Drift of adjacent teeth away from implants
- Concern for adjacent structures: Maxillary sinus, IAN/Mental nerve
- No PDL and therefore not equal to a real tooth

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Other Considerations

- How strategic is the tooth?
  - Esthetic Zone
  - FDP/RDP abutment
  - Occlusal function
  - Type of tooth
- Amalgam
- Silver Diamine Fluoride (SDF)
- Patient priorities/finances

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Other Considerations - Christensen

- Age of the patient
- Occlusion
- Oral hygiene
- Amount and condition of remaining supra-bone tooth structure
- Periodontal disease
- Caries present in most of the teeth
- Patient financial status

"When Should Teeth Be Removed?" Gordon Christensen, *Dental Economics* Apr 2019

97

Other Considerations - Christensen

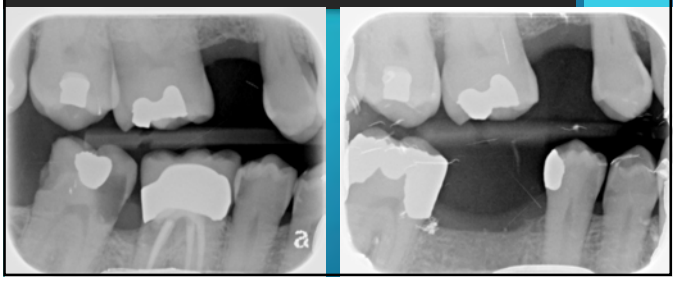
If the patient is really motivated to retain the teeth:

- Diagnose and treatment plan the patient
- Determine which teeth need immediate restoration
- Depending on financial availability, restore the most severely involved teeth first, allowing the patient to recover financially before proceeding with the less involved teeth
- If the patient cannot afford long-term treatment, place glass ionomer restorations in the most severely involved teeth
- 3M Ketac Universal, GC Equia Forte, Voco IonoStar Plus, etc are indicated for an interim period until final restorations can be completed

"When Should Teeth Be Removed?" Gordon Christensen, *Dental Economics* Apr 2019

98

75-Year-Old Patient



99

Commandment #5: Always Provide Same-Day Treatment For Emergency Patients

"Do not withhold good from those to whom it is due,
when it is in your power to act. Do not say to your neighbor,
'Come back tomorrow and I'll give it to you'—
when you already have it with you" (Proverbs 3:27-28).

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Why Same-Day Emergency Treatment?

- Why not?
- Eliminate source of pain
- Eliminate source of (or potential source of) infection
- Practice Builder
- "Cure" for dental anxiety

101

Symptoms That Are Not Indicative Of True Infection (Yet Are Often Mis-Diagnosed As Infection)

- Severe Pain/"Toothache"
  - Irreversible Pulpitis
  - Alveolar Osteitis (after recent treatment)
- Normal Post-operative Edema (especially within first 3 days)
- Post-operative trismus (within 1st week)
- Patient Demand/Self-Diagnosis
- ER diagnosis!

102

Signs (Not Symptoms) Of True Infection

- Pus
- Trismus (unless post-operative trismus from recent treatment)
- Fever (especially in younger patients)
- Malaise

103

Four Myths About Infection That "Prevent" Immediate Treatment

1. Antibiotics alone will cause the infection to subside (without definitive treatment). Therefore, immediate treatment is not necessary.
2. Local anesthetic injections in the presence of infection can cause the spread of infection.
3. The presence of infection makes adequate anesthesia impossible.
4. Definitive treatment in the presence of infection will cause the infection to spread.

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Myth #1: Antibiotics Alone Will Cause The Infection To Subside (Without Definitive Treatment)

- "It is critical to keep in mind that the primary method for treating endodontic infections is to perform surgery to remove the source of the infection and drain the anatomic spaces affected by indurated cellulitis or an abscess. Whenever an abscess or cellulitis is diagnosed, the surgeon must drain it. Failure to do so may result in worsening of the infection and failure of the infection to resolve, even if antibiotics are given" (305).
- "Moreover, when surgery cannot be done immediately, a course of antibiotics does not reliably prevent worsening of the infection" (306).

Hupp, James R et al. *Contemporary Oral and Maxillofacial Surgery, Sixth Edition.* Mosby, 2014.

105

Myth #1: Antibiotics Alone Will Cause The Infection To Subside (Continued)

- "Because the organisms that cause orofacial infections are abscess-formers that are introduced deeply into the bone of the jaws, surgical drainage is the most important treatment we can offer. Another feature common in dental infections is biofilm formation. Antibiotics do not penetrate biofilms well. Furthermore, biofilm-bound bacteria are generally in a quiescent state in which they do not actively incorporate antibiotics. Physical removal appears to be the best strategy for eradicating biofilms, when possible. Essentially, the treatment of almost all dental infection is surgical, ranging from excavation of decay and gingival curettage to extraction and incision and drainage. Such is the nature of the diseases dentists treat; it has been so since before antibiotics were introduced" (248).
- "The primary treatment for infections is surgery, not antibiotics" (261).

Mehra, Pushkar and Richard D'Innocenzo, eds. *Manual of Minor Oral Surgery for the General Dentist, Second Edition.* Wiley, 2016.

106

Myth #2: Local Anesthetic Injections In The Presence Of Infection Can Cause The Spread Of Infection

- "The traditional belief is that injecting directly into a swelling is contraindicated. The reasons given were the possible spread of infection and that the anesthetic solutions would be affected by the lower pH and would be rendered less effective. However, a basic science investigation found that local anesthetics may be successful in inflamed tissue, which is acidified. Regardless, the basic reasons we do not inject swellings is that it is very painful and relatively ineffective" (157).
- "If soft tissue swelling (ie, cellulitis or abscess) is present, infiltrate on either side of the swelling or administer a block" (157).

Reader, Al et al. *Successful Local Anesthesia for Restorative Dentistry and Endodontics.* Quintessence, 2011.

107

Myth #3: The Presence Of Infection Makes Adequate Anesthesia Impossible

- Anesthetic failure is well-documented in the endodontic literature for lower molars with irreversible pulpitis.
- This inflammatory phenomenon often gets misdiagnosed as infection.
- Chapter 1 of Malamed's local anesthesia text inadvertently reinforces the idea that infection prohibits adequate anesthesia.
- The primary reference to support this idea of anesthetic being ineffective in the presence of infection is a study from Bieter in 1936.

Malamed, Stanley F. *Handbook of Local Anesthesia, Fifth Edition.* Mosby, 2004.

108

Reader et al Undermine The "pH Theory" Based On More Current Literature

- "Another explanation relates to the theory that that the lowered pH of inflamed tissue reduces the amount of the base form of anesthetic to penetrate the nerve membrane. Consequently, there is less of the ionized form within the nerve to achieve anesthesia. If this mechanism of failure is correct, it may be true for an infiltration injection in the maxilla. It does not explain the mandibular molar with pulpitis that is not readily anesthetized by an IANB injection. The local anesthetic is administered at some distance from the area of inflammation. Therefore, it is difficult to correlate local influences with failure of the IANB" (135).
- "Interestingly, a basic science investigation found that local anesthetics may be successful in inflamed tissue which is acidified" (135). This was based on research published by Tsuschiya et al in 2007.

Reader, Al et al. *Successful Local Anesthesia for Restorative Dentistry and Endodontics.* Quintessence, 2011.

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Myth #4: Treatment In The Presence Of Infection Will Cause The Infection To Spread

- "Contrary to widely held opinion, extraction of a tooth in the presence of infection does not promote the spread of infection. Several studies have shown that removal of a tooth in the presence of infection hastens the resolution and minimizes the complications of the infection, such as time out of work, hospitalization, and the need for extraoral I & D. Therefore, prompt removal of the offending tooth (or teeth) in the presence of infection is to be encouraged; a prior period of antibiotic therapy is not necessary" (306).
- "In addition to the endodontic procedure or extraction of the tooth, an I & D procedure may be required for an infection that has spread beyond the periapical region. Incision of the abscess or cellulitis allows removal of the accumulated pus and bacteria from the underlying tissue. Evacuation of the abscess cavity dramatically decreases the load of bacteria and necrotic debris. Evacuation also reduces the hydrostatic pressure in the region by decompressing tissues, which improves the local blood supply and increases the delivery of host defenses and antibiotics to the infected area. I & D of a cellulitis serves to abort the spread of the infection into deeper anatomic spaces" (304).

Hupp, James R et al. *Contemporary Oral and Maxillofacial Surgery, Sixth Edition.* Mosby, 2014.

111

Contraindications To Same-Day Extraction

- Patient taking Coumadin whose INR is unknown and/or not recent
- Trismus to the point where patient cannot open sufficiently to perform removal of the tooth
  - Rare in outpatient general dentistry setting
  - Administration of local anesthesia can often allow for patient to be comfortable enough to open wider
- If tooth is to be retained: Then perform pulpectomy and/or I & D

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An I&D Is The Minimum Treatment That Should Be Performed When A True Infection Is Present

- "Even if the tooth cannot be immediately opened or extracted, an I & D should be done" (305).
- "Incision of the abscess or cellulitis allows removal of the accumulated pus and bacteria from the underlying tissue. Evacuation of the abscess cavity dramatically decreases the load of bacteria and necrotic debris. Evacuation also reduces the hydrostatic pressure in the region by decompressing tissues, which improves the local blood supply and increases the delivery of host defenses and antibiotics to the infected area. I & D of a cellulitis serves to abort the spread of the infection into deeper anatomic spaces" (304).

Hupp, James R et al. *Contemporary Oral and Maxillofacial Surgery, Sixth Edition.* Mosby, 2014.

113

An I&D Is Effective, Even If Pus Is Not Encountered During Procedure

"Incision and drainage of a cellulitis is to be encouraged rather than avoided. Experience has shown that when pus is not encountered during incision and drainage, the patient still gets better. . . . Therefore, it is appropriate to use the same thorough exploration and debridement of the site of infection, whether or not pus is encountered at incision and drainage" (250).

Mehra, Pushkar and Richard D'Innocenzo, eds. *Manual of Minor Oral Surgery for the General Dentist, Second Edition.* Wiley, 2016.

114

Commandment #6: Just Say "No" To Antibiotics

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Antimicrobial Stewardship In Dental Practice

CONCLUSIONS

- Antibiotic resistance is a major public health problem, with dentists being an established focus for AMS.
- Inappropriate prescribing, prescribing for nonmedical reasons, and use of broad-spectrum agents are some practices in the dental industry that should be addressed.
- Identifying opportunities for AMS in dentistry should be a priority, with many areas established as appropriate targets, such as awareness raising, providing education for dentists and patients, and tracking antibiotic use.
- Considering previous interventions, the CDC core elements of outpatient antibiotic stewardship and use of readily available resources are a good starting point to develop locally contextualized AMS strategies in outpatient dental practice.

Teoh et al. *JADA* August 2020 Page 589

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Categories Of Antibiotic Uses

1. Prophylactic
   a. Primary: "prevention of an initial infection, such as antibiotics administered to prevent surgical site infections."
   b. Secondary: "to prevent infection at a distant site; for example, antibiotics administered to patients with a high-risk cardiac condition to prevent infective endocarditis (IE)."
2. Therapeutic
   a. Primary: "first line treatment for an infection and is rarely used in dentistry."
   b. Adjunctive: "those administered in conjunction with surgical intervention."

Stein et al. *JADA* October 2018 Page 870

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Antibiotic Principles

- Antibiotics should rarely be given in dentistry
- If deemed necessary, prophylactic antibiotics are given before treatment, not afterwards.
- Prophylactic antibiotics are given at a loading dose (at least twice the dose of therapeutic antibiotics).
- Antibiotics are never given as a substitute for definitive care (Just say "no" to primary therapeutic antibiotics)
- If needed, antibiotics are always prescribed in conjunction with definitive care (adjunctive therapeutic antibiotics)
- The narrowest spectrum antibiotic should be given
- Therapeutic antibiotics should be given at a therapeutic dose

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Antibiotics (Continued)

- "In the United States, an estimated 8% of the population has had an allergic reaction to penicillin."
- "However, only 10% to 20% of patients with a reported antimicrobial allergy have allergy test positive results."
- "In accordance with antimicrobial stewardship initiatives, part of the responsibility of oral health care professionals is to educate the general public about the significance of antibiotic resistance and the importance of restricting the use of antibiotics in the oral health setting."
- "Patients need to understand that the use of antibiotics is not an acceptable treatment for most oral health-related problems such as a 'toothache' and should be used only in cases of severe infection when systemic involvement is evident."

Stein et al. *JADA* October 2018 Page 880.

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1. Prophylactic Antibiotics

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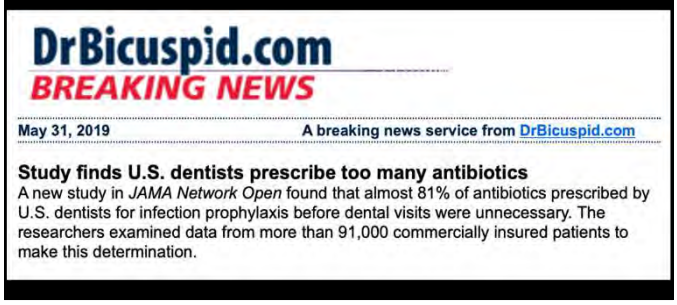
JAMA Network Open May 31, 2019



DrBicuspid.com
BREAKING NEWS

May 31, 2019 — A breaking news service from DrBicuspid.com

Study finds U.S. dentists prescribe too many antibiotics

A new study in *JAMA Network Open* found that almost 81% of antibiotics prescribed by U.S. dentists for infection prophylaxis before dental visits were unnecessary. The researchers examined data from more than 91,000 commercially insured patients to make this determination.

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Are Primary Prophylactic Antibiotics Really Necessary In Dentistry?

