Epinephrine in the Dental Setting

Evidence Based Dentistry Rounds

Specialty: Collaborative Care

Group: 7A-3

Team: Tyler Koupal, Caleb Abfall, Nataliia Dauksz, Isabella Duarte

Date: 10/14/2020

Rounds Team

- **Group Leader:** Dr. Rossi
- **Specialty Leader:** Dr. Yale (ENT)
- **Project Team Leader:** D4-Tyler Koupal
- **Project Team Participants:** D1-Isabella Duarte, D2-Nataliia Dauksz, D3-Caleb Abfall

Patient

- Age: 68
- Gender: Female
- Ethnicity: White
- Complicated medical and dental histories
- Patient at Marquette since 2006-2011 and 2015-now

Medical History

- Current & past:
  - Diagnoses: High blood pressure, High cholesterol, Cervical cancer 1984 (benign), Hysterectomy-1985, Cardiac Disease, Carotid Stenosis
  - Conditions: Multiple sclerosis
  - Medications: Methylphenidate, Advir Diskus, Pravastatin, Albuterol Sulfate, Aubagio, Gabapentin, Topiramate, Doxazosin, Benazepril, Multivatamin, Calcium, Flonase
  - Medical Consults: 09/08/20, and 09/28/20
  - Treatment considerations: Limit the use of Epinephrine?

Dental History

- History of:
  - Extractions, Implants, Periodontal Disease, Partials, and Root Canal Therapy
- Neck pains
  - Due to a pinched nerve
  - Sees physical therapist to treat
- Brushes twice a day and flosses more than once a day

Periodontal Chart

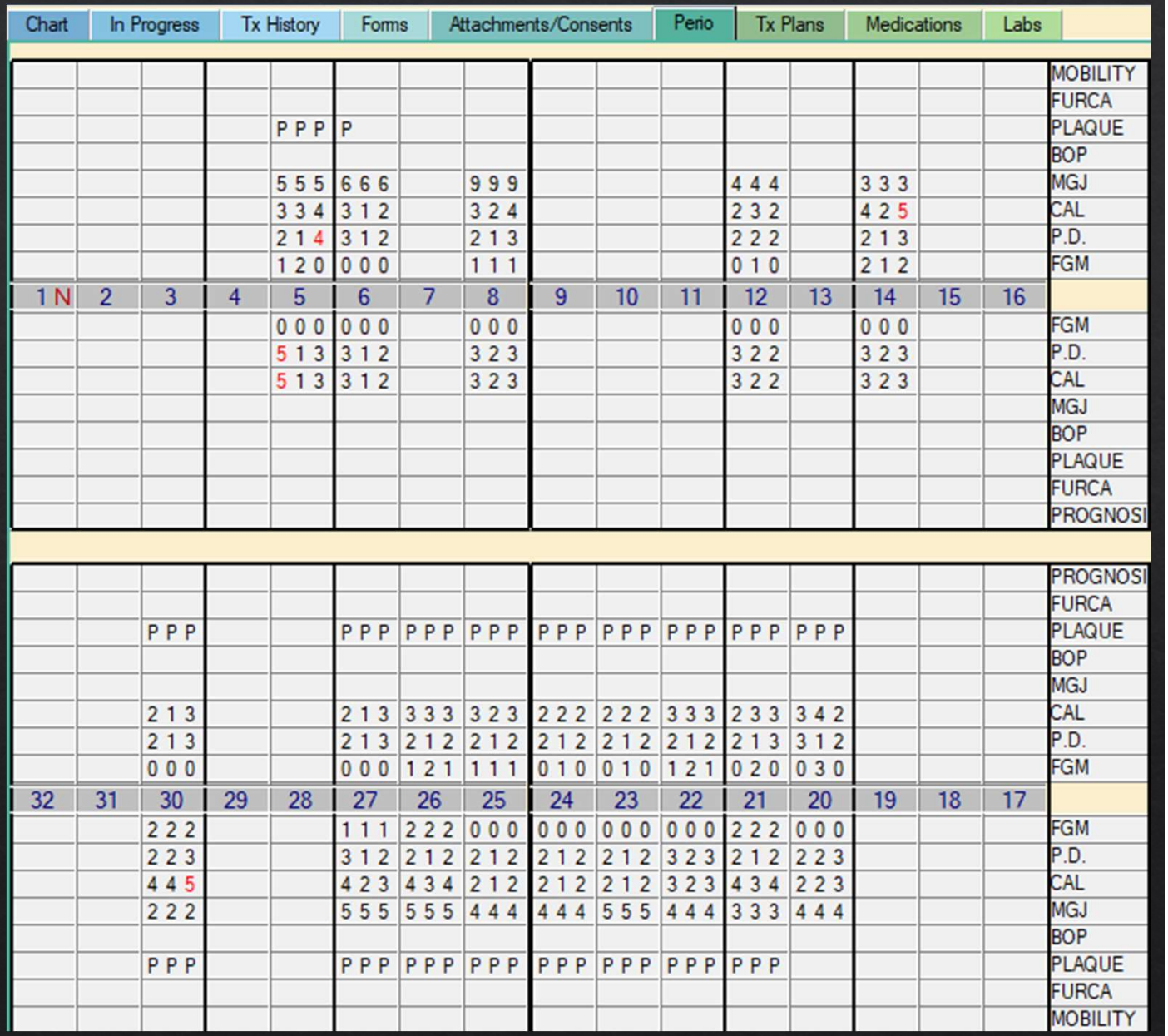

Chart | In Progress | Tx History | Forms | Attachments/Consents | Perio | Tx Plans | Medications | Labs

