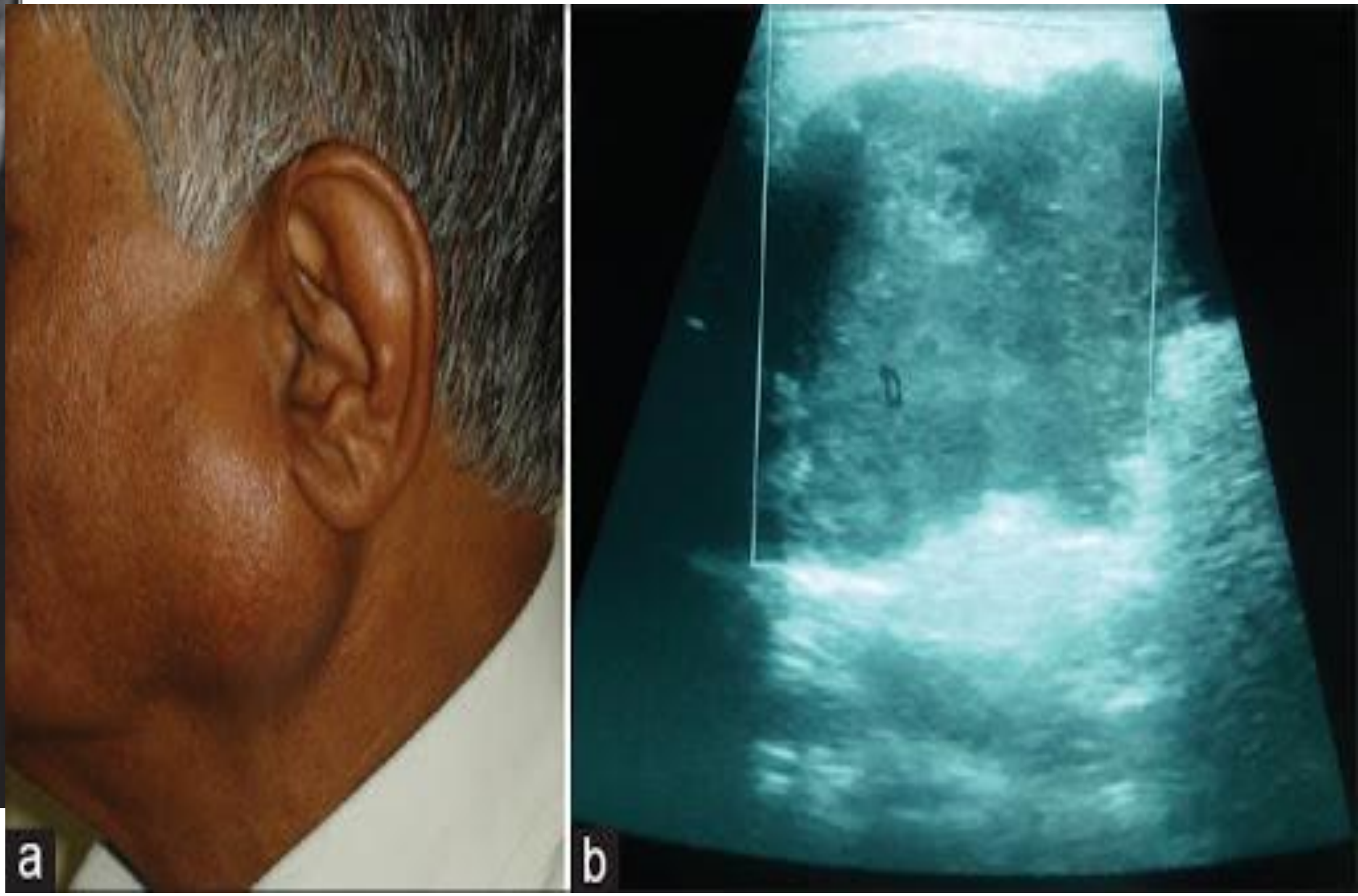
Advanced imaging modalities 18



PROF. ABBAS AY TAHER

Computed tomography :

The body structure of a three dimensional image is composed of a series of plane of cross-sectional images that is made along the axis in a computer.

The imaging in CT is made into cone beamed and fan beamed. Patient are positioned horizontally on the table .

The table slowly moves over the center of a X-ray machine. **This procedure is considered as a painless when compared to other test**

Clinical application

Diagnosis of **salivary gland pathologies ,TMJ ankylosis ,Fractures** ,

Maxillary sinus examination Implant placement

Advantages Desired image details are obtained.

Fast image rendering

ages

Computed tomography (CT)

Cone Beam Computed Tomography (CBCT)

Computed tomography (CT):

Computed tomography (CT) is today frequently used in imaging of the oral and maxillofacial region.

All radiological examinations must be based on clinical information and relevant clinical questions that should be answered. A useful investigation is one, in which the result – positive or negative – will alter patient management or add confidence to the clinician's diagnosis .