- " . . . little scientific evidence supports the effectiveness of prophylactic antibiotics in dentistry and oral-maxillofacial surgery" (COMS 312).
- "For the dentist doing routine oral surgery, this means that most office procedures performed on healthy patients do not require prophylactically administered antibiotics. The incidence of infection after tooth extraction, frenectomy, biopsy, minor alveoloplasty, and torus reduction is extremely low; therefore, antibiotics would provide no benefit. This is true even in the presence of periapical infection, severe periodontitis, and multiple extractions" (COMS 312).
- "Most dental procedures on healthy patients do not require antibiotic prophylaxis" (COMS 313).
- "There is no scientific evidence or expert recommendation to support antibiotic prophylaxis for removal of erupted teeth in otherwise healthy patients" (MMOS 261).

122

When Truly Warranted, Prophylactic Antibiotics Should Be Given Beforehand And Not Afterwards

- "However, some patients, especially those with depressed immune host-defense responses, may require antibiotics to prevent infection. Antibiotics in these patients should be administered before the surgical procedure is begun. Additional antibiotics after surgery are usually not necessary for routine extractions in healthy patients" (171).
- "A few select patients who are to undergo long surgical procedures or the insertion of foreign bodies such as dental implants should be considered for prophylaxis. Patients who have compromised host defenses because of poorly controlled metabolic disease or certain diseases that interfere with host defenses or who are taking drugs that suppress the immune system should be given prophylactic antibiotics. . . . When the antibiotic is given, it should be taken before the surgery begins, at a normal dose twice that of therapeutically administered antibiotics" (313).

Hupp, James R et al. *Contemporary Oral and Maxillofacial Surgery, Sixth Edition*. Mosby, 2014.

123

Third Molars?

- "After combining all the available studies, their statistical method demonstrated a benefit of antibiotic prophylaxis for third molar removal only when the antibiotic was started 30 to 90 minutes before the surgery. There was a small additional benefit when the antibiotic was continued for 3 to 5 days after surgery. There was no additional benefit when the antibiotic was started postoperatively" (260-261).
- "Thus, it appears evident that preoperative, not post-operative antibiotic administration is of benefit in preventing infection following mandibular third molar removal. The antibiotic may be continued 3 to 5 days postoperatively. However, starting the antibiotic after surgery is of no benefit" (261).

Mehra, Pushkar and Richard D'Innocenzo, eds. *Manual of Minor Oral Surgery for the General Dentist, Second Edition*. Wiley, 2016.

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Prophylactic Antibiotics For Surgical Removal Of Impacted Third Molars: Still No Consensus

- Dental providers bear substantial responsibility with regard to the use of prophylactic antibiotic therapy for dental procedures, and their recommendations to patients are of critical importance.
- However, there is no consensus about the indications or regimens for antibiotic prophylaxis in healthy patients undergoing surgical removal of impacted M3s.
- Clinicians can consider prescribing antibiotics postoperatively, only when an infection develops, because most infections are relatively minor, treatable, and self-limiting.
- Further research and guidance from professional organizations are needed to better inform dental professionals about the risks and benefits of antibiotics for these patients as well as the importance of antibiotic stewardship

Khan, et al. "Prophylactic antibiotics for surgical removal of impacted third molars: still no consensus." General Dentistry. January/February 2021

125

Third Molars (Continued)

"The incidence of infection after the removal of third molars is low, at only 1.7% to 2.7%. About 50% are localized subperiosteal abscess infections, which occur 2 to 4 weeks after an uneventful postoperative course. These infections are often attributed to debris remaining under the mucoperiosteal flap. Treatment is simply surgical debridement and drainage. Of the remaining 50%, few postoperative infections are significant to warrant surgery, antibiotics, or hospitalization. Infections only occur within the first 7 days 0.5% to 1% of the time. According to literature, this situation is considered an acceptable infection rate, which would not warrant administration of prophylactic antibiotics" (78).

Pierse JE, Dym H, Clarkson E. Diagnosis and Management of Common Postextraction Complications. *Dent Clin North Am*. 2012; 56(1):75-93.

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Table 14.15: Recommendations About Antibiotic Prophylaxis For Dental Procedures

Medical Condition	Prophylaxis Recommended?	Antibiotic Regimen
High risk of endocarditis	Yes	AHA
Mitral valve prolapse	No	
Heart murmurs	No	
Cardiac pacemaker	No	
Implanted defibrillator	No	
Coronary artery bypass graft	No	
Coronary artery stents	No	
Prosthetic joints	No	
Cancer chemotherapy	Yes, although definitive evidence is lacking	AHA
Renal hemodialysis	Yes, although definitive evidence is lacking	AHA
Poorly controlled diabetes milletus	Yes, although definitive evidence is lacking	AHA
Ventriculoatrial shunts for hydrocephalus	Yes	AHA
Ventriculoperitoneal shunts for hydrocephalus	No	
Immune system compromise	Yes, only for invasive procedures	AHA
Impacted third molar removal	Yes	Preoperative dose before procedure, with possible 3-5 day postoperative course
Dental implant placement	Yes	AHA
Extraction of erupted teeth	No	

Mehra, Pushkar and Richard D'Innocenzo, eds. *Manual of Minor Oral Surgery for the General Dentist, Second Edition.* Wiley, 2016.

127

AHA Guidelines For Prophylaxis (Secondary)

The current infective endocarditis/valvular heart disease guidelines (as of 2017) state that use of preventive antibiotics before certain dental procedures is reasonable for patients with:

1) Prosthetic cardiac valves, including transcatheter-implanted prostheses and homografts.
2) Prosthetic material used for cardiac valve repair, such as annuloplasty rings and chords.
3) Previous infective endocarditis (IE).
4) A cardiac transplant[a] with valve regurgitation due to a structurally abnormal valve.

The following congenital (present from birth) heart disease:[b]

5) Unrepaired cyanotic congenital heart disease, including palliative shunts and conduits.
6) Any repaired congenital heart defect with residual shunts or valvular regurgitation at the site of or adjacent to the site of a prosthetic patch or prosthetic device.

[a] According to limited data, infective endocarditis appears to be more common in heart transplant recipients than in the general population; the risk of infective endocarditis is highest in the first 6 months after transplant because of endothelial disruption, high-intensity immunosuppressive therapy, frequent central venous catheter access, and frequent endomyocardial biopsies.

[b] Except for the conditions listed above, antibiotic prophylaxis is no longer recommended for any other form of congenital heart disease.

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High-Risk Cardiac Conditions For Which Antibiotic Prophylaxis Before Dental Procedures Is Recommended

- Prosthetic cardiac valve
- Previous IE
- Congenital heart disease (CHD)
  - Unrepaired CHD, which includes palliative shunts and conduits
  - Repaired CHD within the first 6 months following the procedure
  - Repaired CHD with residual defects
- Cardiac transplantation recipients who develop cardiac valvulopathy

Shapiro, et al. "Antibiotic Prophylaxis for Dental Procedures." *Inside Dentistry*, September 2020.

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Prescribing Of Antibiotic Prophylaxis To Prevent Infective Endocarditis

CONCLUSIONS

- This study identified substantial under-prescribing of AP in patients at high risk of developing IE complications undergoing invasive dental procedures.
- Of the invasive dental procedures performed, scaling accounted for most (80%-90%).
- The study also identified a number of different prescribing strategies to provide AP, particularly for repeat dental visits, some of which might not be consistent with modern antibiotic stewardship recommendations.
- In addition, this study validates, for the first time to our knowledge, the sensitivity and specificity of algorithms to identify AP prescribing in big data studies

Thornhill et al. *JADA* November 2020 Page 835

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eBox 2. Dental procedures for which endocarditis prophylaxis is reasonable according to the 2007 American Heart Association guidelines.*

Dental Procedure

- All dental procedures that involve manipulation of gingival tissue or the periapical region of teeth or perforation of the oral mucosa.*

*The following procedures and events do not need prophylaxis: routine anesthetic injections through noninfected tissue, obtaining dental radiographs, placement of removable prosthodontic or orthodontic appliances, adjustment of orthodontic appliances, placement of orthodontic brackets, shedding of primary teeth, and bleeding from trauma to the lips or oral mucosa. Source: Wilson and colleagues.[4]

Thornhill et al. *JADA* November 2020 Page 835

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Dental Procedures For Which Antibiotic Prophylaxis For High-Risk Cardiac Patients Is Recommended

- Restorative care wherein gingival tissues will be manipulated
- Surgical and nonsurgical periodontal procedures
- Surgical and nonsurgical endodontic procedures
- Oral surgery, including extractions
- All dental procedures involving manipulation of gingival tissue, the periapical region of the teeth, or perforation of the oral mucosa

Shapiro, et al. "Antibiotic Prophylaxis for Dental Procedures." *Inside Dentistry*, September 2020.

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Dental Procedures In Which Antibiotics Prophylaxis Is Reasonable (AAE 2012)

- Dental Extractions
- Periodontal procedures
- Dental implant placement
- Replantation of avulsed teeth
- Endodontic (root canal) instrumentation only if beyond the root apex and endodontic surgery
- Initial placement of orthodontic bands (not brackets)
- Intraligamentary and intraosseous local anesthetic injections
- Postoperative suture removal (in selected circumstances that may create significant bleeding)
- Prophylactic cleaning of teeth or implants where bleeding is anticipated

American Association of Endodontics. Use and Abuse of Antibiotics. *Endodontics: Colleagues for Excellence*. Winter 2012.

133

Dental Procedures For Which Antibiotic Prophylaxis For High-Risk Cardiac Patients Is NOT Recommended

- Injection of local anesthetic through noninfected tissues
- Dental radiography
- Placement of removable prosthetics
- Placement or adjustment of orthodontic appliances or brackets
- Exfoliation of primary teeth
- Bleeding resulting from trauma sustained by the oral mucosa or lips

Shapiro, et al. "Antibiotic Prophylaxis for Dental Procedures." *Inside Dentistry*, September 2020.

134

Dental Procedures In Which Prophylaxis Is Not Recommended (Box 16-15)

- Restorative Dentistry
- Routine anesthetic injections through noninfected tissues
- Intracanal endodontic therapy and placement of rubber dams
- Suture removal
- Taking dental radiographs
- Placement of removable prosthodontic or orthodontic appliances
- Making of impressions
- Fluoride treatments
- Orthodontic appliance adjustment
- Placement of orthodontic brackets
- Shedding of deciduous teeth
- Bleeding from trauma to the lips or oral mucosa

Hupp, James R et al. *Contemporary Oral and Maxillofacial Surgery, Sixth Edition*. Mosby, 2014.

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AHA Antibiotic Prophylaxis Regimen: Single Dose 30 To 60 Min Before Procedure*

Situation	Agent	Adults	Children
Oral	Amoxicillin	2g	50mg/kg
Unable to take oral medication	Ampicillin **OR** Cefazolin or cetriaxone	2g IM or IV 1g IM or IV	50mg/kg IM or IV 50mg/kg IM or IV
Allergic to penicillins or ampicillin—oral	Cephalexin **OR** Clindamycin **OR** Azithromycin or clarithromycin	2g 600mg 500mg	50mg/kg 20mg/kg 15mg/kg
Allergic to penicillin or ampicillin and unable to take oral medication	Cefazolin or cetriaxone **OR** Clindamycin	1g IM or IV 600mg IM or IV	50mg/kg IM or IV 20mg/kg IM or IV

*In the event that the dosage of antibiotic is inadvertently not administered before the procedure, it may be administered for up to 2 hours after the procedure

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Impact Of Antibiotic Prophylaxis On The Incidence, Nature, Magnitude, And Duration Of Bacteremia Associated With Dental Procedures: A Systematic Review

Practical Implications

- Oral amoxicillin is still the antibiotic of choice to reduce bacteremia.
- IV amoxicillin-clavulanic acid could be used for patients at high risk of developing IE who require invasive dental procedures, have high levels of dental infection, and are to be treated under general anesthesia.
- In patients with penicillin allergies, oral azithromycin showed a higher efficacy for the reduction of bacteremia and the use of clindamycin should be reviewed.
- Antibiotic premedication should be limited to patients at high risk of developing IE, according to the indications of the AHA guide.

Lafaurie et al. *JADA* November 2019 page 948

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Management of patients with prosthetic joints undergoing dental procedures

Clinical Recommendation:

In general, for patients with prosthetic joint implants, prophylactic antibiotics are *not* recommended prior to dental procedures to prevent prosthetic joint infection.

For patients with a history of complications associated with their joint replacement surgery who are undergoing dental procedures that include gingival manipulation or mucosal incision, prophylactic antibiotics should only be considered after consultation with the patient and orthopedic surgeon.* To assess a patient's medical status, a complete health history is always recommended when making final decisions regarding the need for antibiotic prophylaxis.

Clinical Reasoning for the Recommendation:

- There is evidence that dental procedures are not associated with prosthetic joint implant infections.
- There is evidence that antibiotics provided before oral care do not prevent prosthetic joint implant infections.
- There are potential harms of antibiotics including risk for anaphylaxis, antibiotic resistance, and opportunistic infections like *Clostridium difficile*.
- The benefits of antibiotic prophylaxis may not exceed the harms for most patients.
- The individual patient's circumstances and preferences should be considered when deciding whether to prescribe prophylactic antibiotics prior to dental procedures.

ADA Center for Evidence-Based Dentistry™

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2. Therapeutic Antibiotics (Adjunctive)

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Evidence-based clinical practice guideline on antibiotic use for the urgent management of pulpal- and periapical-related dental pain and intraoral swelling

A report from the American Dental Association

Results

The panel formulated 5 clinical recommendations and 2 good practice statements, each specific to the target conditions, for settings in which DCDT is and is not immediately available. With likely negligible benefits and potentially large harms, the panel recommended against using antibiotics in most clinical scenarios, irrespective of DCDT availability. They recommended antibiotics in patients with systemic involvement (for example, malaise or fever) due to the dental conditions or when the risk of experiencing progression to systemic involvement is high.

Lockhart et al. *JADA* November 2019 page 906

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Evidence-based clinical practice guideline on antibiotic use for the urgent management of pulpal- and periapical-related dental pain and intraoral swelling (Continued)

Conclusion and Practical Implications

Evidence suggests that antibiotics for the target conditions may provide negligible benefits and probably contribute to large harms. The expert panel suggests that antibiotics for target conditions be used only when systemic involvement is present and that immediate DCDT should be prioritized in all cases.