																MOBILITY
																FURCA
				P P P	P											PLAQUE
																BOP
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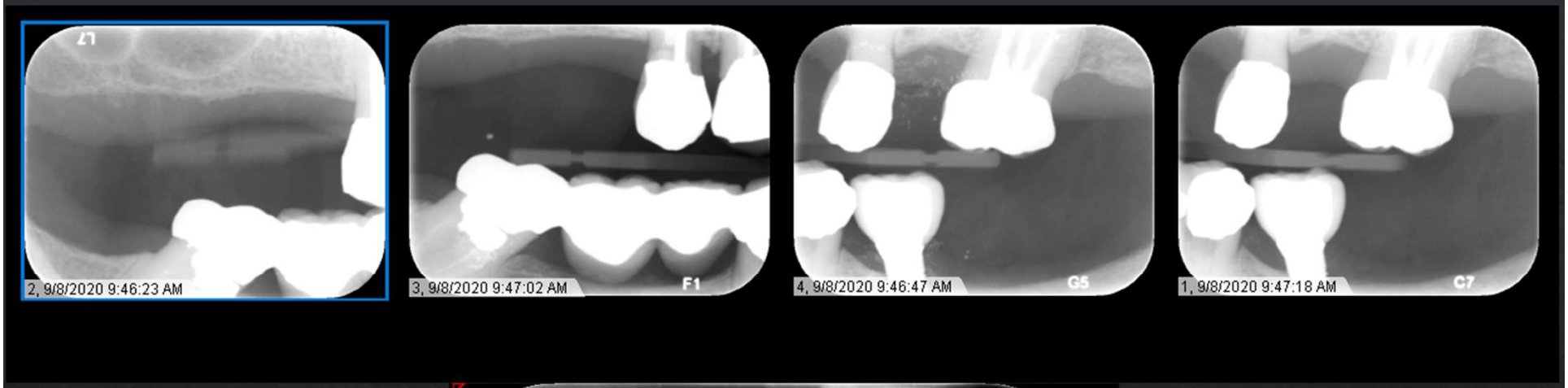
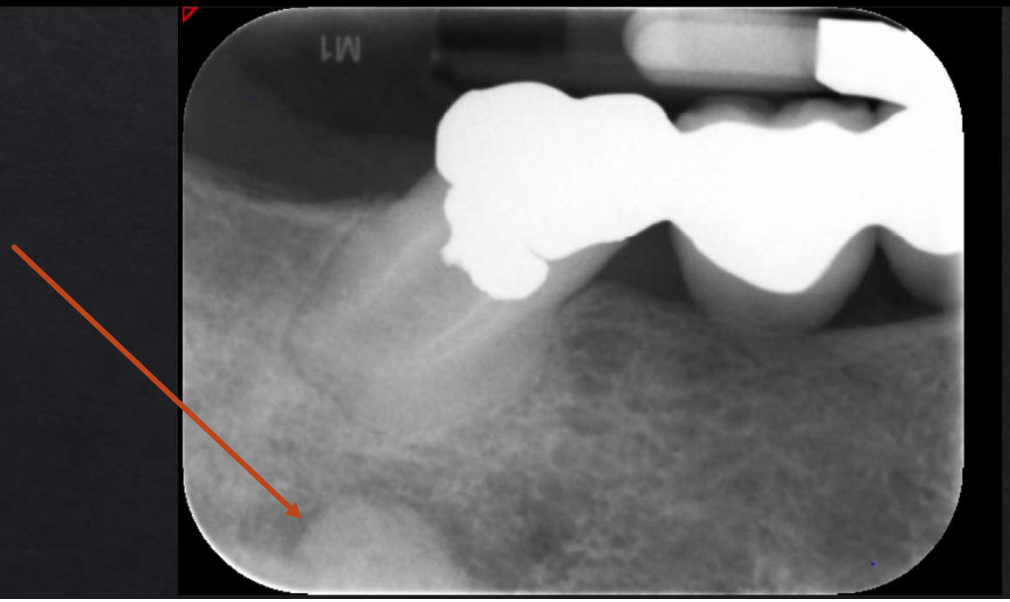
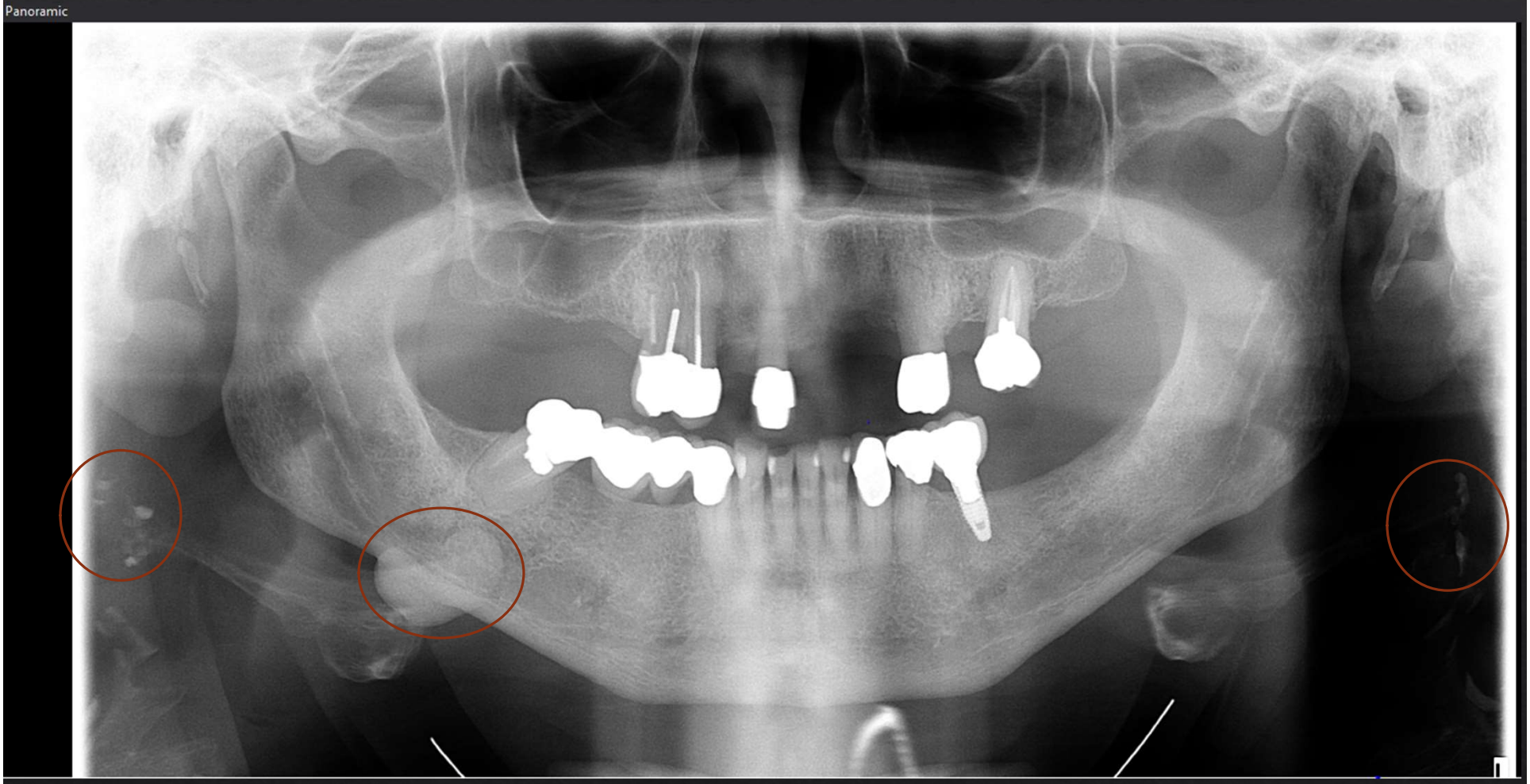
		P P P			P P P	P P P	P P P	P P P	P P P	P P P	P P P					PLAQUE
																FURCA
																MOBILITY