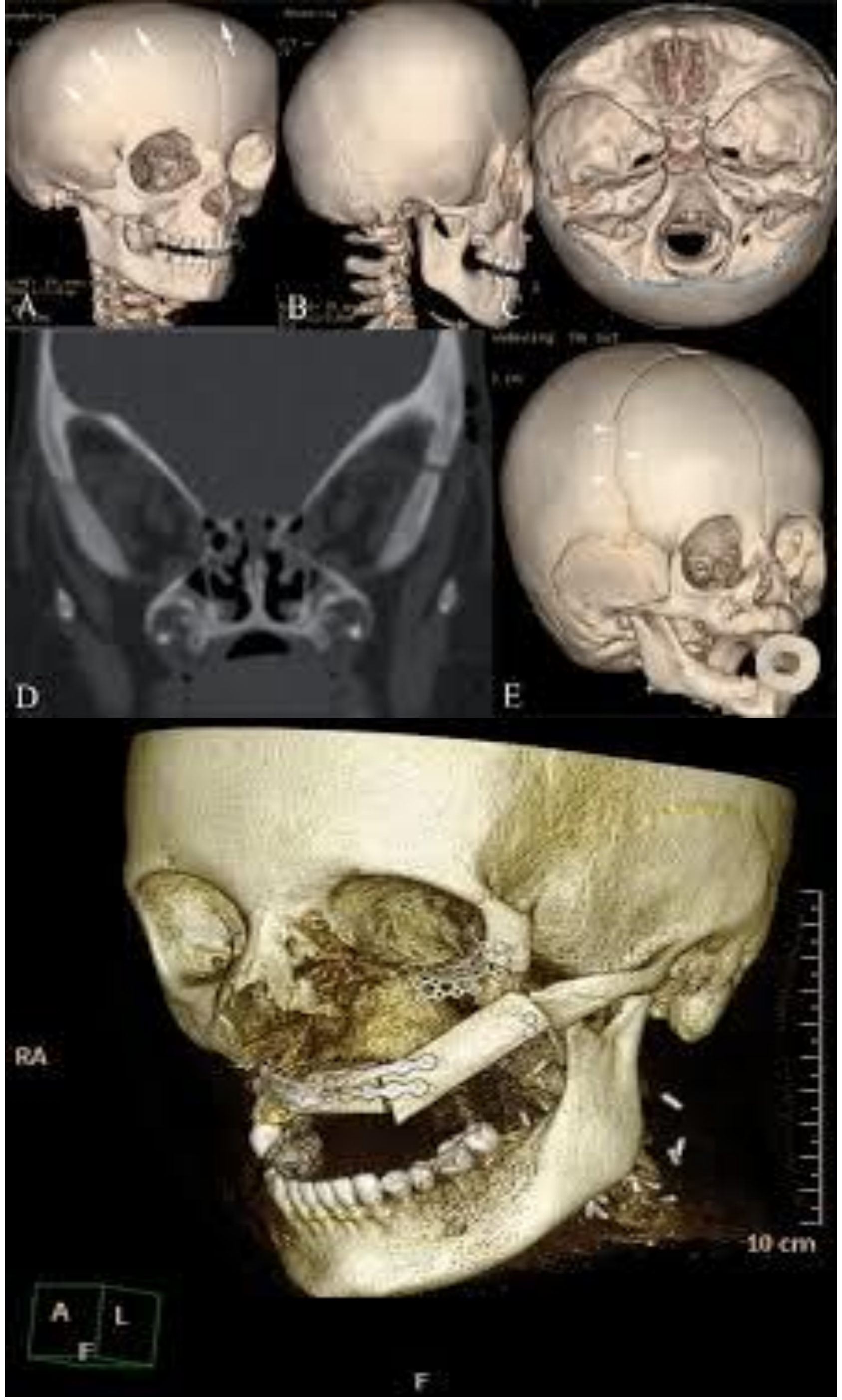
This is especially important regarding CT because the examination is expensive and might give very high radiation doses to the patient.

CT has the advantage over other radiographic techniques in that it has an inherent high-contrast resolution and tissues that differ in physical density by less than 1 % can be distinguished

CT is a digital technique providing images of thin slices with variable thickness.

The technique was described in 1972 by Allan McLeod Cormack and Godfrey Newbold Hounsfield, an invention for which they received the Nobel Prize in 1979.

Hounsfield constructed a machine where the X-ray tube rotated around the patient and a thin slice (8 mm) of the patient was scanned.



In the first generation of CT machines the image reconstruction time was around 30 minutes per slice.

Today CT machines are available that scan more than 100 mm/s with the images appearing on the monitor almost instantaneously. By simultaneously scanning several slices of the body (multislice CT), the scan time can be reduced significantly and the smallest details (resolution around 0.3 mm) can be imaged within short scan times.

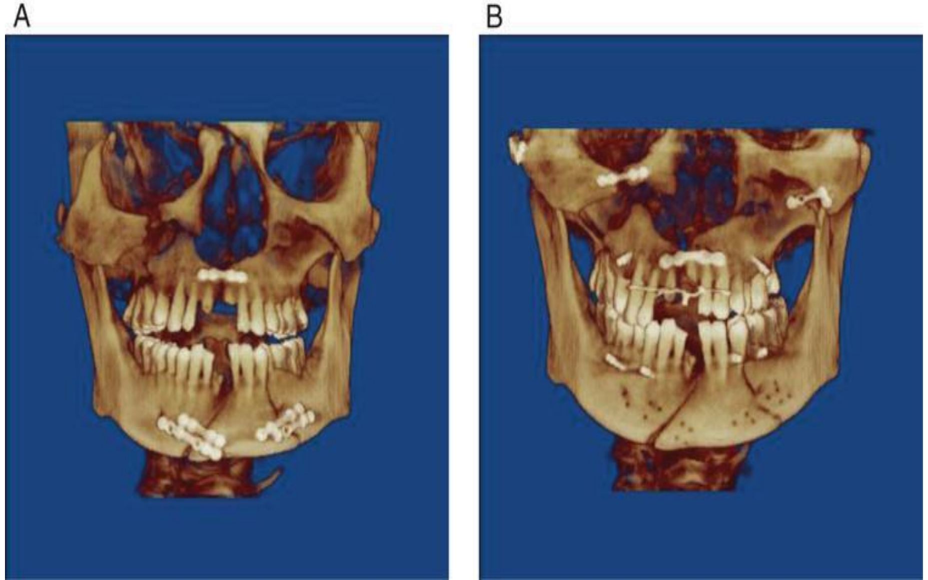
Multislice CT machines are common in medical radiology departments; the slice thickness is usually less than 1 mm by use of very small X-ray detectors and a fan-shaped X-ray beam transmitted through the patien

Difference between CT and CBCT in maxillofacial region:

CT is simply defined as the use of **X-ray-based imaging method to produce 3D images usually displayed in the form of image slices4**.