Lockhart et al. *JADA* November 2019 page 906

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Indications For Adjunctive Antibiotics

- Acute Apical Abscess (AAA) with systemic involvement
- Acute Apical Abscess (AAA) in medically compromised patients
- Replantation of avulsed permanent teeth
- Soft tissue trauma requiring suturing or debridement
- Rapidly progressive infections (onset within 24 hours), cellulitis, or osteomyelitis

Blicher, et al. "Antibiotic Stewardship in the Management of Endodontic Infections." *Inside Dentistry*, vol. 14, no. 1, 2018.

143

Contraindications For Adjunctive Antibiotics

- Irreversible pulpitis
- Pain in the absence of other signs/symptoms of infection
- Pulpal necrosis
- Asymptomatic Apical Periodontitis
- Symptomatic apical periodontitis
- Chronic apical abscess (Sinus Tract)
- Acute Apical Abscess without signs of systemic involvement
- Traumatic injuries including fractures and luxation injuries

Blicher, et al. "Antibiotic Stewardship in the Management of Endodontic Infections." *Inside Dentistry*, vol. 14, no. 1, 2018.

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Indications For Therapeutic Use Of Antibiotics (Box 16-4)

- Swelling extending beyond the alveolar process
- Cellulitis
- Trismus
- Lymphadenopathy
- Temperature higher than 101° F
- Severe Pericoronitis
- Osteomyelitis

Hupp, James R et al. *Contemporary Oral and Maxillofacial Surgery, Sixth Edition.* Mosby, 2014.

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Situations In Which Antibiotics Are Not Necessary

- Patient Demand
- Severe Pain/"Toothache"
- Periapical Abscess
- Dry Socket
- Multiple dental extractions in a patient who is not immunocompromised
- Mild Pericoronitis (inflammation of the operculum only)
- Drained alveolar abscess

Hupp, James R et al. *Contemporary Oral and Maxillofacial Surgery, Sixth Edition.* Box 16-5. Mosby, 2014.

146

Algorithm For Appropriate Antibiotic Selection To Treat Endodontic Infection

FIRST LINE:
Penicillin
IF MEDICALLY COMPROMISED:
Amoxicillin
IF PENICILLIN/AMOXICILLIN RESISTANT:
Add Metronidazole *or* replace with Augmentin
IF ALLERGIC TO PENICILLIN:
Clindamycin
IF ALLERGIC TO PENICILLIN AND CLINDAMYCIN:
Clarithromycin *or* Azithromycin

Blicher, et al. "Antibiotic Stewardship in the Management of Endodontic Infections." *Inside Dentistry*, vol. 14, no. 1, 2018.

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Antibiotic Dosages For Endodontic Infections In The Adult Patient

DRUG NAME	LOADING DOSAGE	MAINTENANCE DOSAGE
Penicillin V	1,000 mg	500 mg Q6H
Amoxicillin	1,000 mg	500 mg Q8H
Metronidazole (Flagyl)	1,000 mg	500 mg Q6-8H
Amoxicillin with clavulanic acid (Augmentin)	1,750 mg	875 mg Q12H
Clindamycin (Cleocin)	600 mg	300 mg Q6-8H
Clarithromycin (Biaxin)	500 mg	250 mg Q12H
Azithromycin (Zithromax)	500 mg	250 mg Q24H

Blicher, et al. "Antibiotic Stewardship in the Management of Endodontic Infections." *Inside Dentistry*, vol. 14, no. 1, 2018.

148

Commandment #7: Maintain Antithrombotic Therapy

149

Antithrombotic Medications

- Anticoagulants
  - Vitamin K Antagonists
  - Direct-Acting Oral Anticoagulants (DOACs)
- Antiplatelet Medications

Wahl, Michael J. "Antithrombotic Drugs in Dentistry: Stop the Interruption." *Dental Economics*, November 2017.

150

Anticoagulants

- Vitamin K Antagonists: Warfarin (Coumadin)
  - Recommended therapeutic range for most conditions: INR 2.0-3.0
  - For some mechanical mitral heart valves: INR 2.5-3.5
- Direct Acting Oral Anti-Coagulants (DOACs)
  - Apixaban (Eliquis)
  - Dabigatran (Pradaxa)
  - Edoxaban (Savaysa)
  - Rivaroxaban (Xarelto)

Wahl, Michael J. "Antithrombotic Drugs in Dentistry: Stop the Interruption." *Dental Economics*, November 2017.

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Anticoagulant Indications

- Atrial Fibrillation
- Artificial Heart Valve
- Valvular Heart Disease
- Left Ventricular Dysfunction or Thrombus
- History of Deep Vein Thrombosis (DVT) or Embolism
- History of Transient Ischemic Attack (TIA) or Stroke

Wahl, Michael J. "Antithrombotic Drugs in Dentistry: Stop the Interruption." *Dental Economics*, November 2017.

152

Anticoagulant Recommendations

Year	Group	Recommendation
2016	American Academy of Oral Medicine	Continue warfarin anticoagulation with INR testing within a few days of the procedure
2015	American Dental Association	Continue warfarin or DOAC for most patients
2014	The Society for Neuroscience in Anesthesiology and Critical Care (Supported by the American Society of Anesthesiologists)	Continue warfarin anticoagulation for single dental extractions
2013	American Academy of Neurology	Continue warfarin anticoagulation
2012	American College of Chest Physicians	Continue warfarin anticoagulation with oral prohemostatic agent or interrupt anticoagulation for 2-3 days before dental surgery
2007	The Haemostasis Thrombosis Task Force of the British Committee for Standards in Haematology	Continue warfarin anticoagulation, checking INR levels within 72 hours of dental surgery
2003	American Heart Association and American College of Cardiology	Continue warfarin with antifibrinolytic mouthwash

Wahl, Michael J. "Antithrombotic Drugs in Dentistry: Stop the Interruption." *Dental Economics*, November 2017.

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Oral Maxillofacial Surg Clin N Am 28 (2016) 515-521

Table 2
Warfarin dosing recommendations

Procedures	Examples	INR Level	Coumadin Dosing
Low risk	• Single extraction • Soft tissue biopsy/excision of soft tissue lesion < 1 cm in diameter	• <3.5 • Local hemostatic measures	• No change • Local hemostatic measures
Medium risk	• Multiple extractions: ≤5 teeth • Soft tissue biopsy/excision of soft tissue lesion 1–3 cm in diameter • Placement of 1–3 dental implants	• <3.0 • Local hemostatic measures	• Withhold 1–2 d prior* • Restart within 24 h
High risk	• Multiple extractions >5 teeth or surgical • Open mandible fracture repair • Soft tissue biopsy/excision of soft tissue lesion >3 cm • Biopsy/excision of a hard tissue lesion • Removal of maxillary and/or mandibular tori • Placement of multiple dental implants: >3 implants	• <2.5 • Local hemostatic measures	• Withhold 2–4 d • Restart within 24 h

* Recommend consultation with prescribing physician.

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Antiplatelet Medications

- Aspirin
- Cilstazol (Pletal)
- Clopidogrel (Plavix)
- Dipyridamole (Persantine, Aggrenox)
- Prasugrel (Effient)
- Ticagrelor (Brilinta)
- Ticlopidine (Ticlid)

Wahl, Michael J. "Antithrombotic Drugs in Dentistry: Stop the Interruption." *Dental Economics*, November 2017.

155

Antiplatelet Indications

- Atrial Fibrillation
- History of angina or myocardial infarction
- Coronary Artery Disease prevention
- History of coronary bypass surgery
- History of Transient Ischemic Attack (TIA) or Stroke
- Asymptomatic Carotid Artery Disease

Wahl, Michael J. "Antithrombotic Drugs in Dentistry: Stop the Interruption." *Dental Economics*, November 2017.

156

Antiplatelet Recommendations

Year	Group	Recommendation
2015	American Dental Association	Continue antiplatelets for dental procedures
2014	The Society for Neuroscience in Anesthesiology and Critical Care (Supported by the American Society of Anesthesiologists)	Continue antiplatelets for single dental extractions
2013	American Academy of Neurology	Continue aspirin for dental procedures
2012	American College of Chest Physicians	Continue aspirin for dental procedures
2007	American Heart Association, American College of Cardiology, Society for Cardiovascular Angiography and Interventions, American College of Surgeons, and American Dental Association	Continue antiplatelets for dental procedures

Wahl, Michael J. "Antithrombotic Drugs in Dentistry: Stop the Interruption." *Dental Economics*, November 2017.

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Oral Maxillofacial Surg Clin N Am 28 (2016) 497–506

Table 2
Risk of procedures with regards to antiplatelet therapy

Procedures	Examples	Antiplatelet Therapy	Dual Antiplatelet Therapy
Low risk	• Single extraction • Soft tissue biopsy/excision of soft tissue lesion ≤1 cm in diameter	• No change • Local hemostatic measures	• No change • Local hemostatic measures
Medium risk	• Multiple extractions: ≤5 teeth • Soft tissue biopsy/excision of soft tissue lesion 1–3 cm in diameter • Placement of 1–3 dental implants	• No change • Local hemostatic measures	• Consider withdrawal of one of the drugs before procedure (depending on patient's risk factors) • Restart after hemostasis is achieved
High risk	• Multiple extractions: >5 teeth • Surgical extractions of impacted teeth (eg, impacted wisdom teeth) • Soft tissue biopsy/excision of soft tissue lesion >3 cm • Biopsy/excision of a hard tissue lesion • Removal of maxillary and/or mandibular tori • Placement of multiple dental implants: >3 implants	• No change • Local hemostatic measures	• Withhold one of the drugs before procedure • Restart after hemostasis is achieved

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Avoid Non-Selective NSAIDS In Patients Taking Antithrombotics

- Ibuprofen
- Naproxen
- Etodolac
- Ketorlac

- Selective Cox-2 inhibitor (Celebrex) can be given instead
  - 200mg q 12 hours

Sims, Pamela J et al. "Approaching Acute Dental Pain Management to Reduce Opioid Prescribing." *Today's FDA*, January/February 2019.

159

"The Mythology Of Anticoagulation Therapy Interruption For Dental Surgery"

Background:
Continuous anticoagulation therapy is used to prevent heart attacks, strokes, and other embolic complications. When patients receiving anticoagulation therapy undergo dental surgery, a decision must be made about whether to continue anticoagulation therapy and risk bleeding complications or briefly interrupt anticoagulation therapy and increase the risk of developing embolic complications. Results from decades of studies of thousands of dental patients receiving anticoagulation therapy reveal that bleeding complications requiring more than local measures for hemostasis have been rare and never fatal. However, embolic complications (some of which were fatal and others possibly permanently debilitating) sometimes have occurred in patients whose anticoagulation therapy was interrupted for dental procedures.

Michael J. Wahl, DDS. *JADA* January 2018 e1-e10

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"The Mythology Of Anticoagulation Therapy Interruption For Dental Surgery" Practical Implications and Conclusion

- Although there is now virtually universal consensus among national medical and dental groups and other experts that anticoagulation therapy should not be interrupted for most dental surgery, there are still some arguments made supporting anti- coagulation therapy interruption. An analysis of these arguments shows them to be based on a collection of myths and half-truths rather than on logical scientific conclusions. The time has come to stop anticoagulation therapy interruption for dental procedures.

- "Although the arguments for interruption may be based in mythology, the embolic complications these patients can have are all too real. The evidence shows that it is time to stop anticoagulation therapy interruption for dental surgery."

Michael J. Wahl, DDS. *JADA* January 2018 e1-e10

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"Anticoagulants Are Dental Friendly"

In prospective studies of warfarin and patients on direct anticoagulation, authors have concluded that dental treatment is safe regardless of the complexity of the procedures:

- Bajkin et al. concluded in their prospective study on patients on warfarin, "Dental extractions in patients who are highly anticoagulated (INR ≥3.5- 4.2), as well as more extensive oral surgical procedures in patients who are therapeutically anticoagulated, can be performed safely without interruption or modification of the therapy."

- Zeevi et al.23 concluded in their prospective controlled study of patients on direct anti- coagulation, "The present data suggest that modification of direct oral anticoagulant therapy for dental surgical procedures is unnecessary, regardless of the type, the complexity, or the extent of the procedure."

Wahl et al. *OOOO* Vol. 125 No. 2 February 2018

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"Anticoagulants Are Dental Friendly" (Continued)

- "Patients on anticoagulation therapy should be treated the same as otherwise healthy patients, and the dentist should be knowledgeable about various local measures for hemostasis."
- "Anticoagulation therapy should not be interrupted for dental procedures because such interruption unnecessarily increases the risk for embolism; bleeding complications are usually minor and simple to treat."
- "If anticoagulation therapy is going to be interrupted anyway in spite of the above recommendations, then the physician, *not* the dentist, should prescribe such interruption."

Wahl et al. *OOOO* Vol. 125 No. 2 February 2018

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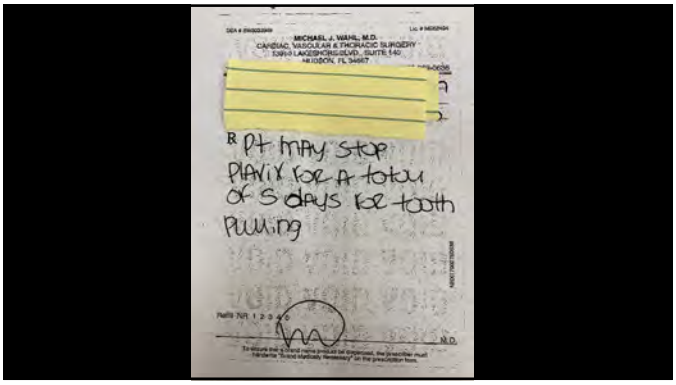

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"Bleeding frequency of patients taking ticagrelor, aspirin, clopidogrel, and dual antiplatelet therapy after tooth extraction and minor oral surgery"

- **Conclusions:** Patients taking aspirin, clopidogrel, ticagrelor, and dual antiplatelet therapy experienced acceptable rates of controllable postoperative bleeding after tooth extraction or minor oral surgical procedures.
- **Practical Implications:** In accordance with recommendations from published studies and guidelines, antiplatelet medications, including dual antiplatelet therapy, should not be interrupted for tooth extractions or minor oral surgery.