Radiographs: Bitewings, PA





Radiographs: Pan



Radiographic Findings

- Oral Pathology Consultation: Dr. Rawal
  - “Opaque smooth, lobulated mass of homogenous density. Overlapping right posterior mandible at lower border.”
  - Differential diagnosis- Osteoma and sialolith
- Bilateral Carotid Stenosis
- Would benefit from CBCT
  - Insurance coverage?

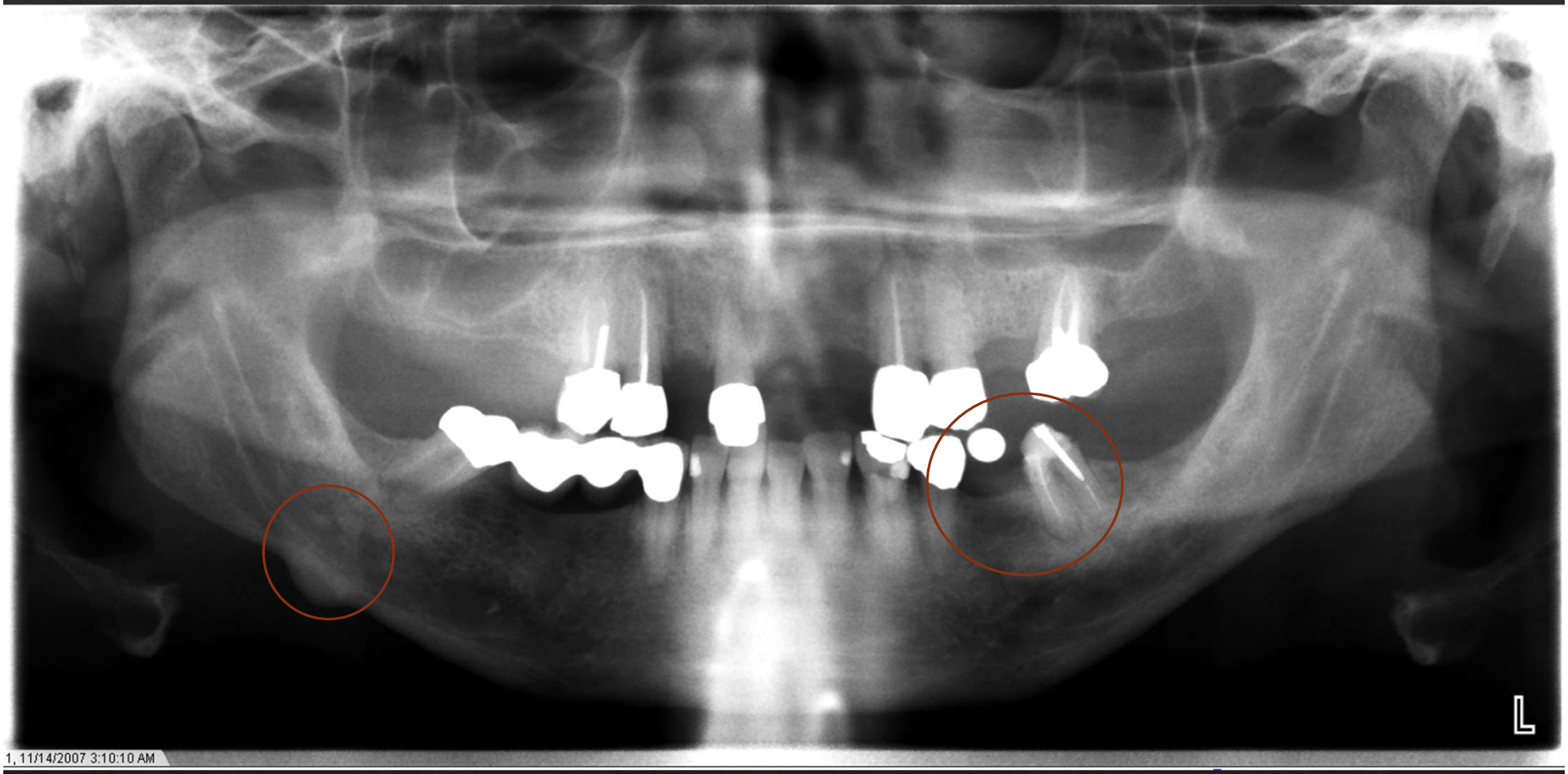
Clinical Findings

- #21 Buccal marginal root caries
- #23 DB recurrent caries
- #26 M caries
- Unilateral hard mass in the lower right mandible upon palpation
- Clinical photos: none
- Diagnostic casts: none