The CBCT machine uses cone-beam imaging technology **rather than a fan-shaped X-ray beam** ashat used in conventional CT machines. **The CBCT image quality was superior** to that of MSCT even though some variability existed among different CBCT systems in visualizing fine structures. Considering the low radiation dose and high resolution, **CBCT may be beneficial for dentomaxillofacial imaging**

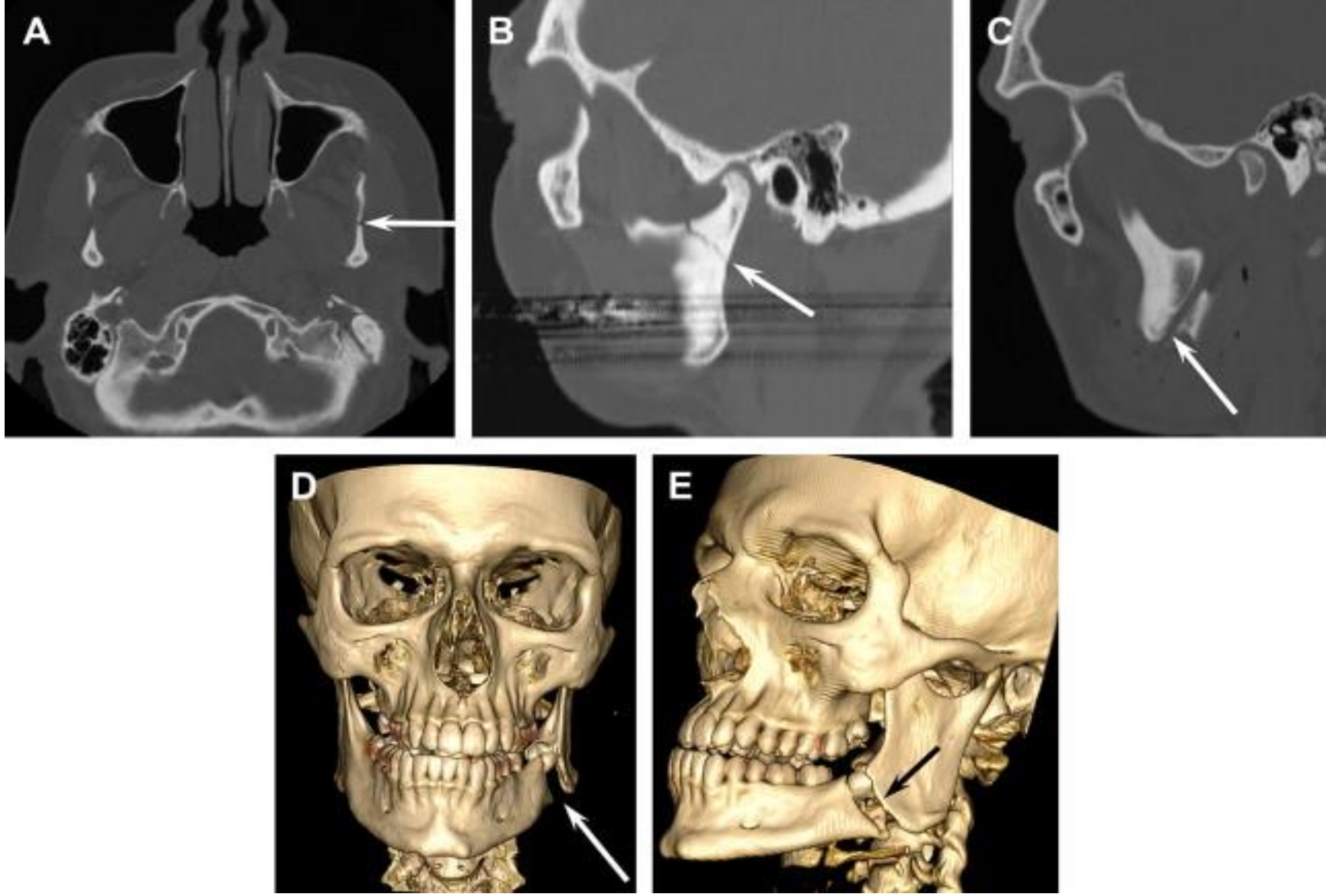
3D CT IMAGES



3D CBCT IMAGES

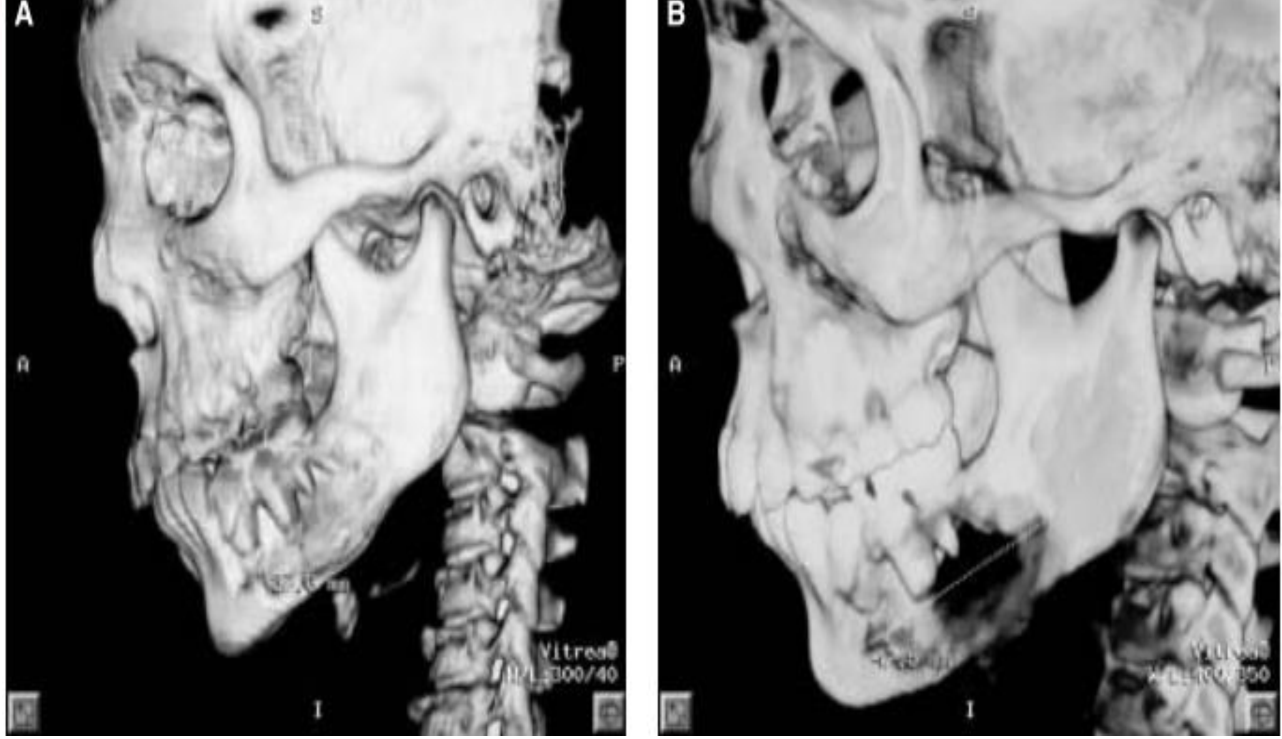
Apart from the types of CT machines described, DVT has now become available for maxillofacial imaging. In contrast to conventional CT, where slices are scanned DVT produces an image volume from a large number of conventional x-ray images. From this volume, slices of different thicknesses can be reconstructed in any plane. One advantage with DVT over conventional CT is the lower radiation dose.