Doganay et al. *JADA* February 2018

165

"Risk Of Bleeding During Oral Surgery In Patients With Liver Cirrhosis"

Conclusions and Practical Implications:

During dental treatment, patients with liver cirrhosis have a low bleeding risk in spite of the decreased number of platelets and increased international normalized ratio.

Conclusions:

We found that patients with LC have a low risk of developing life-threatening bleeding resulting from dental surgery procedures and that local hemostatic measures are usually adequate to control bleeding.

de Oliveira Rech, et al. "Risk of bleeding during oral surgery in patients with liver cirrhosis." JADA, January 2021.

166

Local Measures For Hemostasis

- Pressure!
- Tea Bags
- Surgifoam/Gelfoam (Porcine Collagen)
- Surgicel
- Bone Burnishing
- Bone wax (now available as resorbable)
- Thrombin
- Tranexamic Acid

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Commandment #8: Provide Profound Local Anesthesia/ Peri-Operative Pain Control

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Elimination Half-Life Of Local Anesthetics

The rate at which the local anesthetic is removed from the blood

- Articaine=0.5 hours
- Lidocaine=1.6 hours
- Prilocaine=1.6 hours
- Mepivacaine=1.9 hours
- Bupivacaine=3.5 hours

Malamed, Stanley F. *Handbook of Local Anesthesia*, Table 2-4, *Fifth Edition*. Mosby, 2004.

169

Just Say "No" To Plain Anesthetics

1. An increased rate of absorption of the local anesthetic into the cardiovascular system, which in turn removes it from the injection site (redistribution).
2. Higher plasma levels of the local anesthetic, with an attendant increase in the risk of local anesthetic toxicity.
3. Decreased depth of anesthesia and a decreased duration of action because the local anesthetic diffuses away from the injection site more rapidly.
4. Increased bleeding at the site of treatment because of increased perfusion.

Malamed, Stanley F. *Handbook of Local Anesthesia, Fifth Edition*. Page 41. Mosby, 2004.

170

Vasoconstrictors

1. By constricting blood vessels, vasoconstrictors decrease blood flow (perfusion) to the site of administration.
2. Absorption of the local anesthetic into the cardiovascular system is slowed, resulting in lower anesthetic blood levels.
3. Local anesthetic blood levels are lowered, thereby minimizing the risk of local anesthetic toxicity.
4. Increased amounts of the local anesthetic remain in and around the nerve for longer periods, thereby increasing the duration of action of most local anesthetics.
5. Vasoconstrictors decrease bleeding at the site of administration; therefore they are useful when increased bleeding is anticipated (e.g., during a surgical procedure).

Malamed, Stanley F. *Handbook of Local Anesthesia, Fifth Edition*. Page 41. Mosby, 2004.

171

Cardiovascular Risk Protocol?

- 0.04mg of epinephrine for ASA III and IV patients (0.2 mg epi for ASA Class I patients)
- Only two carpules of 1:100,000 epi anesthetics (0.034mg or 0.036mg epi)
- Consider 1:200,000 epi formulations if overly concerned
- Articaine 4% with 1:200,000 epi is an option
- Bupivacaine 0.5% has 1:200,000 epi

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Non-Selective Beta-Andrenergic Blockers

- Prescribed to treat the following conditions:
  - Hypertension
  - Cardiac Arrythmias
  - Angina
  - Migraine headaches
- Common Examples:
  - Propanolol (Inderal)
  - Pinodolol (Visken)
  - Nadolol (Corgard)

Hersh, et al. "Recommendations for Selecting 2% Lidocaine with 1:100,000 epinephrine or 3% Mepivacaine." General Dentistry, March/April 2020

173

Local Anesthesia In The Presence Of Infection

"In the mandible, a conventional INAB injection and long buccal injection (for molars) are administered. In the maxilla, infiltrate 1.8mL of 2% lidocaine with 1: 100,000 epinephrine on either side of the labial or buccal swelling. . . . the following injections may be used: a PSA nerve block for molars, a second division nerve block for molars and premolars, and an infraorbital injection in anterior teeth. For palatal swellings, infiltrate 0.5mL of 2% lidocaine with 1: 100,000 epinephrine over the greater palatine foramen for molars and premolars or the nasopalatine foramen for anterior teeth. However, do not use these injections if swelling is present over the foramen. Infiltrate on either side of the swelling" (157).

Reader, Al et al. *Successful Local Anesthesia for Restorative Dentistry and Endodontics*. Quintessence, 2011.

174

Local Anesthesia Difficulties

- Irreversible Pulpitis in Mandibular Molars
  - Typical IAN block of 2% lidocaine with 1:100,000 epinephrine?
  - Long Buccal with 4% articaine containing 1:100,000 epinephrine
- Not waiting long enough?
- Redheads
- PDL injections:
  - Bind needle at all four line angles
  - Must have back-pressure
- Intrapulpal:
  - Access to pulp chamber must be available
  - Painful but effective!
- Consider Intraosseous delivery methods if needed
  - Stabident
  - X-Tip

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Different Anesthetics On The Efficacy Of Inferior Alveolar Nerve Block In Patients With Irreversible Pulpitis

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.

De Geus, et al. "Different anesthetic on the efficacy of inferior alveolar nerve block in patients with irreversible pulpitis." JADA, February 2020.

176

Safety And Efficacy Of 4% Articaine In Mandibular Third Molar Extraction

Results:

- The authors assessed 482 articles but only 14 randomized clinical trials met the inclusion criteria for review.
- No statistically significant differences were found among the selected LAs regarding safety.
- Four percent articaine required fewer reinjections than 2% lidocaine and had a shorter onset time than 2% lidocaine, 0.5% bupivacaine, and 4% lidocaine.
- Four percent articaine had a longer anesthesia effect than 2% lidocaine and 2% mepivacaine, but a shorter anesthesia effect than 0.5% bupivacaine.

Practical Implications:

Use of 4% articaine for mandibular third-molar extraction is a safe choice that requires fewer reinjections and has a shorter onset time than other aminoamide-type LAs.

Santos-Sans, et al. "Safety and efficacy of 4% articaine in mandibular third molar extraction." JADA, December 2020.

177

Ensure Profound Anesthesia When Treating a "Hot Tooth"

- Initial Nerve Block Injection
- PDL
- Intraosseous (Stabident, X-Tip, etc)
- Intrapulpal
- Reappoint & Premedicate
  - Dexamethasone
  - NSAID
  - NSAID & Acetaminophen
  - Tramadol
  - Nitrous Oxide Sedation

Sharma, et al. "Supplemental Anesthetic Techniques of Symptomatic Irreversible Pulpitis." Inside Dentistry, April 2020.

178

Goodchild & Donaldson's Perfect Prescription: "1-2-4-24"

179

"1"= One 4mg Dose Of Dexamethasone Either Pre- Or Peri-Operatively

- Pre-operatively
  - 4mg taken one day to one hour prior to the procedure
- Peri-operatively
  - 4mg injected submucosally (after administration of local anesthesia)
  - Adjacent to surgical site in a manner consistent with an infiltration injection
  - 1mL of 4mg/mL concentration or 0.4mL of 10mg/mL concentration
  - Increased patient compliance
  - Higher duration of action (6 days vs. ~2.5 days for oral administration)

Goodchild, et al. "Treating Nociceptive Orofacial Pain." *Inside Dentistry*, vol. 13, no. 10, 2017.

180

Glucocortoids

- Contraindicated in patients who suffer from acute psychoses or exhibit a psychotic tendency
- Used with caution for the following patients:
  - Diabetics
  - Patients with peptic ulcers
  - Pregnant/lactating females

Goodchild, et al. "Treating Nociceptive Orofacial Pain." *Inside Dentistry*, vol. 13, no. 10, 2017.

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Sedation Considerations

- Know your patient!
- Nitrous Oxide
- Oral sedatives
  - Long-acting
  - Short-acting
- Combination of Nitrous Oxide & Oral sedatives
- IV Sedation

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Commandment #9: Remove Teeth Atraumatically

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Procedural Infection Prevention

- "The most important measure to prevent infection following routine extractions is for the surgeon to adhere carefully to the basic principles of surgery. These principles are to minimize tissue damage, remove sources of infection, and cleanse the wound. No other special measures need to be taken with the average patient" (171).
- "Clean surgery with strict adherence to basic surgical principles usually has an incidence of infection of about 3%" (312).

Hupp, James R et al. *Contemporary Oral and Maxillofacial Surgery, Sixth Edition*. Mosby, 2014.

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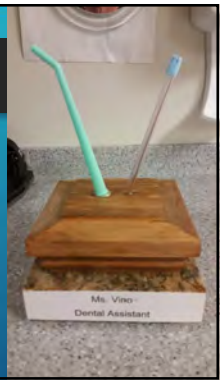
Safety Considerations

- Always make sure provider, assistant, and patient are on same page
- Have consent form signed confirming teeth to be extracted as well as verbal agreement
- Controlled force; Finger rests whenever possible
- Bite block for mandibular extractions
- Throat screen!
- Grasp loose items with Rongeur
- Adequate suctioning



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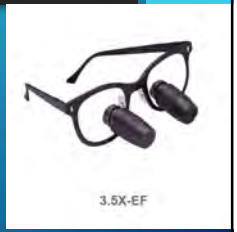
Safety Considerations Continued: Visibility

- No blind suctioning!
- Position patient so you and the assistant can see
- Adequate retraction
- "If you cannot see it, you cannot remove it"
- Loupes
- Chair light
- Additional light for provider



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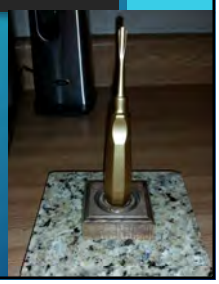
"Standard" Armamentarium

- Minnesota Cheek Retractor
- DE Surgical Curette (Miller 11 or Lucas 86)
- Elevators: 301, 77R, and possibly 34S or E92 (avoid 34)
- Forceps: 150, 151, 74, MD3, and 23 (Cowhorn)
- Rongeur (30º Blumenthal)
- Luxator: 3mm straight
- Periotome
- East/West (E25/E26 or 39/40)
- Root Tip Picks (79/80)



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"Surgical" Armamentarium

- Blade holder/15 Blades
- Molt 9 periosteal elevator
- Cogswell B
- Reverse exhaust 45-degree surgical handpiece
- 702 surgical length FG burs, possibly 701 burs
- Suture holder
- Suture Scissors
- Reverse cutting, 3/8 circle 3-0 chromic or 4-0 Vicryl (PGA)

188

Seven Exodontia Principles

1. Sever Connective Tissue Fibers
2. Just Say "No" to the Flap
3. Multiple Directions of Motion
4. Resistance Form/Path of Draw
5. Divide and Conquer
6. Implode, Don't Explode
7. Leave No Root Behind

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1. Sever Connective Tissue Fibers

- Incise circumferentially around tooth
  - No. 15c surgical blade
  - Thin periotome
- To avoid trauma to the soft tissue during extraction
- A good initial check for anesthesia
- Separate soft tissue from teeth being extracted, but not from the bone

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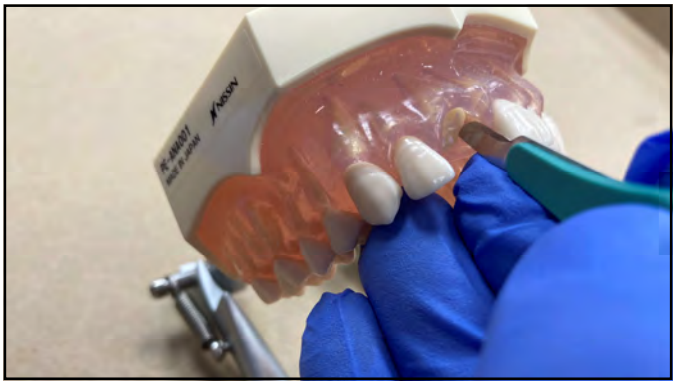

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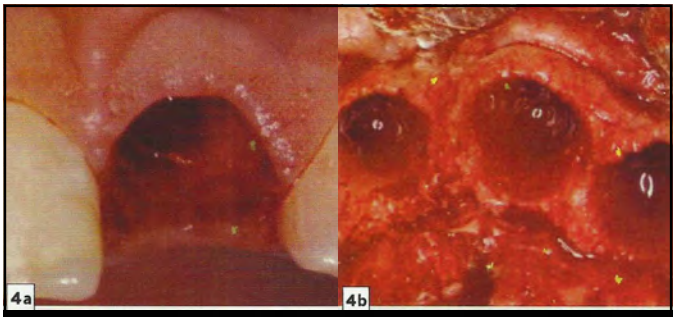
2. Just Say "No" To The Flap

- Closed Surgical instead of Open Surgical
- Flaps usually not necessary for erupted teeth
- Flaps are used to facilitate the removal of buccal bone, which we normally do not want to remove
- Bone fracture when still attached to periosteum is not as problematic
- Flaps used only when absolutely necessary: "Whenever the periosteum is reflected, cells are injured and need to regenerate before the remodeling process begins. The cortical bone receives more than 80 percent of its arterial blood supply and facilitates 100 percent of its venous blood return through the periosteum" (77).

Resnik, Randolph R. "Extraction and Socket Grafting Part 1-Atraumatic Extraction." *Chairside*, vol. 14, iss. 1, 2019.

195



Figures 4a, 4b: Soft-tissue reflection for tooth extraction: ideal technique including no soft-tissue reflection for a tooth extraction (4a); nonideal technique including extensive reflection of the soft tissue, which results in compromised blood supply (4b).

