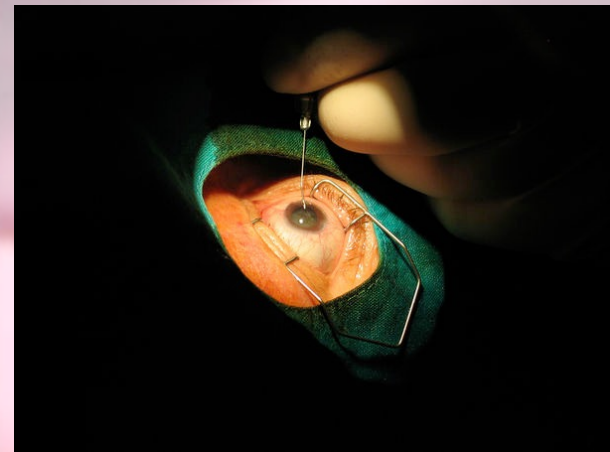


Applications in Dermatology, Dentistry and LASIK Eye Surgery using LASERs



Lasers in Dentistry

Laser dentistry can be a precise and effective way to perform many dental procedures. The potential for laser dentistry to improve dental procedures rests in the dentist's ability to control power output and the duration of exposure on the tissue (whether gum or tooth structure), allowing for treatment of a highly specific area of focus without damaging surrounding tissues.

Advantages of a laser (compared with the traditional dental drill)

- May cause less pain in some instances, therefore reducing the need for anesthesia.
- May reduce anxiety in patients uncomfortable with the use of the dental drill.
- Minimize bleeding (high-energy beam photocoagulation) and swelling during soft tissue treatments.
- May reduce bacterial infections because the high-energy beam sterilizes the area being worked on.
- May preserve more healthy tooth during cavity treatment.