A DVT or CT scan is mostly used in maxillofacial surgery. In some cases, a 3D diagnosis is also required for orthodontic treatments. Prior to orthodontic surgery, an advance 3D diagnosis is mandatory. In any case, prior to an implant surgery, preliminary examinations must take place. First, a panoramic x-ray is taken. When evaluating the X-ray, it is decided which teeth must be replaced



Utility of CT postprocessing in the evaluation of mandibular fractures. (*A*) Axial CT image through the mandibular ramus depicts a subtle fracture of the left sigmoid notch (*arrow*). The fracture might be easily overlooked in this plane. (*B*) The subcondylar fracture (*arrow*) is much more evident, and better characterized, on sagittal reformatted image. (*C*) Sagittal reformatted image in another patient demonstrates the relationship between the fracture and the inferior alveolar canal (*arrow*). (*D*) Surface-rendered 3D reconstruction in frontal projection provides surgeons with an excellent gestalt of the fracture pattern (*arrow*). (*E*) Surface renderings can be performed in any projection to best depict the fracture (*arrow*).

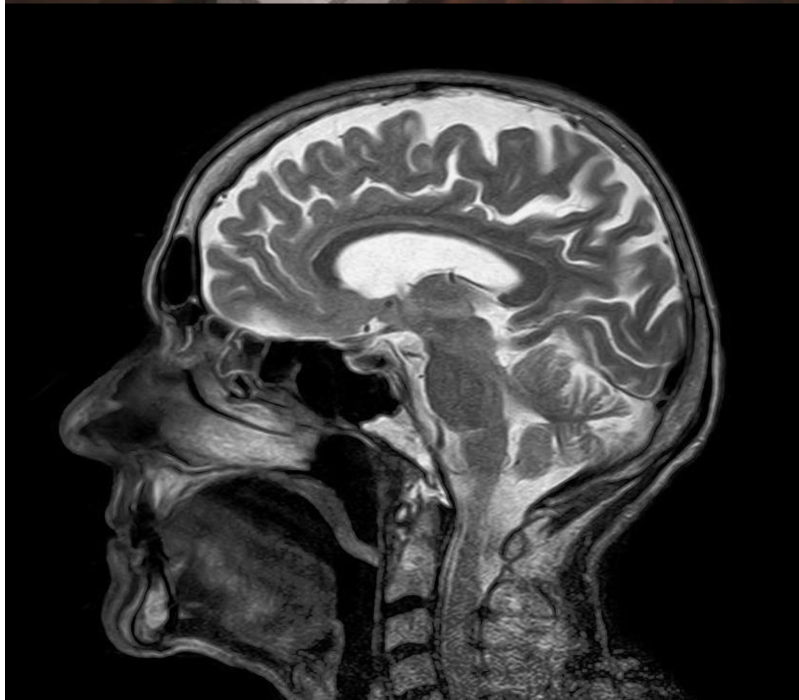
Imaging in facial trauma aims to define the number and locations of facial fractures and to identify injuries that could compromise the airway, vision, mastication, lacrimal system, and sinus function. Individual fractures should be listed and associated soft tissue injuries described with attention to these areas. If possible, bony findings should be summarized in one of several typical fracture pattern



Dentigerous cyst of the mandible. A: 3D-CT surface-rendered image of the lesion indicating 37.6 mm of length destruction. B: 3D-CT volume-rendered image of the same lesion indicating 47.5 mm of length destruction

Postoperativ CT
3D
reconstruction

Magnetic resonance imaging (MRI)



Magnetic resonance imaging (**MRI**) is a medical imaging technique used in radiology to form pictures of the anatomy and the physiological processes of the body.

MRI scanners use strong magnetic fields, magnetic field gradients, and radio waves to generate images of the organs in the body.