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3. Multiple Directions Of Motion: Elevators

- Mesial-Distal or Luxation motion?
- Usually start with 301 (3mm)
- 77R especially for upper molars
- Do not use 34S (4mm) or E92 in luxation motion (unless removing multiple adjacent teeth)
- Usually do not want to use 34 (5mm) elevator at all
- As apical as possible, yet try not to disrupt interdental "col"
- Be mindful of pressure on/movement of adjacent teeth
- Be mindful of prosthetic crowns/restorations on adjacent teeth
- Consider removing contact areas on clinical crown to allow for more mesial-distal movement

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Multiple Directions Of Motion: Forceps

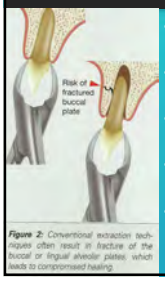


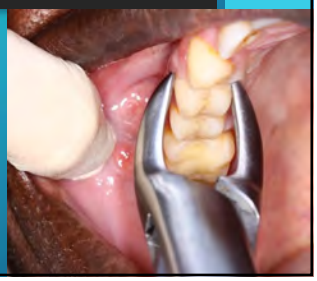
Figure 2: Conventional extraction techniques often result in fracture of the buccal or lingual alveolar plates, which leads to compromised healing.

- Only after elevation
- Historically buccal-lingual motion
- Use traction and twisting motions (single-rooted teeth)
- More force is not the answer!
- Go back to elevators or consider surgical approach if forceps are requiring too much force (fingers on non-dominant hand used to palpate)

200

Multiple Directions Of Motion: Forceps (Continued)

- Typically "Palm Up" for more control
- Seat beaks of forceps as apically as possible (Apical to CEJ)
- Grip Cementum, not enamel
- Controlled Force!
  - Look for bleeding around periphery of crown
  - Watch relationship of crown to adjacent teeth



201

Multiple Directions Of Motion: Periotome

Driven in apical direction to move root in occlusal direction

Figures 8a–8c: Periotome technique: The periotome is inserted along the long axis of the tooth (8a, 8b); as the periotome is inserted more apically, the tooth will become loose and slowly avulse (8c).

202

Periotome (Continued)

- Used vertically, along the long axis of the tooth/root
- Cuts through PDL space
- Can create enough space for larger instruments to be used: Luxator or Elevator
- Hold the blade parallel to the root
- Do not twist the blade as it can break easily

203

204

205

Multiple Directions Of Motion: Luxator

- Used VERTICALLY, along the long axis of the tooth/root
- Used with a twisting, cutting motion
- Use a finger rest on a nearby tooth for stability

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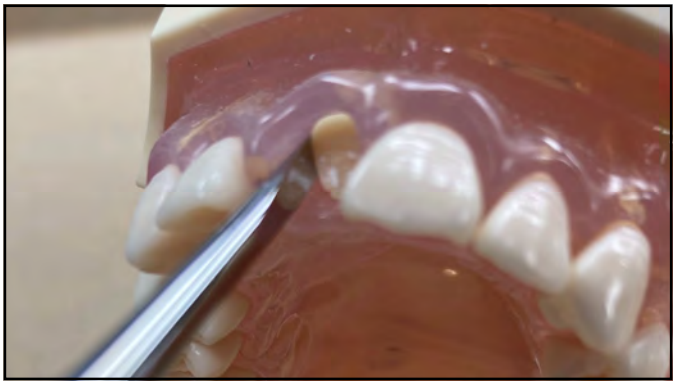

208

4. Resistance Form/Path Of Draw

- Prosthodontics: How much tooth structure has to break in order for the crown to be dislodged
- Exodontia: How much bone has to be removed/compressed in order for the tooth/root(s) to have an unimpeded path of removal
- Bulbous Roots
- Dilacerated roots

209

5. Divide And Conquer

"A house divided against itself cannot stand" (Abraham Lincoln/Matthew 12:25)

- Section Multi-Rooted teeth
- Give each root its own path of draw
- May choose to prophylactically remove clinical crown to better visualize root trunk prior to sectioning
- If tooth to be extracted has a prosthetic crown, consider removing the crown with forceps to avoid having to section through the crown.
- Or, section tooth perpendicular to long axis apical to prosthetic crown margin or amalgam restoration

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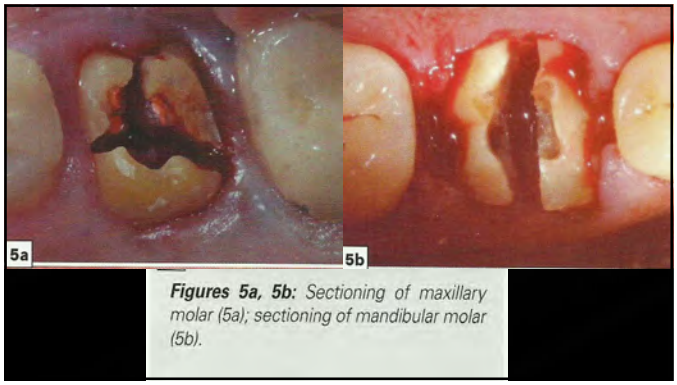


Figures 5a, 5b: *Sectioning of maxillary molar (5a); sectioning of mandibular molar (5b).*

211

6. Implode, Don't Explode

- Aggressive removal of Inter-radicular bone: It will grow back!
  - 702 surgical bur
  - Create space to implode tooth into
- Conservative removal of Peri-radicular bone
  - 701 surgical-length bur
  - Only when necessary
  - Only in areas where it is safe
  - More palatal bone than buccal bone
  - Cautious removal of mesial & distal bone when adjacent teeth present
  - Can use 702 bur to remove mesial & distal bone adjacent to free-standing teeth

212

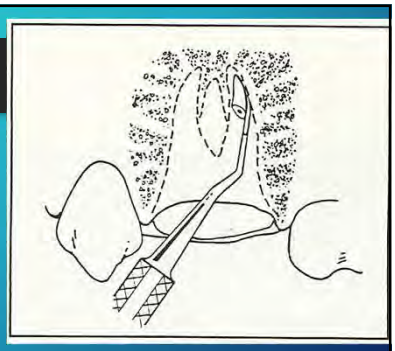
7. Leave No Root Behind

- Leaving root tips should be rare
- Only when small (<3mm) and close to vital structures
- Reasonable attempt should be made to retrieve all roots
- Be aware of anatomy/radiographs
- Put teeth back together on the bench!
- Laziness is not a vital structure!
- PAX instead of pano for more detail

213

Root Tip Picks

- Place between root and bone
- Gently move side to side to loosen and remove the root tip
- Do not push toward root apex
- Fragile instrument, do not use like a lever
- Heidbrink 13/14



Koerner, K.R.; Tilt, L.V.; and Johnson, K. Color atlas of minor oral surgery. Mosby. St. Louis, 1994.

214

To Curette Or Not To Curette?

- Not usually necessary in the absence of periapical pathology
- Remove any periapical granuloma/abscess
- Curette follicle of impacted teeth
- Caution around Maxillary Sinus and IAN/Mental nerve
- Moderately-sized, rounded-end instrument like Miller 11 or Lucas 86

215

Maxillary Sinus

"The surgeon must not probe through the socket into the sinus with a dental curette or root tip pick. The bone of the sinus may possibly have been removed without perforation of the sinus mucosa. To probe the socket with an instrument might unnecessarily lacerate the membrane. Probing of the communication may also introduce foreign material, including bacteria, into the sinus, thereby further complicating the situation. Probing of the communication is therefore contraindicated."

Hupp, James R et al. Contemporary Oral and Maxillofacial Surgery. Seventh Edition. Mosby. 2019.

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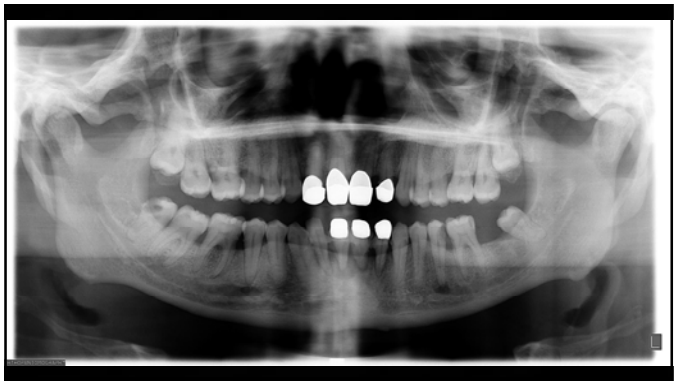

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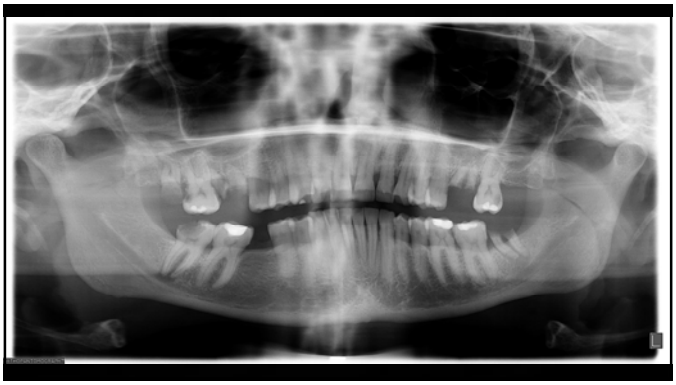

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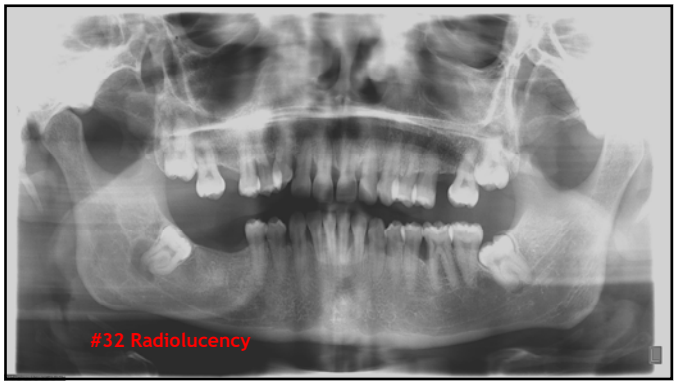
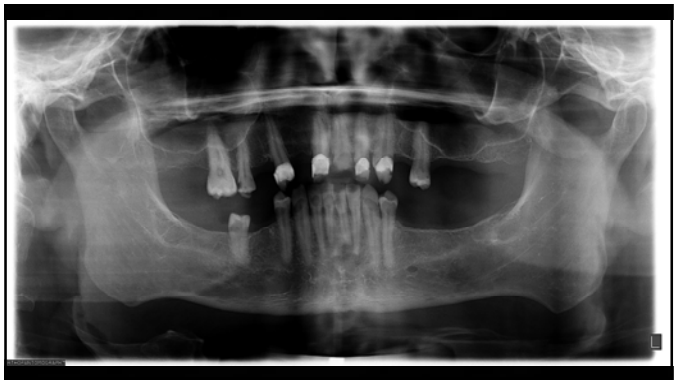


219

Serial Extraction Considerations

- Full-mouth extractions should be a last resort
- A full lower denture is to be avoided at all costs, especially if patient does not have intentions and/or finances to get implants to preserve bone/retain denture
- Inverse relationship between patient age and our reluctance to remove all their teeth
- Just because a patient asks us to do something does not mean that we are obligated to do so
- We are doctors, not pharmacists (Healthcare Professional vs. Healthcare Provider)
- ADA principles of beneficence/non-maleficence trump patient autonomy
- We know more about dentistry and the consequences of tooth (and subsequent bone) loss than the patient does
- We are obligated to act in the patient's best interests even if it goes against what they want

220



221

Pre-Prosthetic Considerations

- Frena: Maxillary (Labial), Lingual, Mandibular (Labial)
- Tori: Maxillary & Mandibular
- Undercuts?

222

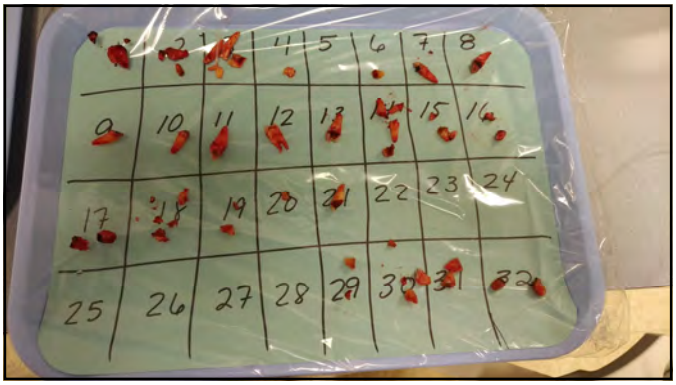
223

224

Procedural Considerations When Removing Multiple Teeth

- Remove the easiest tooth/teeth first!
- Consider giving anesthesia in stages, especially for those with lower body weight
- Start with teeth that have an adjacent edentulous space and elevate tooth into the space
- If you encounter difficulty, move on to other teeth (Hyaluronidase)
- Removal of neighboring teeth may facilitate M-D forcep use
- Consider "Map" when removing multiple teeth (especially when predominantly root tips)
- Consider new pano after full-mouth extraction to verify complete removal of all root tips

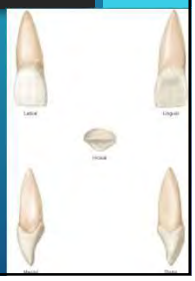
225



226

Maxillary Central Incisor

- Large, round root
- Dilaceration rare
- Perfect root for twisting motion
- If removing lateral as well, consider removing lateral first
- Forceps: 150, 99, or 1
  (either buccal-lingually or mesial-distally)



227

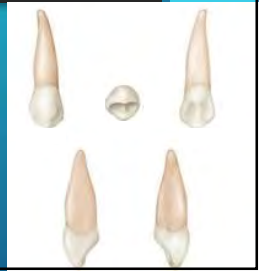
Maxillary Lateral Incisor

- Similar to maxillary central, only smaller and root not as round
- Still can use a twisting motion
- Sometimes has distal curvature of root
- Usually easier to remove than maxillary central or canine
- Forcep: 150, 99, or 1

228

Maxillary Canine

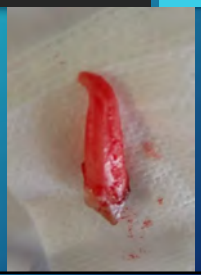
- Large, long, oval-shaped root
- Can use some twisting motion but not as many degrees of motion as central
- Can be one of the most difficult teeth to extract