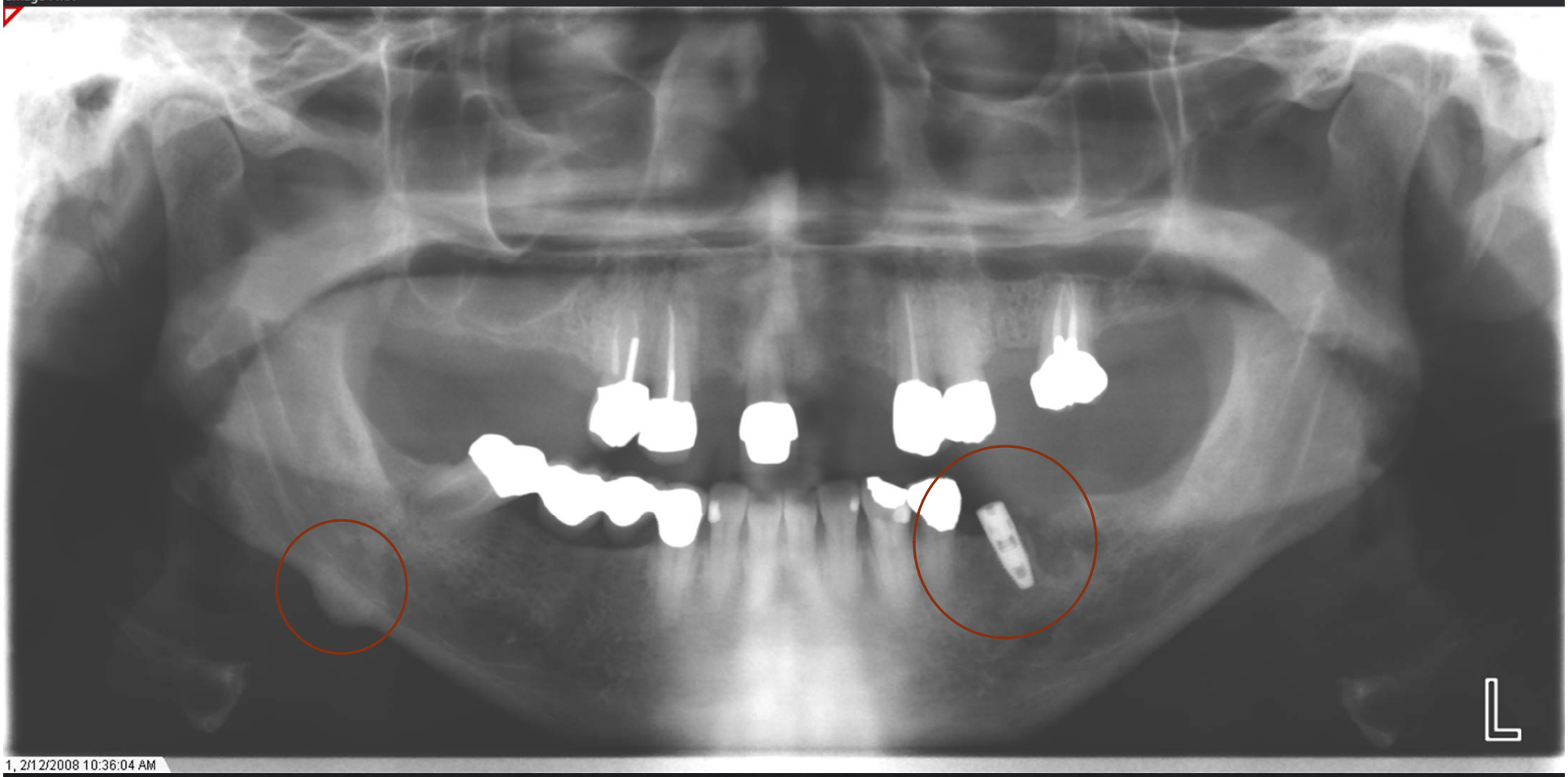
Specific Findings

- Bilateral carotid stenosis
  - Med consult with cardiologist: 09/28/20
    - Carotid ultrasound done in February 2020
    - Less than 50% bilateral stenosis
    - On imaging both arteries appear smooth
- Unilateral mandibular mass
  - Med Consult with ENT
    - In process