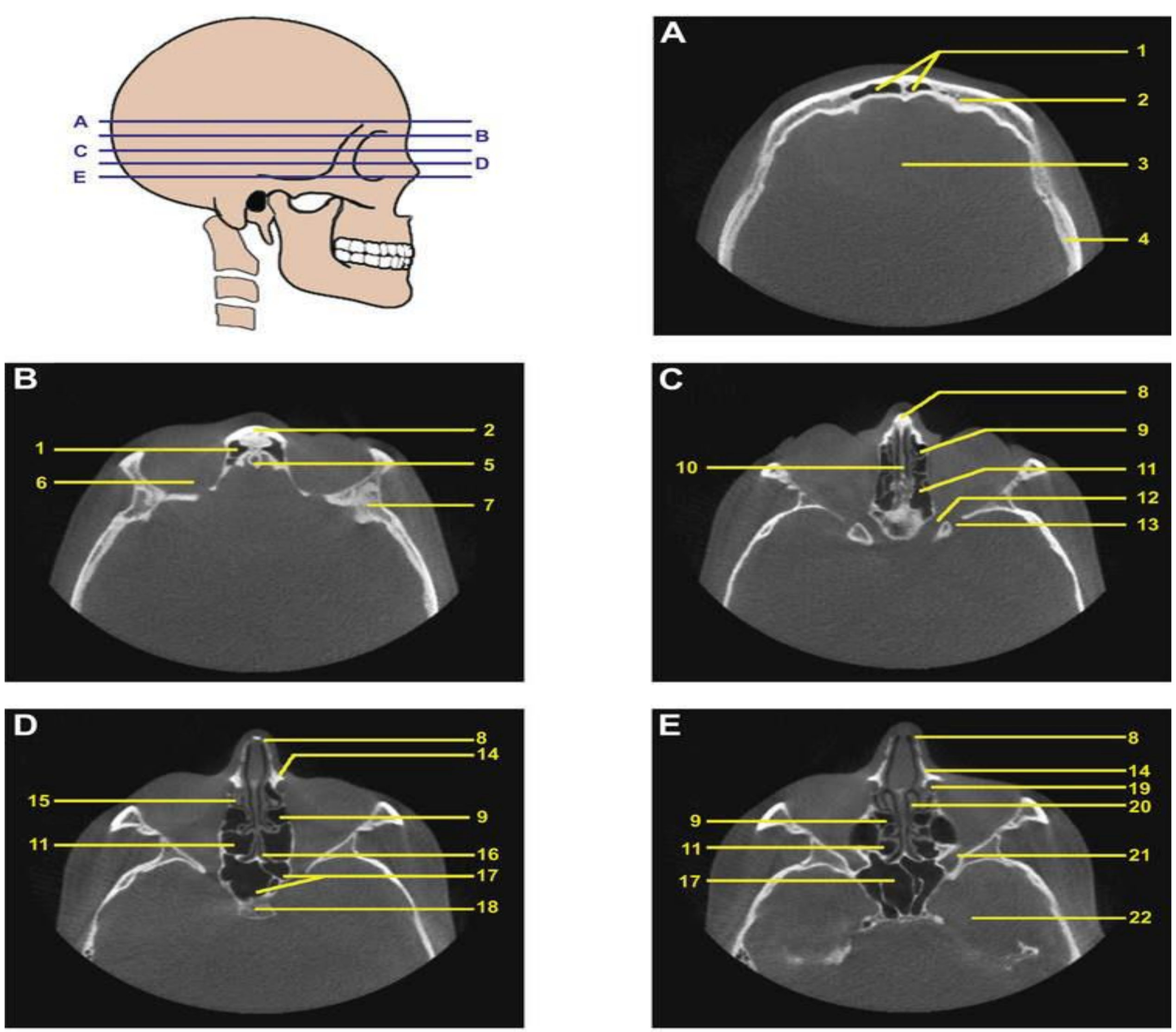
MRI is a non-invasive imaging technology that produces three dimensional detailed anatomical images. It is often used for disease detection, diagnosis, and treatment monitoring.

It is based on sophisticated technology that excites and detects the change in the direction of the rotational axis of protons found in the water that makes up living tissue

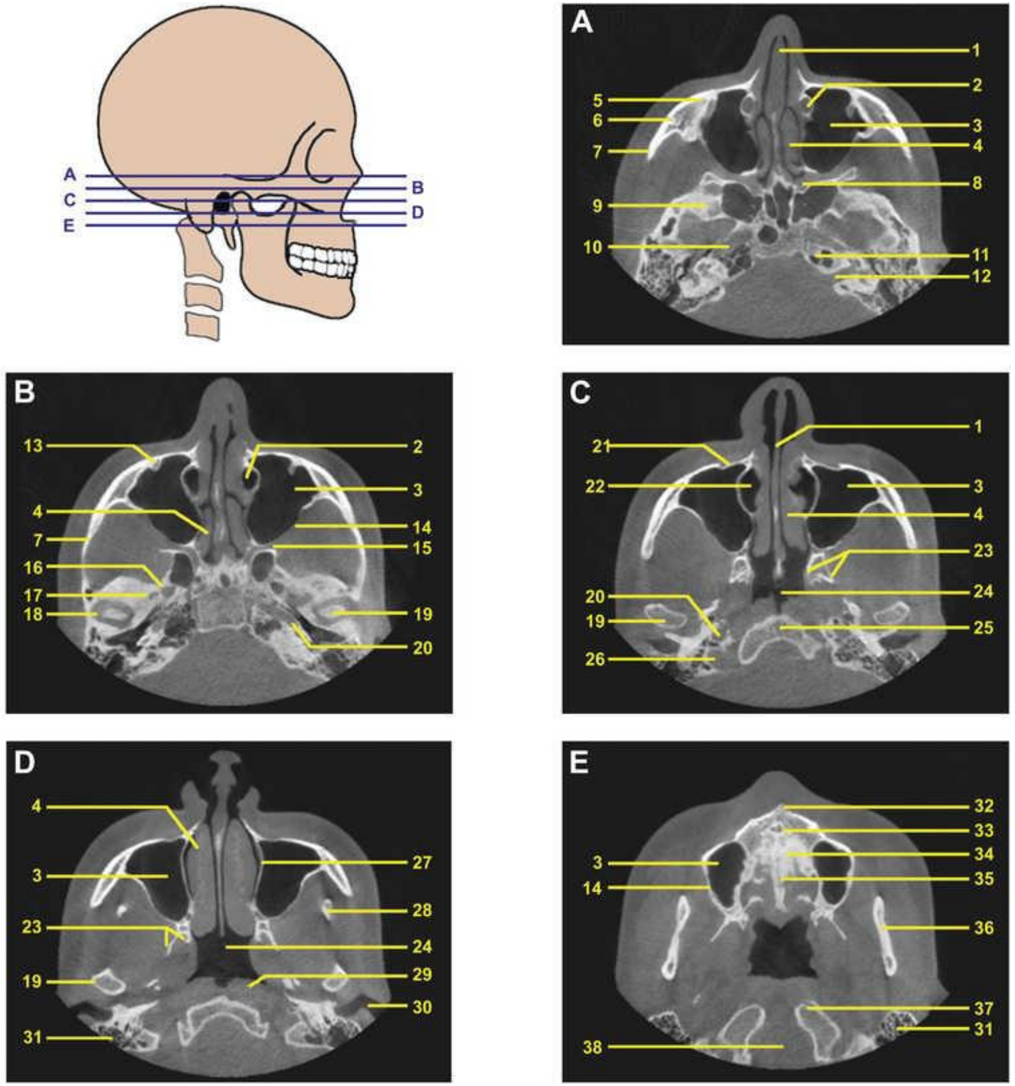
Although MRI does not emit the ionizing radiation that is found in x-ray and CT imaging, it does employ a strong magnetic field.