229

Maxillary Canine

- Consider luxator/periotome "troughing" at mesial and distal
- If removing multiple teeth, consider removing lateral and 1st premolar first
- Forceps: 150, 99, or 1 (either buccal-lingually or mesial-distally)



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231

Maxillary First Premolar

- Can be challenging, especially #12 for right-handed operator
- Usually two roots (57%)
- Often want to section in M-D direction to separate buccal and palatal roots
- Buccal root can often penetrate buccal plate
- Can use explorer or root tip pick trough buccal soft tissue to drive buccal root tip in occlusal direction
- Forceps: 150; Rongeur after sectioning

232

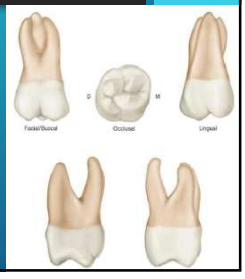
Maxillary Second Premolar

- Usually has 1 root (oval-shaped) 88% of the time
- Therefore, normally easier to remove than maxillary 1st premolar
- Forceps: 150

233

Maxillary First Molar

- Usually 3 separate roots (sometimes fused buccal roots)
- Should usually be sectioned (unless significant bone loss or fused)
- "T-type" or "Y-type" section trough root trunk
- Section in M-D direction first and split
- Section buccal roots in B-L direction if necessary
- Forceps: 150, F89/F90, 88, 53 if not sectioned
- 150 or Rongeur if sectioned



234

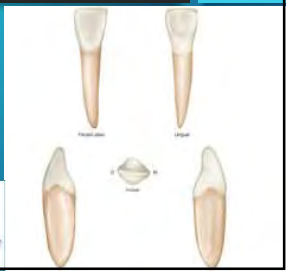
Maxillary Second Molar

- 3 roots 60% of time
- Buccal roots more likely to be fused than in Maxillary 1st molar
- Possible "Safety" instead of "Touchdown" buccal roots
- Possible M-D section only
- Forceps: 150, F89/F90, 88, 53 if not sectioned
- 150 or Rongeur if sectioned

235

Mandibular Incisors (Central And Lateral)

- Single, small, oval-shaped root
- Can use slight twisting motion
- Local anesthesia can be challenging
  - Consider articaine infiltration
  - PDL injections?
- Forceps: 74



236

Mandibular Canine

- Single, oval-shaped root
- Similar to maxillary canine but slightly shorter
- Consider removing lateral and 1st premolar first if removing multiple teeth
- Forceps: MD3

237

Mandibular Premolars (First And Second)

- Single, oval-shaped root
- Usually more round than incisors or canines
- Utilize twisting motion
- Forceps: MD3

238

Mandibular First Molar

- Usually two "Touchdown" roots
- Elevate from mesial/distal with 301 elevator
- Sometimes can elevate between roots if enough bone loss is present to expose furcation
- Forcep: Cowhorn (if both roots still connected)
  - Beaks placed in furcation an "pumped" like well handle
  - Goal is to elevate tooth through the furcation (attempt to completely close handle)
  - Beware of apical migration of beaks that could break buccal (or even lingual) bone
  - Cowhorn will sometimes split root trunk and/or remove one or both roots

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Mandibular First Molar (Continued)

- Section tooth in B-L direction if needed to separate roots
  - Elevate between roots in attempt to drive roots occlusally
  - East/West (Cryer) can be used especially after one root is removed
- 151 forcep can sometimes be used to remove roots once separated
- Or, roots can be "imploded" into space created by sectioning
  - If roots are occlusal to crestal bone, 301 elevator can be used at mesial of mesial root and distal of distal root to push roots toward space
  - If roots are even with or apical to crestal bone, periotome or root tip pick can be used to push roots toward space

242

Cryer (East-West/Triangular Elevator)

- Easiest to use when one socket is empty
- Rotate like a wheel-and-axle
- Beware that Cryer can go apical and break buccal bone if root does not want to move
- Cogswell B can also be an option that might be less likely to break buccal bone

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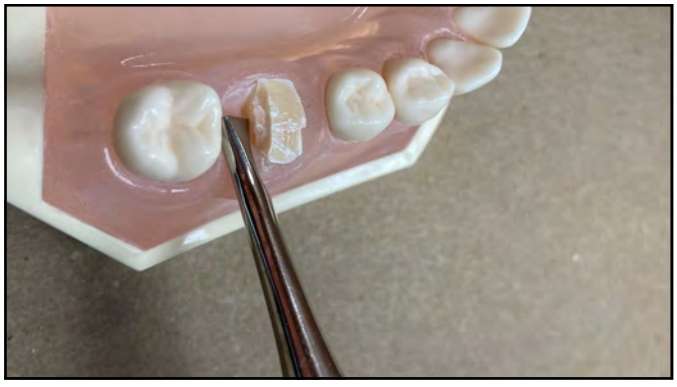

245

Mandibular Second Molar

- Similar to Mandibular 1st Molar, but possibly "Safety" roots instead of "Touchdown"
- Cowhorn Forceps if both roots still connected
- 151 Forceps
  - If no utilizable furcation
  - If roots have already been separated by sectioning or if use of cowhorn splits the root trunk
- Not normally an implant site so can be less hesitant to remove buccal bone if necessary

246

Orthodontic Considerations

- Obtain written documentation from orthodontist indicating the teeth to be extracted.
- Obtain tooth number and written description (like a checkbook)
- Beware of confusion, especially in URQ:
  - UR5 in Palmer notation is actually #4
  - UR4 in Palmer notation is actually #5
- Make sure dentist, assistant, and even patient are on the same page: Count from midline
- Beware of crowding: may use narrower 74 forcep on premolars when there is excessive crowding.

247

Pediatric Considerations

- Parents in operatory or not?
- If so, make sure they are on your team!
- Extraction rather than pulpectomy/SSC indicated if furcal radiolucency present.
- Asymptomatic pediatric teeth with caries may be kept for short-term to hold space
- Elevation usually not necessary
- Rongeur for most pediatric extractions
- 150S/151S for more substantially rooted teeth
- Beware of using cowhorn when crown of erupting lower premolar is near eruption
- May choose to "unroof" bone inhibiting permanent tooth trying to erupt (Endo Z bur)

248

Periodontal Considerations

- Be careful with elevation adjacent to periodontally involved teeth
- Often only forceps needed; Possibly Rongeur
- Consider local supplemental anesthesia
- Extract periodontally hopeless teeth (Miller Class 3)
- Leave teeth with 5+ year prognosis

249

Rongeur

- One of the best kept secrets in dentistry!
- 30 degree Blumenthal
- Can be used to clip sharp bone, excise tissue, even remove teeth/roots
- Thin beaks able to grip subgingivally
- Sharp beaks have superior grip compared to forceps
- Use to grasp/twist individual roots or single-rooted teeth

250

Prosthodontic Considerations

- Beware of adjacent teeth with prosthetic crowns, especially PFMs
- Consider removing contact area on tooth to be extracted to avoid contact with adjacent prosthetic crown(s)
- If luted crown on tooth being extracted, attempt to remove with forceps
- If bonded crown, attempt to cut apical to crown margin
- Section FDPs to allow for removal of offending tooth/teeth
- Do not leave cantilevered pontics!
- Polish connector area with finishing carbide/Arkansas stone
- Make retainer crown looks like a single-unit crown!

251

Closed Surgical Extractions

- Maxillary First Premolar
- Maxillary Molar
- Mandibular Molar

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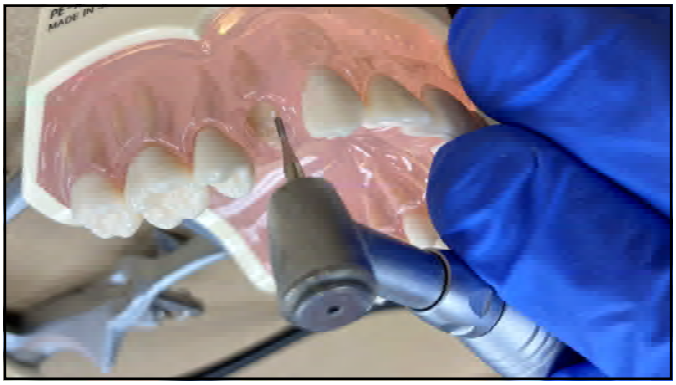

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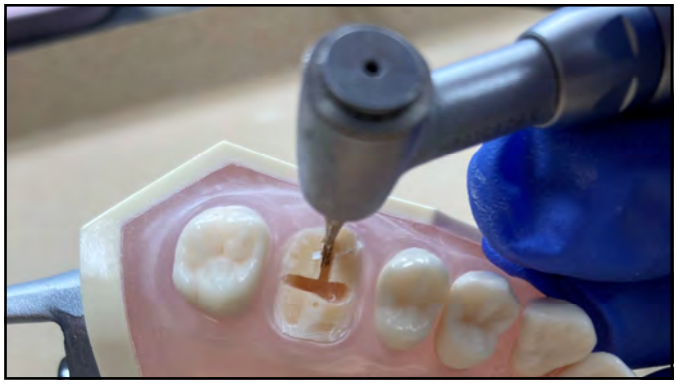

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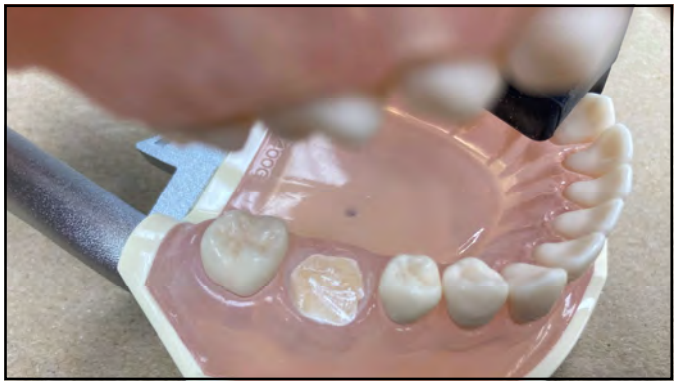

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Purchase Points

- Horizontal
- Vertical

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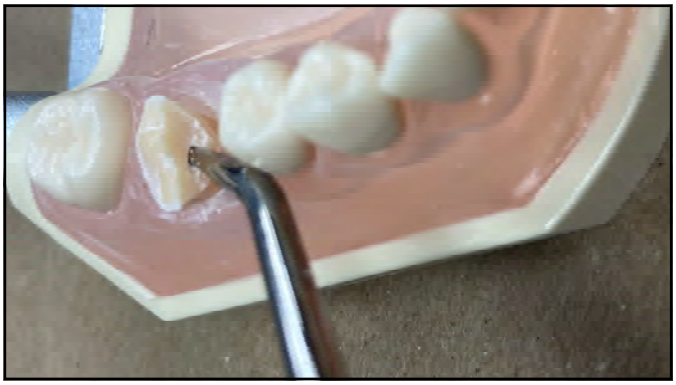

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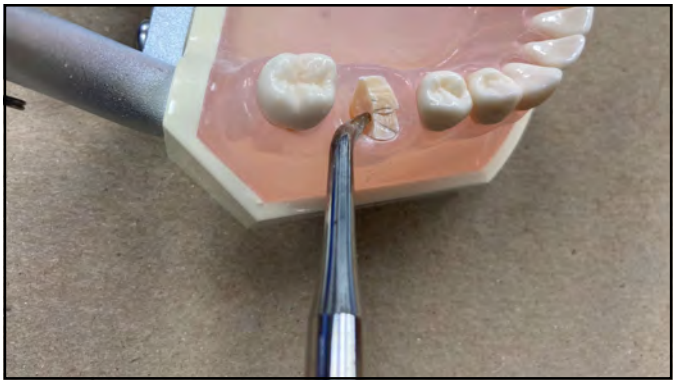

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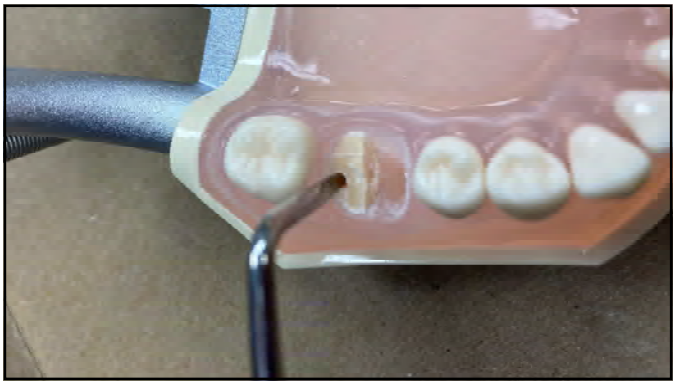

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Third Molars: Forbidden Fruit?

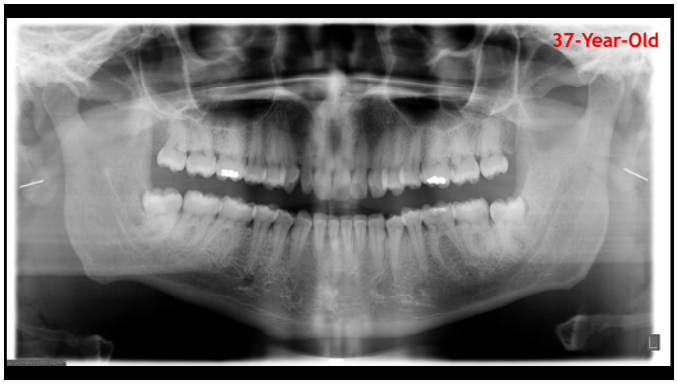
"And the LORD God commanded him, 'You may eat freely from every tree of the garden, but you must not eat from the tree of the knowledge of good and evil; for in the day that you eat of it, you will surely die'" (Genesis 2:16-17).