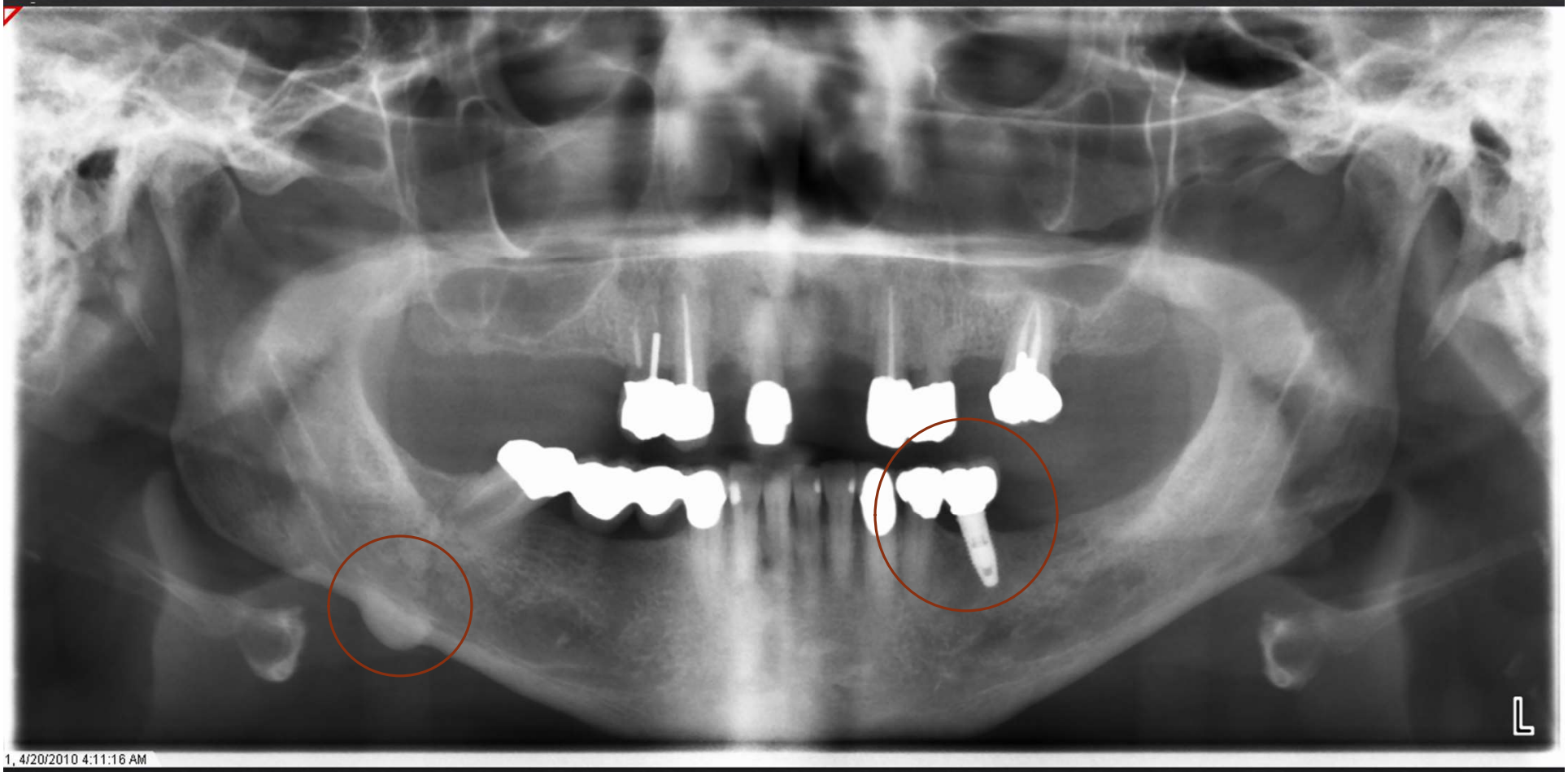
Pan 2007



Pan 2008



Pan 2010



Diagnosis

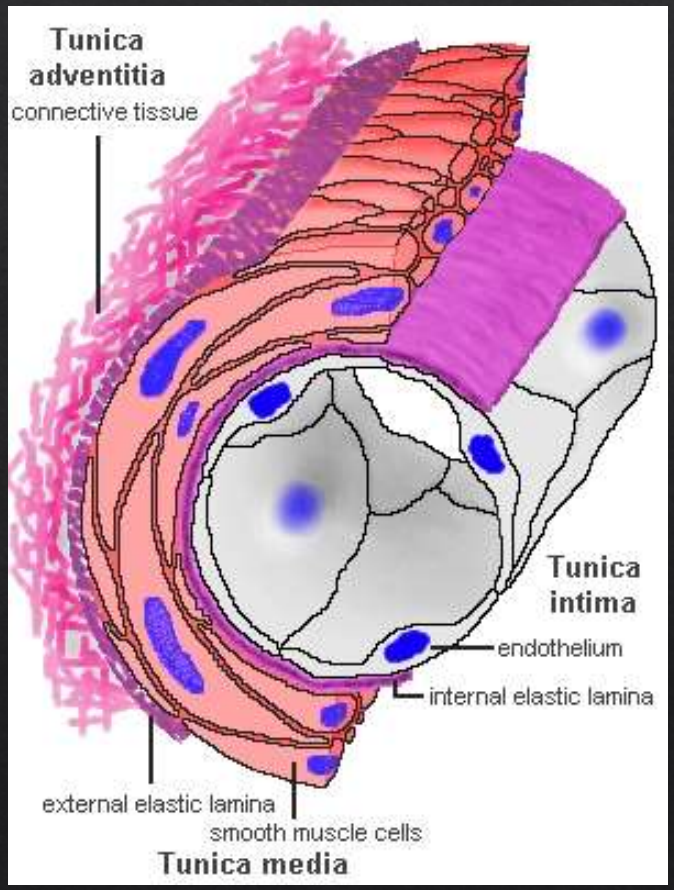
- Bilateral Carotid Stenosis

D1: Basic Science Question

What is the anatomy of a blood vessel?

Blood Vessel Anatomy

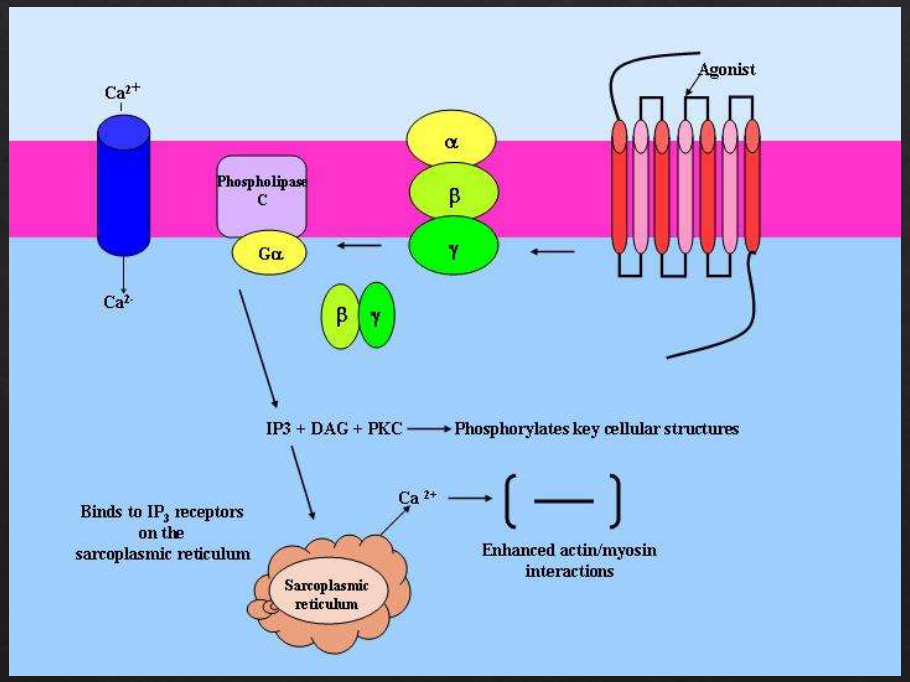
- 3 Layers
  - Tunica Adventitia
  - Tunica Media
  - Tunica Intima



http://www.siumed.edu/~dking2/crr/cvguide.htm

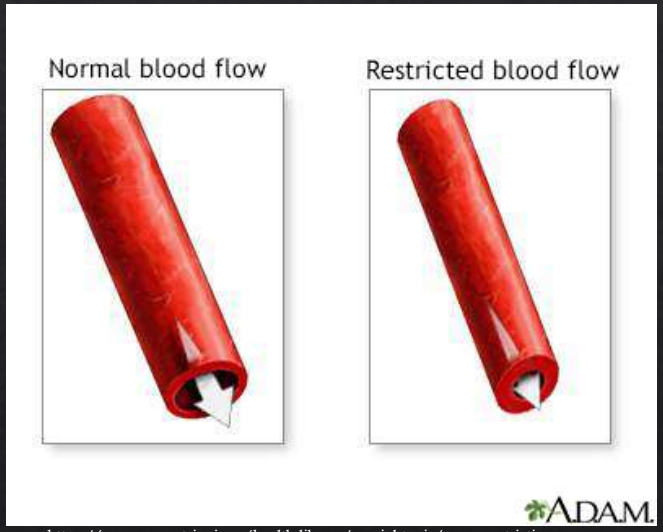
Epinephrine on Blood Vessels

Mode of Action



https://www.google.com/search?q=epinephrine+mode+of+action+vascocontriction&tbm=isch&ved=2ahUKEwjd_ImU0qrsAhUHzawKHTiZBXAQ2-cCegQIABAA&oq=epinc&gs_lcp=CgNpbWcQARgAMgQIIxAnMgQIIxAnMgcIABCxAxBDMgQIABBDMgQIABBDMgQIABBDMgQIABBDMgIIADICCAA6CAgAELEDEIMBOgUIABCxA1DS5AVYkOkFYLD2BWgAcAB4AIABS4gB3gKSAQE1mAEAoAEBqgELZ3dzLXdpei1pbWfAAQE&sclient=img&ei=rPuBX932NIeaswW4spaABw&bih=752&biw=1178#imgrc=CYxULc5V5H52iM