The magnetic field extends beyond the machine and exerts very powerful forces on objects of iron, some steels, and other magnetizable objects; it is strong enough to fling a wheelchair across the room.

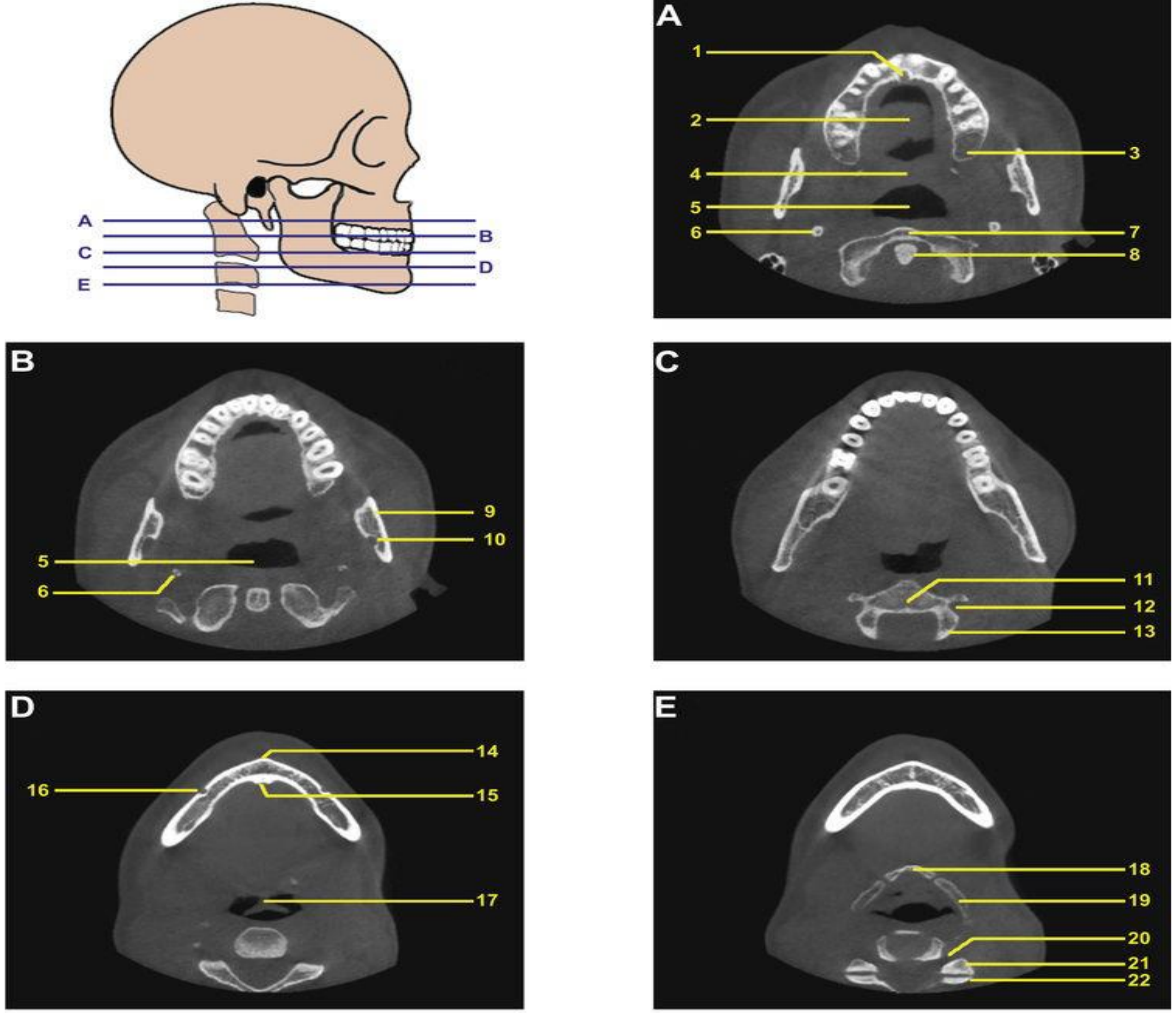
Patients should notify their physicians of any form of medical or implant prior to an MR scan