Lasers in Dentistry

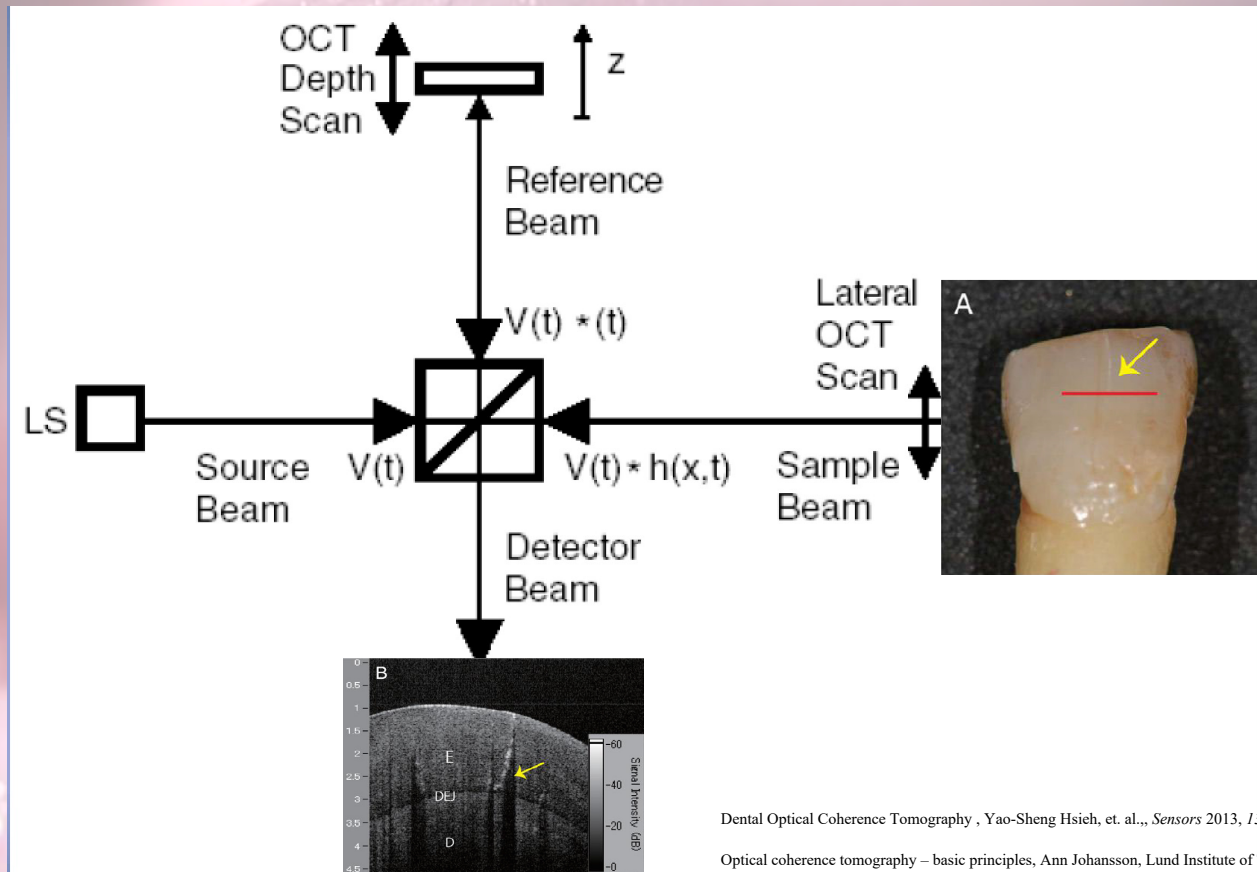


Laser disadvantages

- Lasers can't be used on teeth with fillings that are already in place.
- Lasers can't be used in many commonly performed dental procedures. For example, lasers can't be used to fill cavities located between teeth, cavities around old fillings, and large cavities that need to be prepared for a crown, nor can they be used to remove defective crowns or silver fillings, or prepare teeth for bridges.
- Traditional drills may still be needed to shape the filling, adjust the bite, and polish the filling even when a laser is used.
- Lasers do not eliminate the need for anesthesia.
- Laser treatment tends to be more expensive since the cost of the laser is much higher.
- Possibility of introducing viruses or cancers into other areas.

Lasers in Dentistry: Applications

- *Viewing Tooth and Gum Tissues:* Optical Coherence Tomography is a safer way to see inside tooth and gums in real time.