Vasoconstriction



https://www.mountsinai.org/health-library/special-topic/vasoconstriction

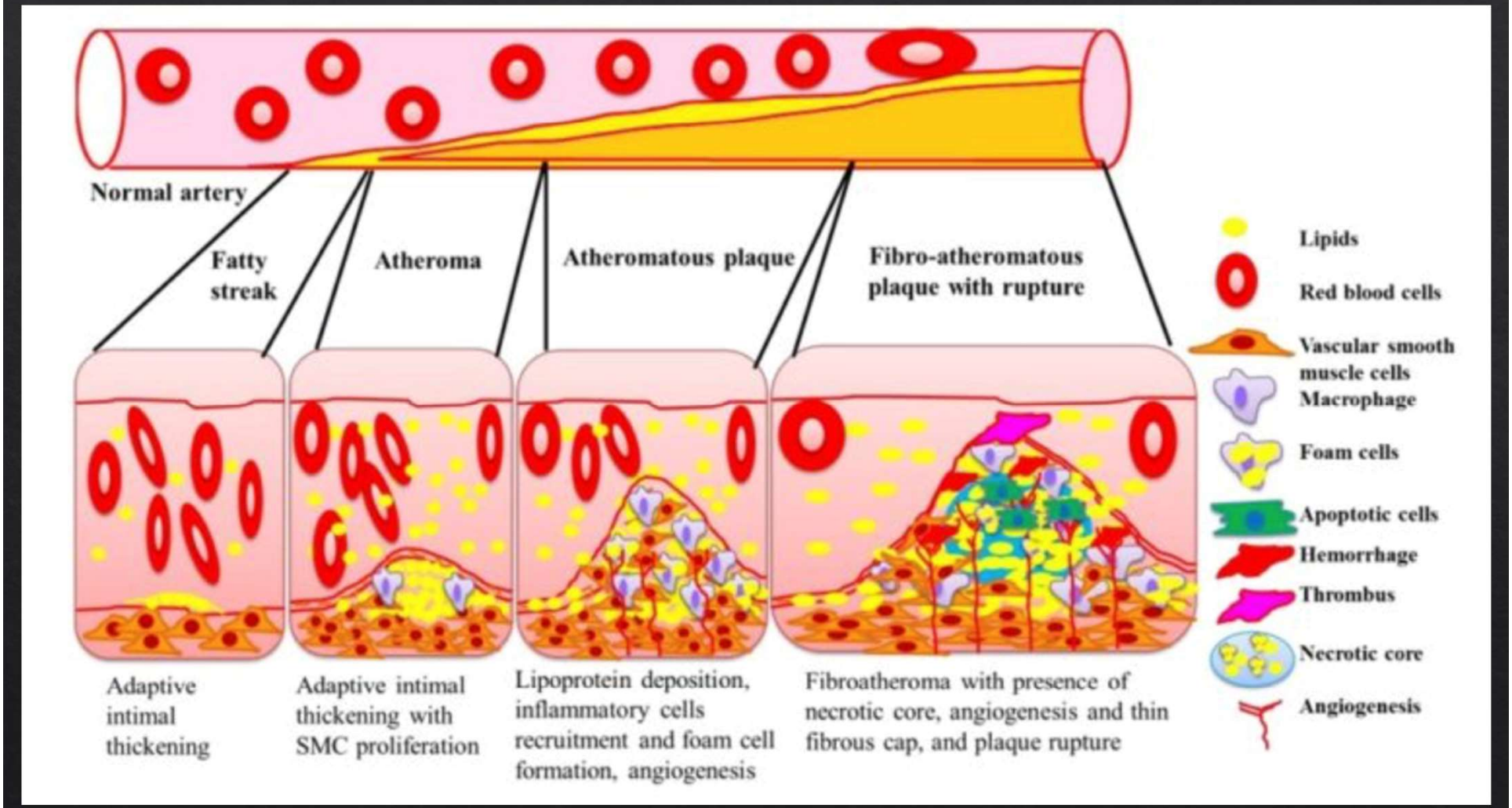
D2: Pathology

What is Atherosclerosis?

- Arteriosclerosis - is a thickening, hardening, and loss of elasticity of the arterial walls.
- Atherosclerosis - arteriosclerosis in the intima of the large and medium sized arteries.
- Risk factors for atherosclerosis:
  - non-modifiable: genetics, age, gender
  - Modifiable: inflammation, hypertension, hyperlipidemia, diabetes, cigarettes, and left ventricular hypertrophy.
- Hyperlipidemia - elevated levels of lipoproteins (low density lipoprotein-LDL).