281

Know

- Your Patient
  - Symptomatic or Asymptomatic?
- Your own limitations
- Your local dental resources
  - Urban or Rural?
  - Wait time for referral clinics/providers
- "Better to be single than to wish you were."—Dr. David Thompson

282



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Third Molar Removal Contraindications

- Young patient with early loss of second molars
- Advanced patient age AND adequate distal bony support of second molars
- Advanced patient age AND asymptomatic
- Close proximity to other structures (i.e. IAN), especially with advanced patient age

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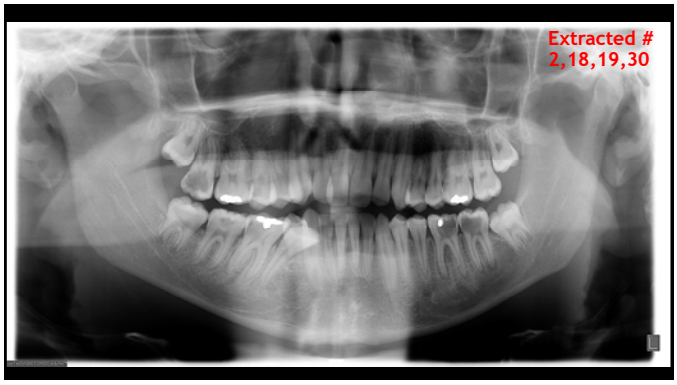

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Third Molar White Paper (AAOMS March 2007)

- IA Canal:
  - Narrowing of canal
  - Diversion of canal
- Third Molar Roots:
  - Darkening of roots where IAN passes over tooth
  - Deflectioning of roots
  - Narrowing of roots
  - Bifurcated roots
- Consider CBCT imaging and/or referral to OMFS if any of these conditions are present

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Rood & Shebab Criteria

1. Darkening of the roots
2. Deflection of the roots
3. Narrowing of the roots
4. Dark and bifid apex
5. Discontinuity of the mandibular canal
6. Deflection of the mandibular canal
7. Narrowing of the mandibular canal

Lacerda-Santos, et al. "Signs of the proximity of third molar roots to the mandibular canal: an observational study in panoramic radiographs." General Dentistry, March/April 2020

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Figure. Radiographic signs of proximity between the third molar and mandibular canal. A. Darkening of the roots. B. Deflection of the roots. C. Narrowing of the roots. D. Dark and bifid apex. E. Discontinuity of the mandibular canal. F. Deflection of the mandibular canal. G. Narrowing of the mandibular canal. (Drawings reprinted from Kim et al with permission from Elsevier.[27] Copyright ©2012.)

Lacerda-Santos, et al. "Signs of the proximity of third molar roots to the mandibular canal: an observational study in panoramic radiographs." General Dentistry, March/April 2020

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Signs of the proximity of third molar roots to the mandibular canal: an observational study in panoramic radiographs

- Proximity to IAC was verified for 63.5% of lower third molars studied
- Most frequent radiographic signs of proximity:
  - Darkened Roots 29.1%
  - Discontinuity of the IAC 28.7%
- Third Molar/IAC proximity was noted more frequently in females
- Third Molar/IAC proximity was noted more frequently in patients 24 years and younger
- Tooth positions most frequently associated with proximity between 3rd molar and IAC:
  - Pell & Gregory Class C (Occlusal table of impacted third molar apical to CEJ of neighboring 2nd Molar)
  - Mesioangular position

Lacerda-Santos, et al. "Signs of the proximity of third molar roots to the mandibular canal: an observational study in panoramic radiographs." General Dentistry, March/April 2020

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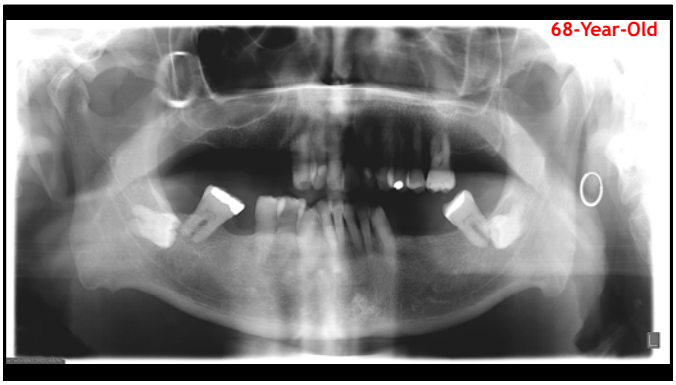

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Indications For Third Molar Removal

- Partial exposure: Just say "No" to partially erupted third molars!
- Pericorontitis: Past Hx, current condition, or potential in future
- Malpositioning
- Caries
- Lack of distal bony support on 2nd molars
- Pathology
- Young Age (ideally <25)

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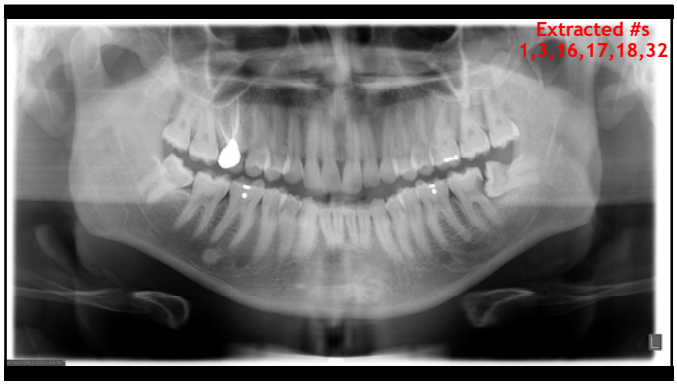

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Why Now Rather Than Later?

- Younger age = easier removal for provider
- Bone becomes more calcified with increasing age
- Younger age = easier recovery for patient
- Younger age = more predictable bone regeneration/reattachment
- Younger age = less likelihood for permanent paresthesia
- Teeth may be come symptomatic at a time when it is less than ideal to remove them

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Erupted Maxillary Third Molar

- Difficult access/visibility (especially if root tip fractures)
- 77R elevator
- Unpredictable root pattern
- More likely to have fused roots than max 1st/2nd molars
- Surgical Approach: Similar to maxillary 1st/2nd molar. May just section in M-D direction
- Possibly flap at buccal and remove buccal bone

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Erupted Mandibular Third Molar

- May require releasing incision at DB if soft tissue covers distal aspect of crown
- Sometimes can elevate from buccal as thick buccal shelf of bone is often present. However, be careful of "mismatch" between thick buccal bone and often thin lingual bone.
- Removal of buccal bone completely acceptable (if necessary) as is not an implant site

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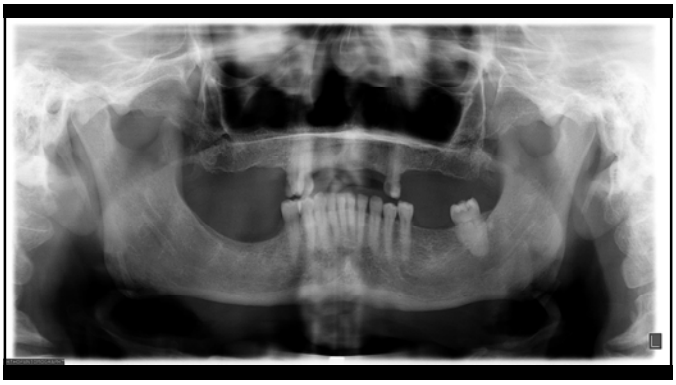

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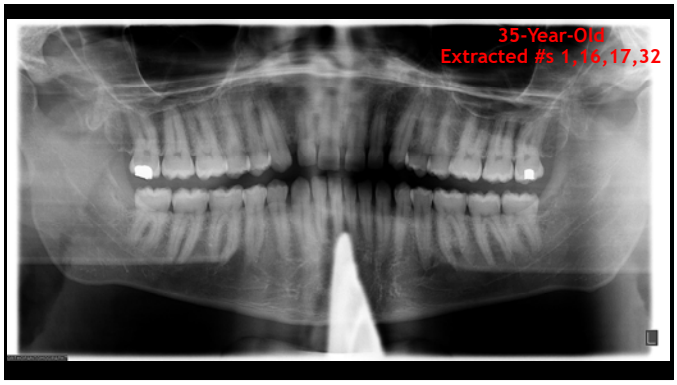

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Impacted Maxillary Third Molar

- "Hockey stick" incision from buccal of second molar to distal/apical of 3rd molar
- Extend incision to first molar only if necessary
- Soft tissue reflected, bone removed as needed to expose crown
- 77R or Cogswell B elevator used to drive tooth buccally and occlusally
- If high impaction, place round end of Molt 9 at distal of impacted tooth to prevent distal/apical migration during elevation
- Curette socket to remove follicle
- Curette distal aspect of second molar
- Suture interproximally between #2/3 or #14/15 if flap extended to first molar
- Suture distal to second molar

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Impacted Mandibular Third Molar

- Crestal incision from mesial of first molar terminating in DB "hockey stick" distal and buccal to impacted third molar
- If completely bony, tooth crown "unroofed" to expose crown
- Buccal trough made to create space/path of draw
- If fused roots, crown may be sectioned and removed to facilitate space for remaining fused roots.
- If distinct separate roots, tooth may be sectioned in B-L direction
- Purchase point can be placed in roots and driven out with Cogswell B elevator

315

Impactions

- Vertical
- Mesioangular
- Horizontal
- Distoangular

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Extraction CDT Codes

- D7140: Simple extraction of an erupted tooth
- D7210: Surgical extraction of an erupted tooth

- D7220: Soft tissue impacted tooth
- D7230: Partial bony impaction (<50% of crown covered by bone)
- D7240: Full bony impaction (>50% of crown covered by bone)

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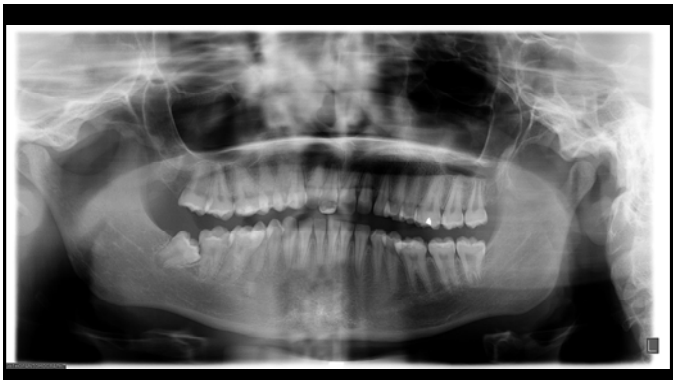

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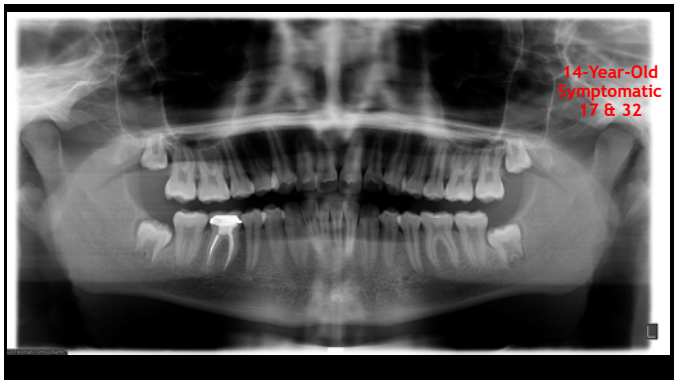

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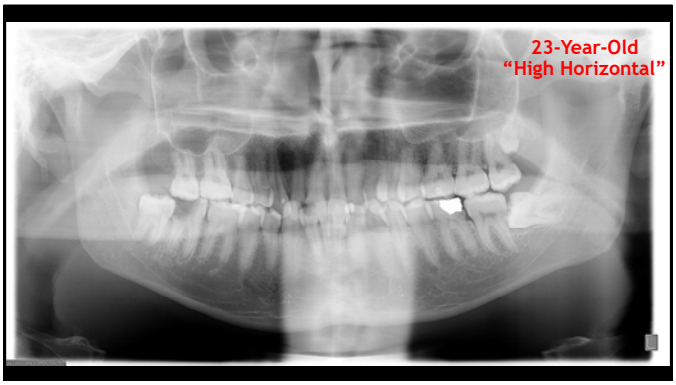

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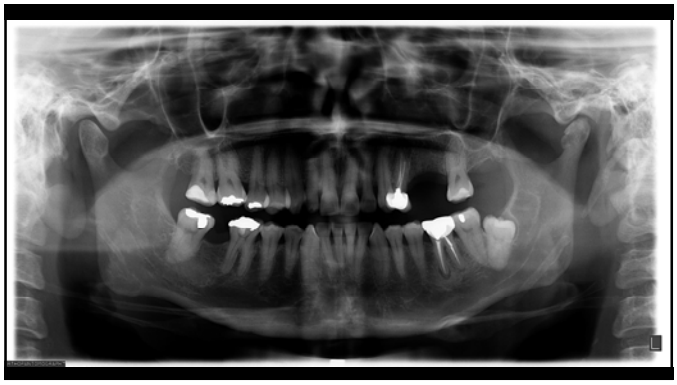

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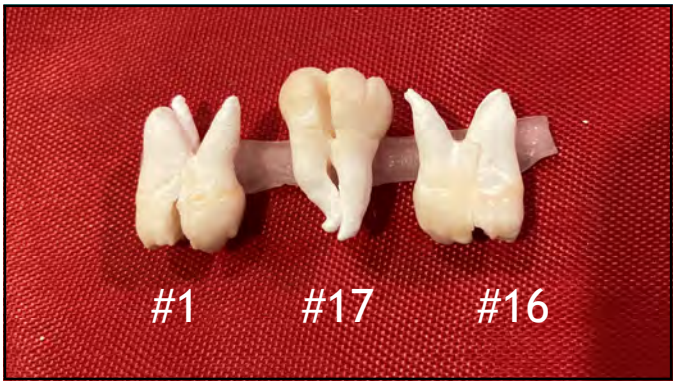

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When The Patient Leaves

- Gauze in Mouth
- Your phone number so they can contact you after hours
  - You do not want them going to the Emergency Room!
- Written Post-Op instructions
  - They're not listening after the procedure is over!
  - "If it's mentioned beforehand, it's an explanation; If it's mentioned afterwards, it's an excuse."
- Directions for OTC medications
  - IBU 200mg
  - APAP
- Prescriptions for post-op medications?
  - IBU 400-800mg
  - CHX

337

Mild Pain (OTC)

IBU 200mg q 6 hrs OR Naproxen Na 220mg q 12 hrs

AND (if needed)

APAP 325-500mg q 6 hours

Sims, Pamela J et al. "Approaching Acute Dental Pain Management to Reduce Opioid Prescribing." *Today's FDA*, January/February 2019.