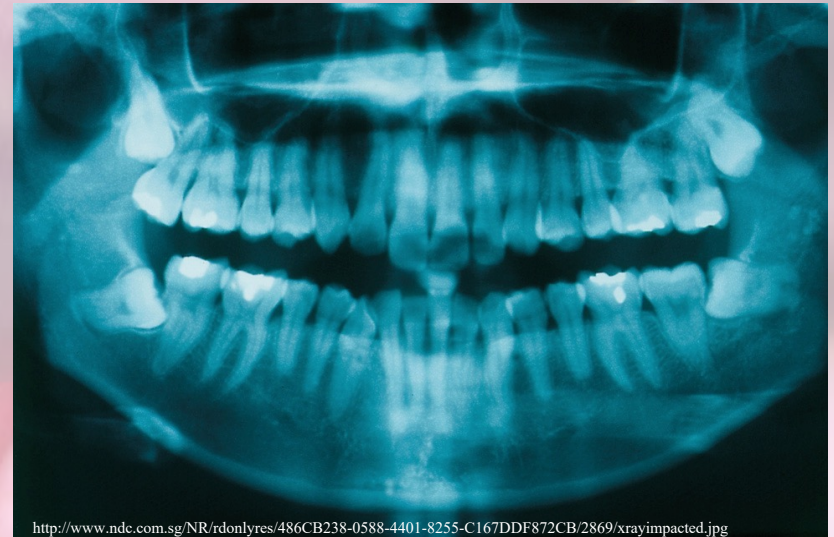


Lasers in Dentistry: Applications

- *Benign Tumors*: Dental lasers may be used for the painless and suture-free removal of benign tumors (biopsy) from the gums, palate, sides of cheeks and lips.
- *Cold Sores*: Low intensity dental lasers reduce pain associated with cold sores and minimize healing time.
- *Nerve Regeneration*: *Photobiomodulation* can be used to regenerate damaged nerves, blood vessels and scars.
- *Teeth Whitening*: Low intensity soft tissue dental lasers may be used to speed up the bleaching process associated with teeth whitening. Bleaching products contain carbamide peroxide(s) that help remove deep (intrinsic) and surface (extrinsic) stains
- *Temporomandibular Joint Treatment*: Dental lasers may be used to quickly reduce pain and inflammation of the temporomandibular jaw joint.

Lasers in Dentistry:

- Anatomy of the Mouth



- Panoramic X-ray images of the human mouth showing the distribution of adult teeth.
- The left image is a “normal” adult mouth and the right image is an “abnormal” adult mouth.
- What’s the abnormality?

Lasers in Dentistry:

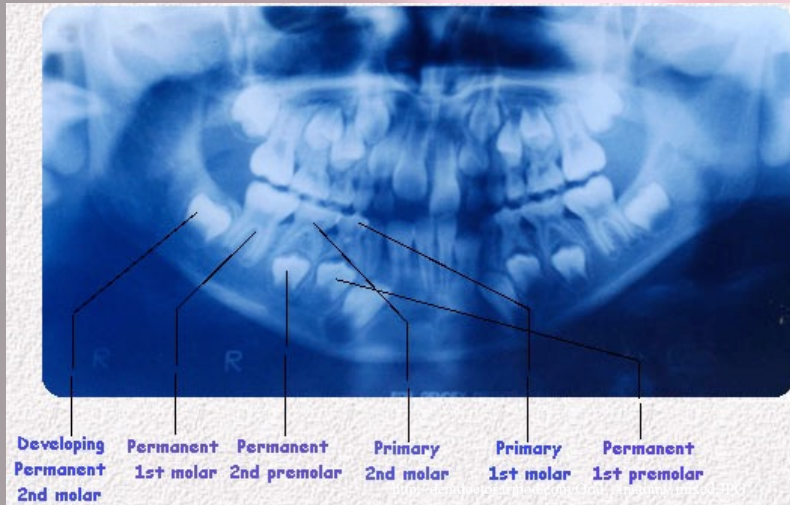
- Anatomy of the Mouth



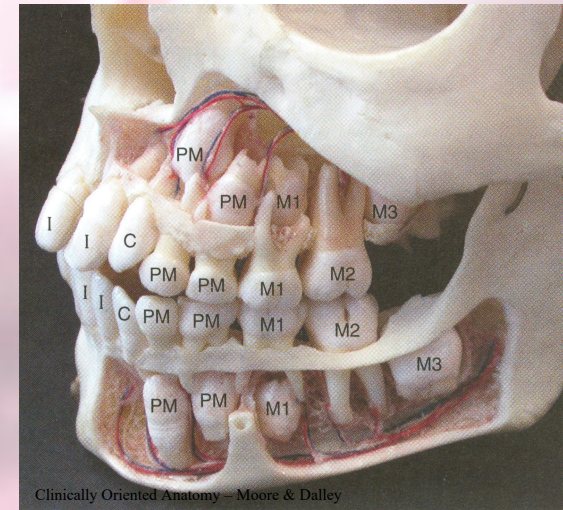
- Panoramic X-ray images of the human mouth showing the distribution of a child's teeth.

Lasers in Dentistry:

- Anatomy of the Mouth



Panoramic x-ray of a 7 year-old child showing primary teeth and secondary tooth development.