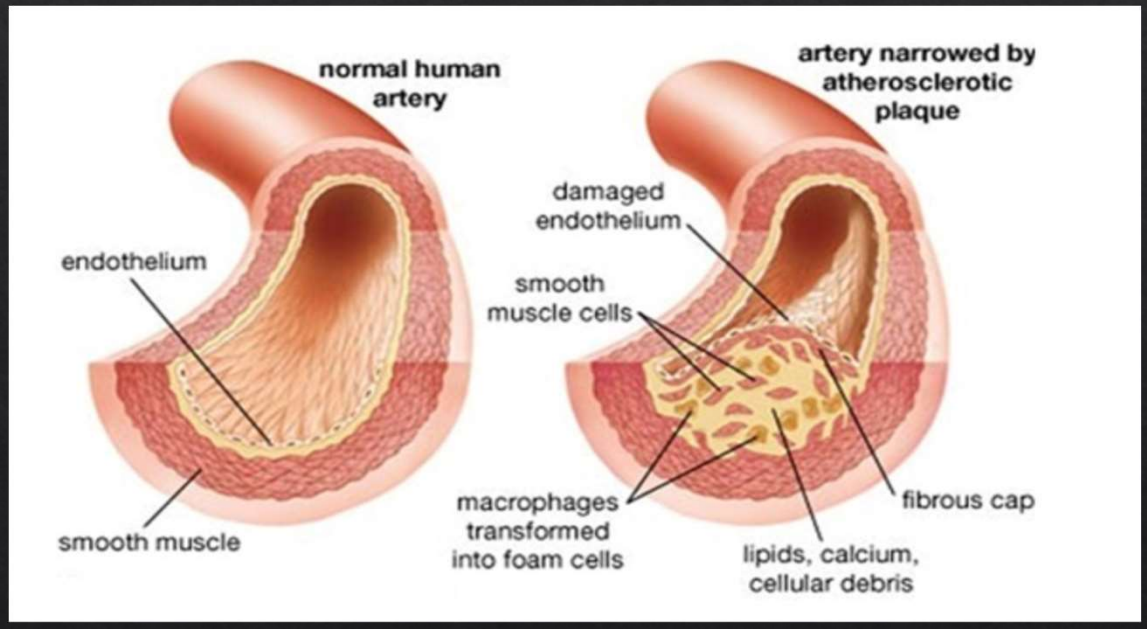
Atherosclerosis Development

- Chronic inflammatory response of the arterial wall to **endothelial injury**.
- **Development of an atheroma**: tunica intima accumulates oxidized LDLs, cholesterol crystals, monocytes, T cells, and platelets.
- **Intima thickening** - smooth muscle cells migrate into tunica intima.
- **Development of a fatty streak** - macrophages and smooth muscle cells engulf oxidized LDLs and become foam cells; T cells release inflammatory cytokines.
- **Development of a fibrofatty atheroma (plaque)** - smooth muscle proliferation and collagen deposition create a fibrous cap; dead foam cells release lipid debris


Normal artery
Fatty streak
Atheroma
Atheromatous plaque
Fibro-atheromatous plaque with rupture
Lipids
Red blood cells
Vascular smooth muscle cells
Macrophage
Foam cells
Apoptotic cells
Hemorrhage
Thrombus
Necrotic core
Angiogenesis
Adaptive intimal thickening
Adaptive intimal thickening with SMC proliferation
Lipoprotein deposition, inflammatory cells recruitment and foam cell formation, angiogenesis
Fibroatheroma with presence of necrotic core, angiogenesis and thin fibrous cap, and plaque rupture

Parts of an atheromatous plaque (atheroma): lumen, fibrous cap, and necrotic core.

Atheroma involves many different arteries, bulge into and occlude lumen, rupture, damage and weaken tunica media causing aneurism.



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- Insull W Jr. The pathology of atherosclerosis: plaque development and plaque responses to medical treatment. Am J Med. 2009 Jan;122(1 Suppl):S3-S14. doi: 10.1016/ j.amjmed.2008.10.013. PMID: 19110086.
- Schaftenaar F, Frodermann V, Kuiper J, Lutgens E. Atherosclerosis: the interplay between lipids and immune cells. Curr Opin Lipidol. 2016 Jun;27(3):209-15. doi: 10.1097/ MOL.0000000000000302. PMID: 27031276.

D3 PICO

- Clinical Question:
  - What is the dental management of a patient with atherosclerosis?

PICO Format

P: Cardiovascular Complications

I: Limiting Epinephrine during dental procedures

C: Administering LA with epinephrine

O: Minimizing the chance of a cardiac emergency in the dental office.

PICO Formatted Question

- In patients with cardiovascular complications, will local anesthetic that does not contain epinephrine compared to using local anesthetic with epinephrine minimize the chance of a cardiac emergency occurring in the dental chair?

Search Background

- **Date(s) of Search:** 10/10/20
- **Database(s) Used:** PubMed
- **Search Strategy/Keywords:** dentistry, local anesthetics, cardiovascular, epinephrine
- **MESH terms used:** dentistry, local anesthesia, cardiovascular abnormalities, vasocontrictors

Article 1

- **Title:** Clinical assessment of the safe use local anesthesia with vasoconstrictor agents in cardiovascular compromised patients: a systematic review

- **Citation:** Godzieba A, Smektała T, Jędrzejewski M, Sporniak-Tutak K. Clinical assessment of the safe use local anaesthesia with vasoconstrictor agents in cardiovascular compromised patients: a systematic review. Med Sci Monit. 2014 Mar 10;20:393-8. doi: 10.12659/MSM.889984. PMID: 24608362; PMCID: PMC3958566.

- **Study Design:** Systematic Review

- **Study Need/Purpose:** To review the literature to assess any scientific basis for the limited use of dental anesthesia with a vasoconstrictor agent in cardiovascular compromised patients.

Article 1 Synopsis

- **Method:** A comprehensive database search with the use of Medline (PubMed), ISI Web of Science, and Cochrane was conducted to review any adverse effects of local anesthesia on patients with cardiovascular complications
- **Parameters:** a clearly defined dose of vasoconstrictor agent and the testing of at least 1 parameter (pressure, heart rate, or saturation) or occurrence of at least 1 cardiac incident (complication). 11 studies were deemed acceptable to be used in the review out of 138 studies that were screened
- **Results:** 10 individual cardiac complications were recorded that could be directly attributed to local anesthesia, however, 4 out of those 10 complications arose after administration of LA that contained NO epinephrine
- **Conclusions:** The use of ≤4 ampules of lignocaine (lidocaine) with epinephrine 1:100,000 as a dental anesthetic seems to be relatively safe for cardiovascular compromised patients
- **Limitations:** Only 11 studies included in the review with only 567 patients across those studies.

Article 1 Selection

- **Reason for selection:** Directly related to the PICO question
- **Applicability to your patient:** our patient has cardiovascular complications
- **Implications:** no implications from this study to suggest altering tx

Article 2

- **Title:** The cardiovascular effect of local anesthesia with articaine plus 1:200,000 adrenalin versus lidocaine plus 1:100,000 adrenalin in medically compromised cardiac patients: a prospective, randomized, double blinded study

- **Citation:** Elad S, Admon D, Kedmi M, Naveh E, Benzki E, Ayalon S, Tuchband A, Lutan H, Kaufman E. The cardiovascular effect of local anesthesia with articaine plus 1:200,000 adrenalin versus lidocaine plus 1:100,000 adrenalin in medically compromised cardiac patients: a prospective, randomized, double blinded study. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2008 Jun;105(6):725-30. doi: 10.1016/j.tripleo.2008.02.005. PMID: 18485309.