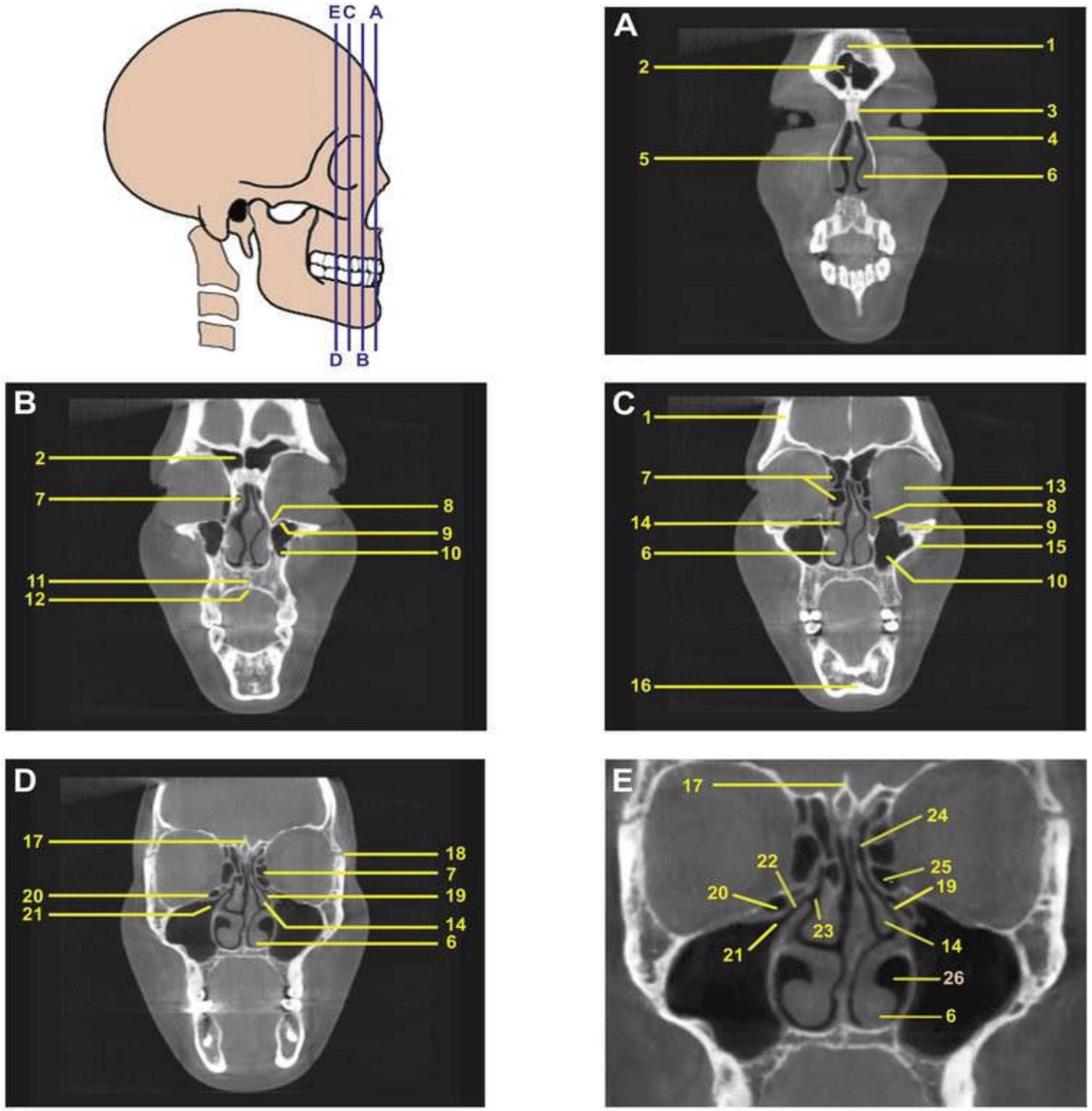
1. Frontal sinus
2. Frontal bone
3. Anterior cranial fossa
4. Squamous portion of temporal bone
5. Crista galli
6. Orbit
7. Greater wing of sphenoid bone
8. Nasal bone
9. Anterior ethmoid air cells
10. Perpendicular plate of ethmoid bone
11. Posterior ethmoid air cells
12. Optic canal
13. Superior orbital fissure
14. Nasal process of maxillary bone
15. Uncinate process
16. Sphenoethmoid recess
17. Sphenoid sinus
18. Floor of sella turcica
19. Nasolacrimal duct
20. Superior turbinate
21. Inferior orbital fissure
22. Middle cranial fossa



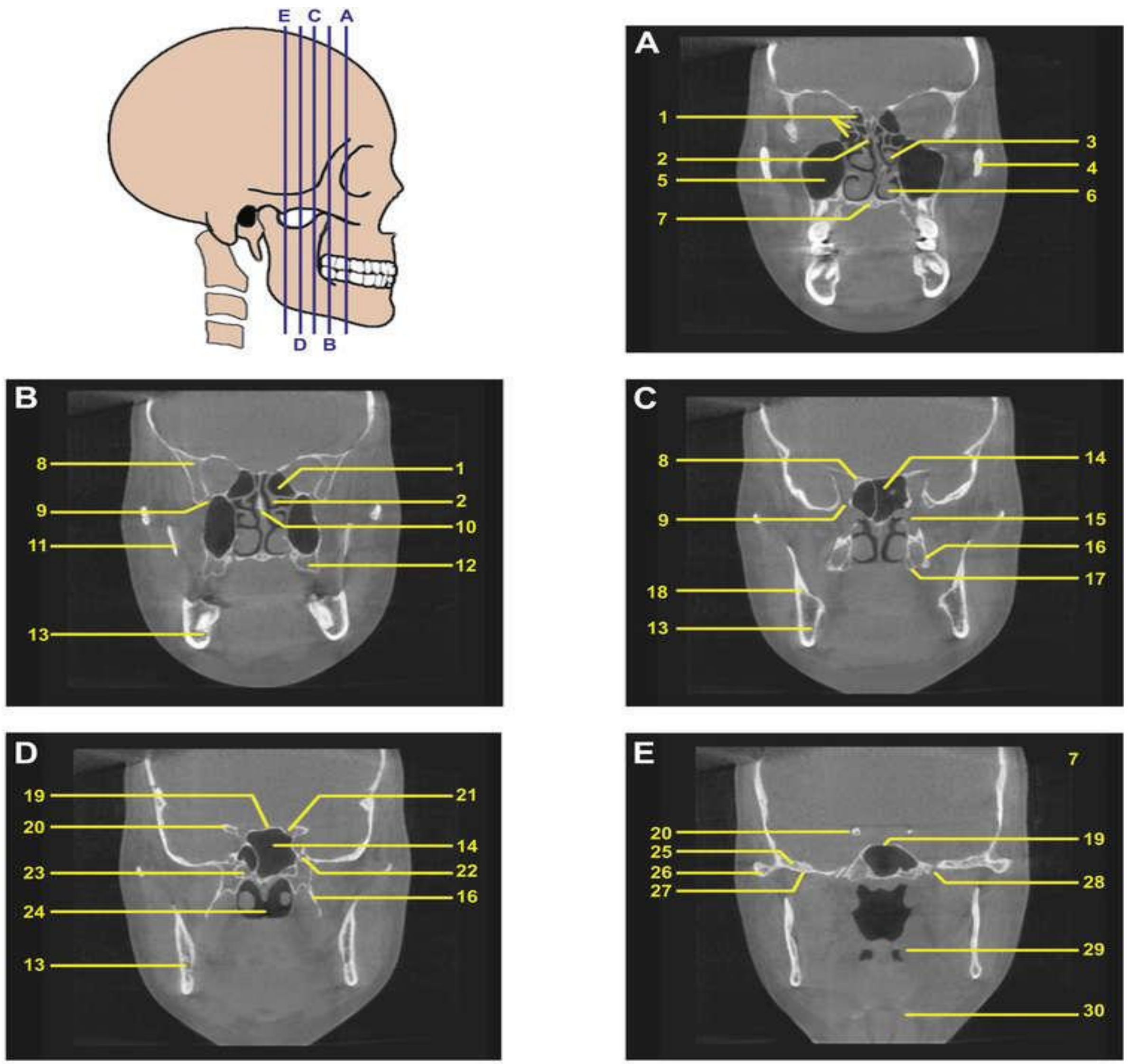
1. Nasal septum
2. Nasolacrimal duct
3. Maxillary sinus
4. Nasal turbinate
5. Zygomatic process of maxilla
6. Zygomatico-maxillary suture
7. Zygomatic arch
8. Pterygopalatine fossa
9. Greater wing of sphenoid bone
10. Carotid canal
11. Petrous portion of temporal bone
12. Internal auditory canal
13. Infraorbital canal
14. Lateral wall of maxillary sinus
15. Pterygomaxillary fissure
16. Foramen ovale
17. Foramen spinosum
18. Glenoid fossa
19. Mandibular condyle
20. Carotid canal
21. Infraorbital foramen
22. Nasal cavity
23. Pterygoid plates
24. Nasopharyngeal airway
25. Occipital bone
26. Jugular foramen
27. Medial wall of maxillary sinus
28. Coronoid process
29. Pharyngeal wall
30. External auditory meatus
31. Mastoid process
32. Anterior nasal spine
33. Nasopalatine canal
34. Hard palate
35. Intermaxillary suture
36. Ramus of mandible
37. Anterior arch of atlas (C1)
38. Foramen magnum