338

Moderate Pain

IBU 200-400mg Q 6hrs

AND

APAP 500mg Q 6hrs

Sims, Pamela J et al. "Approaching Acute Dental Pain Management to Reduce Opioid Prescribing." *Today's FDA*, January/February 2019.

339

Moderate To Severe Pain

IBU 400-600mg Q 6hrs

AND

APAP 650-1000mg Q 6hrs

Sims, Pamela J et al. "Approaching Acute Dental Pain Management to Reduce Opioid Prescribing." *Today's FDA*, January/February 2019.

340

Avoid NSAIDS (Non-Selective & Selective) With Patients Taking The Following:

- ACE Inhibitors (-pril)
- Angiotensin II Receptor Agonists (-sartan)
- Lithium (Bipolar Disorder)
- Cyclosporine
- Methotrexate

Sims, Pamela J et al. "Approaching Acute Dental Pain Management to Reduce Opioid Prescribing." *Today's FDA*, January/February 2019.

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Goodchild & Donaldson's Perfect Prescription: "1-2-4-24"

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2-4-24

- "2"= Two drugs (Ibuprofen and Acetaminophen)
  - 600mg IBU: 1 x 600mg RX IBU or 3 x 200mg OTC IBU
  - 1000mg APAP: 2 x 500mg APAP or 3 x 325mg APAP
- "4"= Four doses (Every 6 hours)
- "24"= Twenty-four hours

Goodchild, et al. "Treating Nociceptive Orofacial Pain." *Inside Dentistry*, vol. 13, no. 10, 2017.

343

Peri/Post-Operative Complications

- Oroantral Communication
- Root/Tooth Displacement
- Bleeding
- Edema
- Hematoma
- Trismus
- Alveolar Osteitis ("Dry Socket")
- Malocclusion
- Infection
- Bony Sequestrum
- Lingual mucosal ulceration
- Paresthesia
- Osteomyelitis

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Oroantral Communication (Sinus Exposure)

- Moderate & Large communications are rare
- 2mm or less will usually resolve on its own within one week
- Primary closure if possible for large exposures
- Unilateral nose bleed possible
- Persistent OAC after two weeks should be treated or referred
- Buccal advancement flap or palatal flap for erupted teeth
- Buccal fat pad for impacted upper third molars
- Antibiotics, Nasal spray, and Decongestant (Mucinex D)
- Sinus Precautions

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Small Communication (2 mm In Diameter Or Less):

1. No additional surgical treatment is necessary.
2. The surgeon will take measures to ensure the formation of a high-quality blood clot in the socket.
3. For 2 weeks the patient will need to take sinus precautions to prevent dislodgment of the blood clot:

"Sinus precautions are aimed at preventing increases or decreases in the maxillary sinus air pressure that would dislodge the clot. Pat should be advised to avoid blowing the nose, sneezing violently, sucking on straws, and smoking."

Hupp, James R et al. Contemporary Oral and Maxillofacial Surgery, Seventh Edition. Mosby, 2019.

346

Moderate-Sized Communication (2 to 6 mm):

1. A piece of material that aids in blood clot formation is placed in the tooth socket.
2. Stitches are placed over the tooth socket to help maintain the material in place.
3. The above-mentioned sinus precautions should also be followed.
4. The patient should be prescribed medication(s) to help lessen the possibility that maxillary sinusitis will occur: antibiotics (amoxicillin, cephalexin, or clindamycin), possibly a decongestant nasal spray, and possibly an oral decongestant.

Hupp, James R et al. Contemporary Oral and Maxillofacial Surgery, Seventh Edition. Mosby, 2019.

347

If The Sinus Opening Is Large (7 mm Or Larger)

1. The dentist will surgically close the sinus communication with a flap procedure or refer to an oral and maxillofacial surgeon who will complete the procedure.
2. The most commonly used flap procedure is a buccal flap. This technique uses soft tissue on the buccal side of the extraction socket to cover the opening and provide closure.
3. This technique will be performed as soon as possible.
4. The same sinus precautions and medications mentioned above will be required.

Hupp, James R et al. Contemporary Oral and Maxillofacial Surgery, Seventh Edition. Mosby, 2019.

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OAC Management Options

- L-PRF for clot formation
- Guidor (et al) in absence of primary closure
- Buccal Flap Advancement
- Palatal Flap Advancement
  - Full Thickness
  - Partial Thickness
- Membrane Assisted Closure: Resorbable Collagen Membrane
- Buccal Fat Pad in Impacted Third Molars

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Root Displacement (Maxillary Sinus)

- PA to determine size/location of displaced root
- Reasonable attempt should be made to retrieve through socket
- 2-3mm root tip can usually be left in place if unable to be retrieved
- Larger root tips should be removed via Caldwell-Luc procedure

Hupp, James R et al. Contemporary Oral and Maxillofacial Surgery, Seventh Edition. Mosby, 2019.

350

Tooth Displacement (Maxillary Third Molars)

- Avoided by adequate soft tissue retraction, Buccal bone removal, and retractor at distal of impacted maxillary third molar.
- Suction used to attempt to draw tooth to extraction site
- Tooth is grasped and pulled in a coronal direction
- No blind probing!
- If unable to be retrieved:
  - Surgical area sutured closed
  - Pt placed on antibiotics
  - Tooth is allowed to fibrose which stabilizes tooth in a firm position
  - Pt referred to OMFS for removal after fibrosis has occurred

Hupp, James R et al. Contemporary Oral and Maxillofacial Surgery, Seventh Edition. Mosby, 2019.

351

Root Displacement (Mandibular Third Molars)

- Frequently root dehiscence at lingual of mandibular third molars (similar to buccal root on maxillary 1st premolar
- Beware of displacement in submandibular space
- Avoid apical pressure
- May need to place finger against lingual soft tissue
- Tease root in lateral direction with root tip pick or endo explorer

Hupp, James R et al. Contemporary Oral and Maxillofacial Surgery, Seventh Edition. Mosby, 2019.

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Bleeding

- Pressure
- Bone burnishing
- Porcine Collagen or Surgicel packed into extraction site and sutured
- Can use woven suture (PGA or silk) in order to get more pressure over extraction site
- Liver clots common under immediate denture

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Edema

- Body's natural response to (controlled) trauma
- Consider Glucocorticoids
- Should peak at 72 hours and resolve within 5-7 days
- Increase in swelling after 72 hours is not normal and patient should notify you
- Older patient age (>30 years), deeply impacted teeth, and long operation times are associated with significantly greater amounts of swelling when performing third molar surgery
- Patient often just wants/needs reassurance that everything is normal

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Hematoma

- Possible complication after Full Thickness Flap in mandibular posterior
- Not an infection, but space is potentially prone to infection

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Trismus

- "Limited opening of the jaw secondary to spasm of the closing muscles of the mandible"
- Overlying etiology is inflammation of the closing muscles of the mandible of the TMJ
- If trismus was present before the procedure (due to infection), removal of offending tooth should bring about eventual resolution
- Caused by local anesthetic injection, deep space infection, hematoma or bleeding in the masticatory muscles, muscle reflection for surgical access, muscle or TMJ trauma secondary to forceful extraction, and prolonged opening.

Mehra, Pushkar and Richard D'Innocenzo, eds. *Manual of Minor Oral Surgery for the General Dentist, Second Edition.* Wiley, 2016.

356

Trismus Continued

- Explain ahead of time that it is a normal complication
- Consider peri-operative steroids and NSAIDS
- Avoid excessive force on the mandible, use a bite block for mandibular extractions, avoid excessive mouth opening.
- Long-standing trismus may include physical therapy (tongue blade technique)

Mehra, Pushkar and Richard D'Innocenzo, eds. *Manual of Minor Oral Surgery for the General Dentist, Second Edition.* Wiley, 2016.

357

Alveolar Osteitis

- Lower molars
- Maxilla possible, but extremely rare
- Normally 3-5 days after procedure but can be earlier or later
- Radiating pain: ear, eye, neck, temple
- Increased risk with smoking, oral contraceptive use, increased procedure time, poor oral hygiene, increased age, female gender
- Pain usually not manageable, even with narcotics
- Not an infection
- Should be treated rather than managed with pain medication
- Gelfoam/Surgifoam soaked in eugenol
- No anesthetic if patient will tolerate
- Relief usually comes in 5-10 minutes
- Usually only have to treat once, but may need to treat multiple times

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Malocclusion

- Rare but can happen in lower second molars after third molar removal
- Microscopic drift of second molar due to elevation?
- Pain upon biting into MI
- Check with bite paper
- Adjust occlusion with high speed HP/football carbide as necessary

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Infection

- Rare, especially with erupted/"unflapped" teeth
- 2% of the time with impacted third molars
- Usually in space of the body of the mandible
- Evidenced by objective signs: fever, trismus, pus, etc.
- If infection was present before procedure, it could be that offending source has not been removed
- Remove any obvious source of infection
- Prescribe antibiotics if systemic involvement or immunocompromised

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Bony Sequestrum

- Fairly common complication after removing impacted lower third molars
- Usually a few weeks after procedure
- Greenstick fracture of buccal bone
- Eventually separates from mandible
- "Foreign body" reaction
- Often evidenced by pus formation at site
- Local anesthesia, open flap, remove broken piece(s) of bone, flush thoroughly, and resuture

361

Post-extraction lingual mucosal ulceration (LMU) with bone necrosis

Photo taken from The Saudi Journal for Dental Research (2016) 7, 34-37

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LMU Treatment

- Can happen after extraction of mandibular third molar
- Minimal/palliative care
- Do not flap lingual soft tissue unless absolutely necessary
- Rongeur to smooth any sharp exposed bone
- Or, use diamond bur in high speed HP to eliminate roughness
- Exposed necrotic bone will eventually slough off

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Paresthesia

- Lingual paresthesia more of a concern than IAN
- Increased age more of a concern
- "Map" area of altered sensation
- Close eyes and conduct brush stroke discrimination test (A fibers)
- Pin prick if no response to brush stroke (C fibers)
- Reassure patient
- Nerve repair is very slow
- Referral to OMFS for lingual nerve paresthesia and non-improving IAN paresthesia

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Paresthesia (Continued)

- IAN:
  - Usually buccal to the third molar when superimposed on 2-Dimensional films
  - Avoid instrumentation (especially rotary) near canal
- Lingual Nerve:
  - Avoid incisions on the lingual (use DB "Hockey stick")
  - Avoid excessive retraction/reflection of lingual soft tissue
  - If follicle is attached to lingual soft tissue, remove with cotton forceps or cut with scissors. Do not grasp/pull with hemostat or Rongeur!
- Mental Nerve:
  - Beware of accessory loops. Do not curette lower premolar sockets!
  - Try to avoid flaps in mandibular premolar area
  - Very careful bone removal at mesial & distal but only if bone removal is necessary

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Osteomyelitis

- "Inflammation of the bone marrow"
- Begins in medullary cavity
- Failure of microcirculation in cancellous bone
- Rare in maxilla
- Rarely occurs if host defenses are intact
- Diabetes, alcoholism, IV drug abuse, malnutrition, leukemia, sickle cell disease, chemotherapy-treated cancer are all implicated
- Treated medically and surgically

Hupp, James R et al. *Contemporary Oral and Maxillofacial Surgery, Sixth Edition.* Mosby, 2014.

366

Osteomyelitis (Continued)

- Acute Suppurative Osteomyelitis:
  - Osteoradionecrosis (ORN)
  - Medication-Related osteonecrosis of the jaws (MRONJ)
  - Clinical Findings:
    - Edema
    - Restricted Movement of the affected area
    - Erythema
    - Pain
- Chronic Suppurative Osteomyelitis
- Chronic Sclerosing Osteomyelitis
- Osteomyelitis with Proliferative Periostitis (Garre Osteomyelitis)

Hupp, James R et al. *Contemporary Oral and Maxillofacial Surgery, Seventh Edition.* Mosby, 2019.

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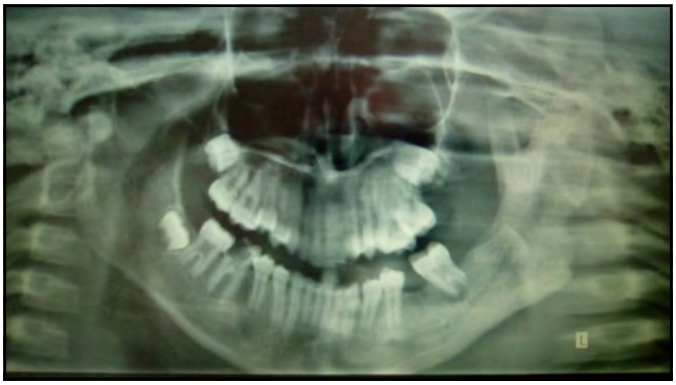

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Post-Operative Evaluation

- Do not delegate (unless necessary)
- Blood Pressure
- Temperature
- Objective ROM (finger widths)
- Presence of pus?

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Action Steps

- Acquire adequate armamentarium
- Low Hanging Fruit
  - Periodontally involved teeth
  - Single erupted teeth
- Build confidence/experience with straightforward cases
- Patient Selection
  - Low maintenance
  - Low anxiety
  - Patients who want you to treat them and do not want to be referred

373

Volunteer

- Treat patients like paying customers, not target practice
- Do not be overly aggressive with teeth that may still have some life left
- Not out of guilt, but as an act of mercy
- A responsibility to give back: “From everyone who has been given much, much will be required” (Luke 12:48)
- Do not take out one tooth per visit!
- Usually very grateful patients
- Consider overseas opportunities

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Questions?

Thank you for your attention!

Email: jonathan.spenn@gmail.com
- Antibiotic ”Quick Start” Guide
- Post-Op Instructions
- Sinus Precautions

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