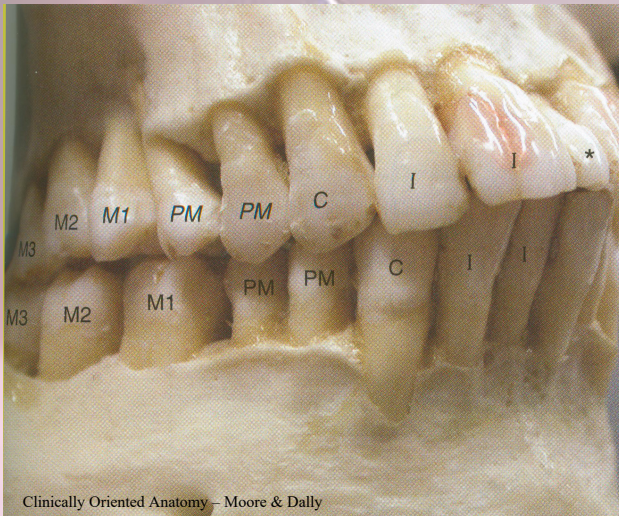
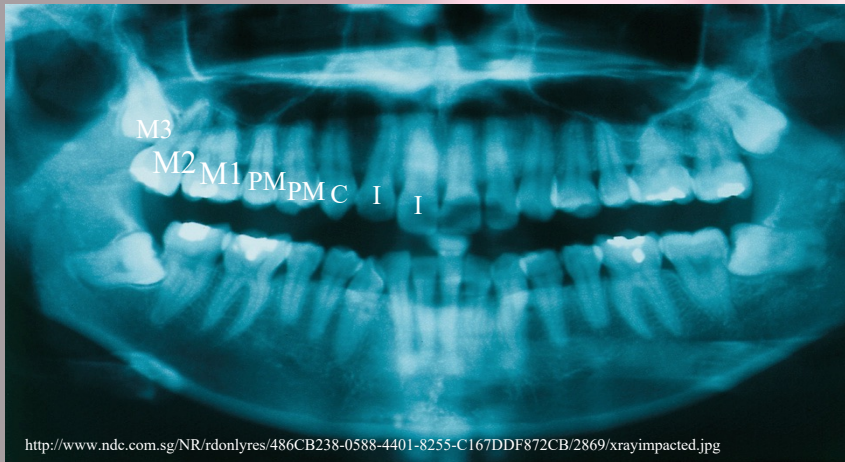


Left anterolateral view of the distribution of primary and secondary teeth in a child

- One can notice the complex mix of the permanent (*secondary*) and the primary (*deciduous*) teeth at this stage.
- The developing permanent teeth up to 2nd premolar are called *succedaneous* teeth because they succeed their corresponding primary teeth.
- The secondary teeth reside in the *alveolar arches* as *tooth buds* before eruption.
- Permanent molars are not considered *succedaneous* teeth.

Lasers in Dentistry:

- Anatomy of the Mouth



Right anterolateral view of the distribution of primary human teeth in the adult

- Panoramic x-ray radiograph, upper left, of the human mouth showing the different types of teeth present in both the *mandible* (lower jaw) and the *maxilla* (upper jaw.)
- *Incisors* (I), *canine* (C), *pre-molars* (PM) and the *molars* (M).
- There are 32 permanent teeth in the adult human.
- The mouth is the primary portal of the alimentary system and a secondary portal for the respiratory system
- In the lower left picture the teeth are in *occlusion* and there is an extra midline tooth (*).