- **Study Design:** randomized, double-blind clinical trial

- **Study Need/Purpose:** to compare the effects of different local anesthetics containing adrenaline on cardiovascular patients.

Article 2 Synopsis

- **Method:** Fifty cardiovascular patients were randomly assigned to dental treatment using 1.8 mL of one of two LA injections: articaine 4% and adrenalin 1:200,000 or lidocaine 2% and adrenalin 1:100,000. A computerized system enabled continuous longitudinal data collection: electrocardiography (ECG), O(2)-saturation, blood pressure (BP), and heart rate (HR)

- **Results:** There were no clinical severe adverse effects, however, one local paresthesia occurred (lidocaine group), which lasted 4 weeks. There were no statistically significant differences between the 2 groups in HR, systolic or diastolic-BP, and O(2) saturation

- **Conclusions:** LA with articaine 4% with adrenalin 1:200,000 was comparably as safe as LA with standard concentrations of lidocaine and adrenalin in cardiovascular patients.

- **Limitations:** Only 50 patients were used in the study, which is a very small sample size. Additionally, there was no control group where an LA was used *without* epinephrine, so we have no data to compare the cardiovascular data of LA with *and* without epinephrine.

Article 2 Selection

- **Reason for selection:** Directly related to the PICO question
- **Applicability to your patient:** our patient has cardiovascular complications
- **Implications:** no implications for altered tx

Article 3

- **Title:** Use of anesthetics associated to vasoconstrictors for dentistry in patients with cardiopathies. Review of the literature published in the last decade

- **Citation:** Serrera Figallo MA, Velázquez Cayón RT, Torres Lagares D, Corcuera Flores JR, Machuca Portillo G. Use of anesthetics associated to vasoconstrictors for dentistry in patients with cardiopathies. Review of the literature published in the last decade. J Clin Exp Dent. 2012 Apr 1;4(2):e107-11. doi: 10.4317/jced.50590. PMID: 24558534; PMCID: PMC3908793.

- **Study Design:** Systematic Review of RCT's

- **Study Need/Purpose:** to compare the effects of different local anesthetics containing adrenaline on patients with any kind of cardiopathy

Article 3 Synopsis

- **Method:** A search for randomized clinical trials on the analysis of cardiovascular effects of local anesthetics used in dentistry, which were published during the last decade and were index-linked in Cochrane, Embase and Medline was conducted.

- **Results:** six randomized clinical trials containing a total of 321 patients were used to compare the adverse effects of different types of anesthetics: lidocaine 2%, mepivacaine 2%, and prilocaine 2%, on patients with cardiovascular complications.

- **Conclusions:** Once the period of absolute dental contraindication has passed, there was no evidence to support the claim that LA without epinephrine is contraindicated in patients with cardiopathy. A volume of 1.8-3.6ml (1-2 carpules) of LA containing epinephrine does not create any adverse effects for a patient with cardiovascular complications.

- **Limitations:** Similar to the other two articles, there is still a small sample size in this review. It is also noteworthy that the clinical trials used in this review were conducted between the years 2000-2010, and the review itself states that more research needs to be done to develop a clinical practice guideline. Finally, although it is not necessarily a direct limitation of this study, it is stated that there is no data on the use of LA containing vasoconstriction agents during the absolute contraindicated time of dental procedures in patients with recent cardiopathy, such as an MI (myocardial infarction) in last six months

Article 3 Selection

- **Reason for selection:** Directly related to the PICO question
- **Applicability to your patient:** our patient has cardiovascular complications
- **Implications:** no implications for altered tx as long as it is outside the contraindicated timeline for dental procedures.

Levels of Evidence

- ☑ **1a** – Clinical Practice Guideline, Meta-Analysis, Systematic Review of Randomized Control Trials (RCTs)
- ☑ **1b** – Individual RCT
- ☐ **2a** – Systematic Review of Cohort Studies
- ☐ **2b** – Individual Cohort Study
- ☐ **3** – Cross-sectional Studies, Ecologic Studies, "Outcomes" Research
- ☐ **4a** – Systematic Review of Case Control Studies
- ☐ **4b** – Individual Case Control Study
- ☐ **5** – Case Series, Case Reports
- ☐ **6** – Expert Opinion without explicit critical appraisal, Narrative Review
- ☐ **7** – Animal Research
- ☐ **8** – In Vitro Research

Strength of Recommendation Taxonomy (SORT)

□	**A** – Consistent, good quality patient oriented evidence
□	**B** – Inconsistent or limited quality patient oriented evidence
□	**C** – Consensus, disease oriented evidence, usual practice, expert opinion, or case series for studies of diagnosis, treatment, prevention, or screening

Clinical Bottom Line

- Until there is more research, or a clinical practice guideline is developed, it is best to limit the amount of epinephrine given to patients with cardiovascular complications. It is always best to consult with the patient's physician prior to administering local anesthesia with epinephrine in the dental setting when the patient presents with cardiovascular complications.

Conclusions: D3

How does the evidence apply to this patient?

- Our patient has multiple cardiovascular complications, so this data is directly related to our method of tx at each appointment. Her vitals must be closely monitored, and every appointment with any other medical professionals must be accurately documented with as much detail as possible to provide the them with the best possible standard of care while keeping them safe.

Based on the above considerations, how will you advise your D4?

- I would advise Tyler, or the primary student assigned to this patient, to consult his cardiologist, ENT, and/or primary care physician before any invasive dental procedure that requires LA. This will keep us informed and educated on the status of our patient's current health and allow us to keep the patient safe while in our office.

Conclusions: D4

Based on your D3's bottom line recommendations, how will you ***advise*** your patient?

- The patient should continue to have routine check ups with her physician and cardiologist. Advise patient to follow up with her ENT to pursue definitive diagnosis on the mandibular mass.

How will you ***help*** your patient?

- Consultaions with patient's physician, cardiologist, and ENT
- Communicate with patient about conditions and check ups
- Monitor patient's vitals closely at appointments

Discussion Questions?

History teacher in 2073: Kids open your textbooks to Chapter 5, we're going to learn about the year 2020