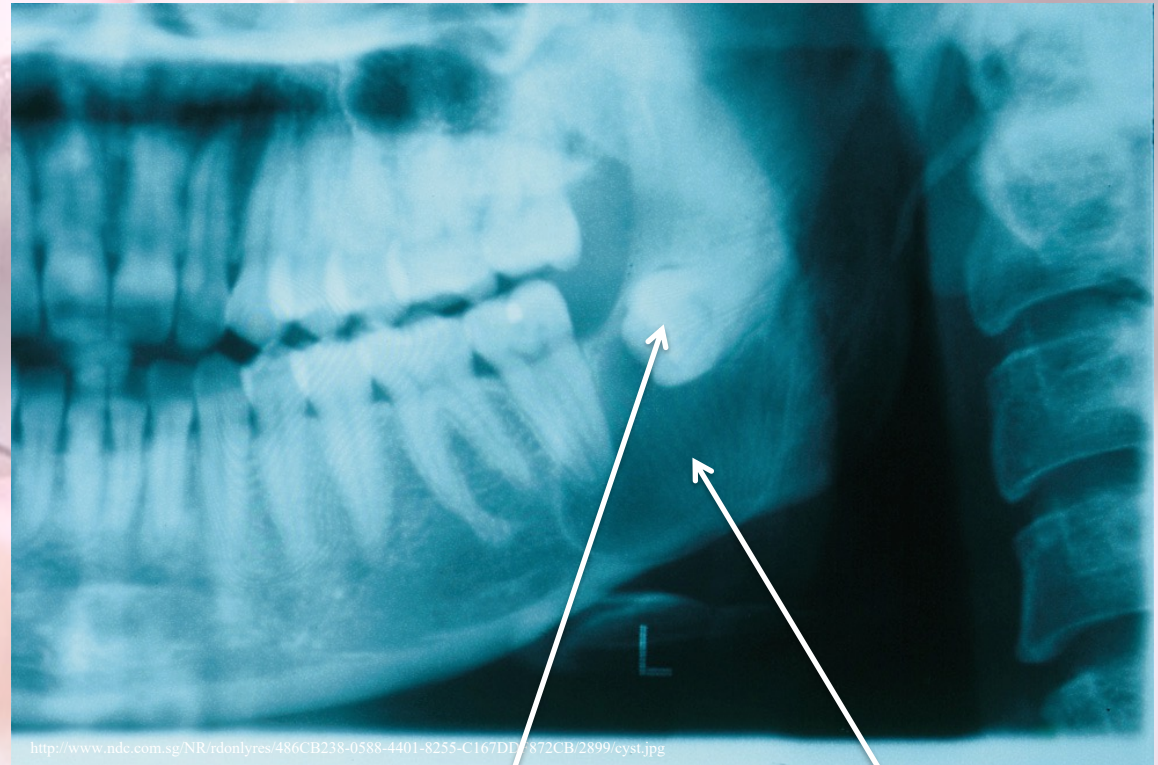
Lasers in Dentistry:

- Anatomy of the Mouth

We, obviously, haven't gotten to x-rays yet, but here is an x-ray image of at least one abnormality in the mouth.

What is the abnormality?

There could be more than one abnormality present.

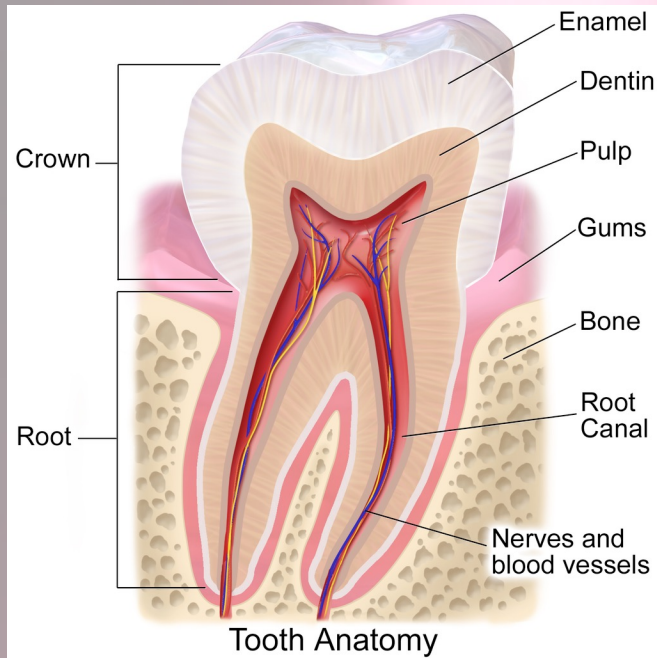


Impacted M3 molar

Development of a cyst in the mandibular portion of the jaw bone

Lasers in Dentistry:

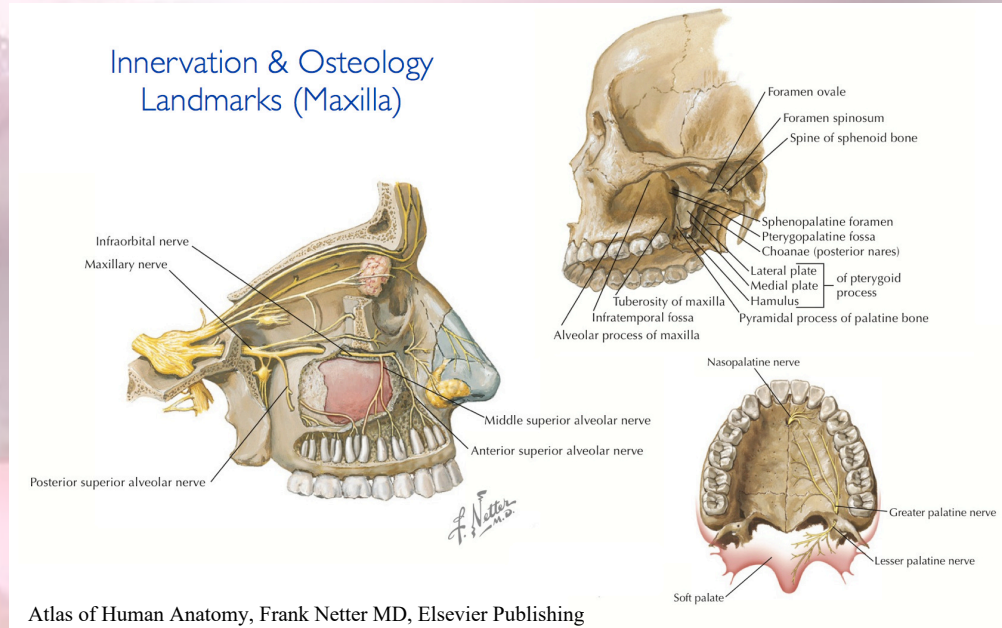
- Anatomy of the Mouth



"Blausen 0863 ToothAnatomy 02" by BruceBlaus. Blausen.com staff. "Blausen gallery 2014". Wikiversity Journal of Medicine. DOI:10.15347/wjm/2014.010. ISSN 20018762. - Own work

Diagram showing the structures of the tooth.

In general only the crown of the tooth is visible above the gingiva.



Atlas of Human Anatomy, Frank Netter MD, Elsevier Publishing

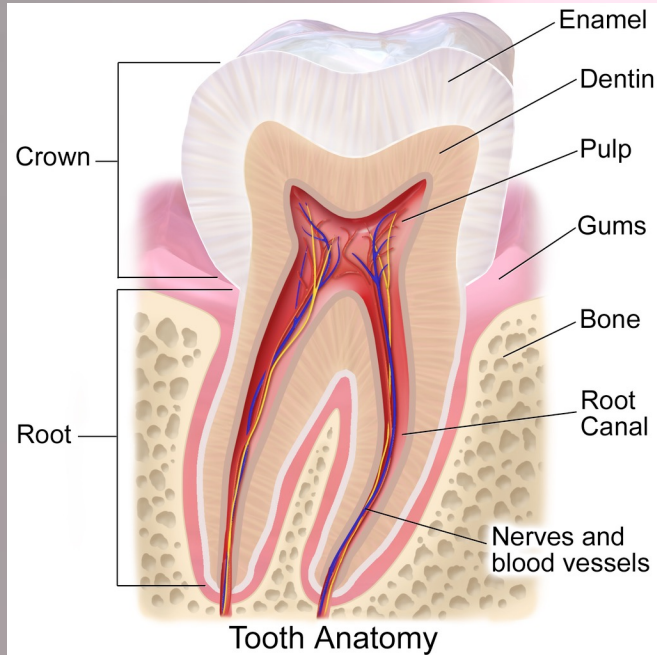
Landmarks of the Maxilla

4 primary components of the tooth

- Enamel
- Dentin
- Pulp
- Cementum

Lasers in Dentistry:

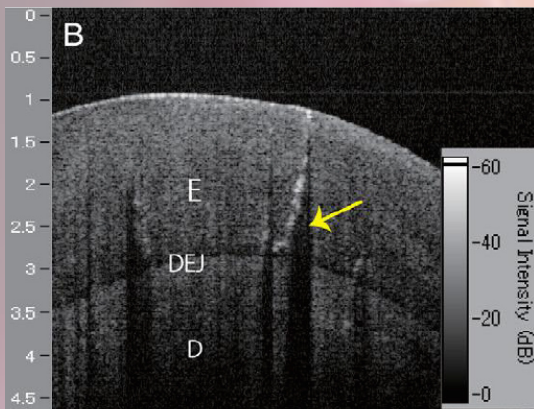
- Anatomy of the Mouth



"Blausen 0863 ToothAnatomy 02" by BruceBlaus. Blausen.com staff. "Blausen gallery 2014".
Wikiversity Journal of Medicine. DOI:10.15347/wjm/2014.010. ISSN 20018762

4 primary components of the human tooth

- Enamel: It is the hardest substance in the human body and contains the highest percentage of minerals, mainly calcium.
- Dentin: Yellow in appearance, it greatly affects the color of a tooth due to the translucency of enamel. Dentin, which is less mineralized and less brittle than enamel, is necessary for the support of enamel.
- Pulp: made up of living connective tissue and cells called odontoblasts. The dental pulp is a part of the dentin–pulp complex (endodontium)
- Cementum: calcified substance covering the root of a tooth. The cementum is the part of the periodontum that attaches the teeth to the alveolar bone.

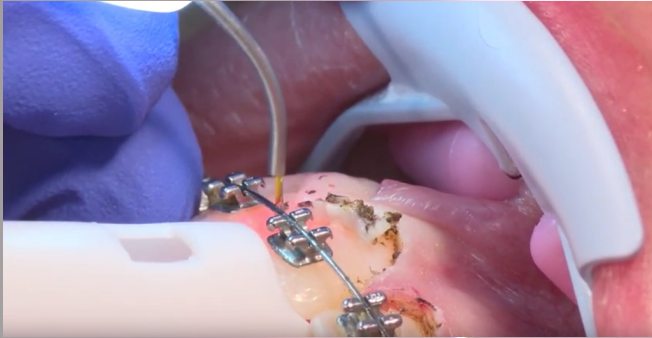


Lasers in Dentistry

- Laser Gingivectomy

A *Gingivectomy* is a periodontal (gum) surgery that removes, and reforms diseased gum tissue or other gingival buildup related to serious underlying conditions.

Performed in a dentist's office, the surgery is primarily done one quadrant of the mouth at a time under local anesthetic.



<https://www.youtube.com/watch?v=o0vFHj-EnyU>

Periodontal surgery is primarily performed to alter or eliminate the microbial factors that create periodontitis, and thereby stop the progression of the disease.

LASER type used in this surgery is a CO₂ laser with wavelength of 10,600nm and the beam is located using usually a He-Ne guidance laser and the actual cutting is seen following the path of the guide laser.

Original procedures were to use a scalpel (and stitches) with Hemadent (to stop bleeding) which evolved over time to using electrosurgery.

Electrosurgery is the use of electricity to remove tissue and cauterize the wound.

Summary:

A laser can be a useful tool in the fields of dermatology, refractive eye surgery and dentistry.

The type and choice of laser is facilitated by the absorption properties of the tissues to be treated.

The laser intensity is generally user controlled and is selected to maximize the treatment and minimize exposure time and damage to the surrounding tissue.

Homework: Kane Q3.7 & Q3.9 and Read Kane Chapter 4, sections 4.1 – 4.4 & Wolbarst Chapter 11, sections 11.1 – 11.12)