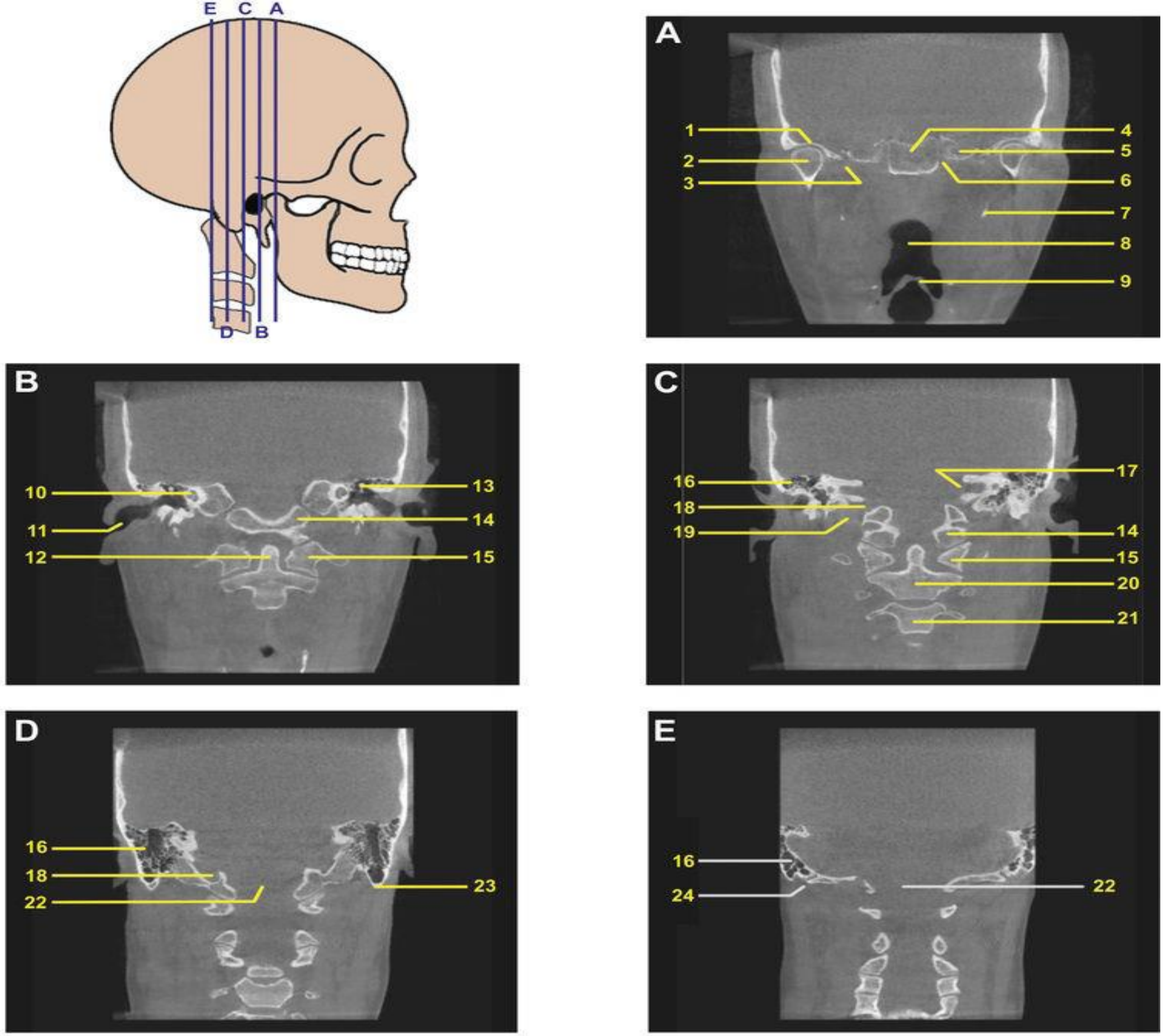
1. Incisive foramen
2. Tongue
3. Maxillary tuberosity
4. Soft palate
5. Oropharyngeal airway
6. Styloid process
7. Anterior arch of atlas (C1)
8. Odontoid process of C2
9. Ramus of mandible
10. Mandibular foramen
11. Inferior body of C2
12. Transverse foramen
13. Lamina of C2
14. Mandibular symphysis
15. Genial tubercles
16. Mental foramen
17. Epiglottis
18. Body of hyoid bone
19. Greater cornu of hyoid bone
20. C2-C3 neural foramen
21. Superior articular process of C3
22. Inferior articular process of C2



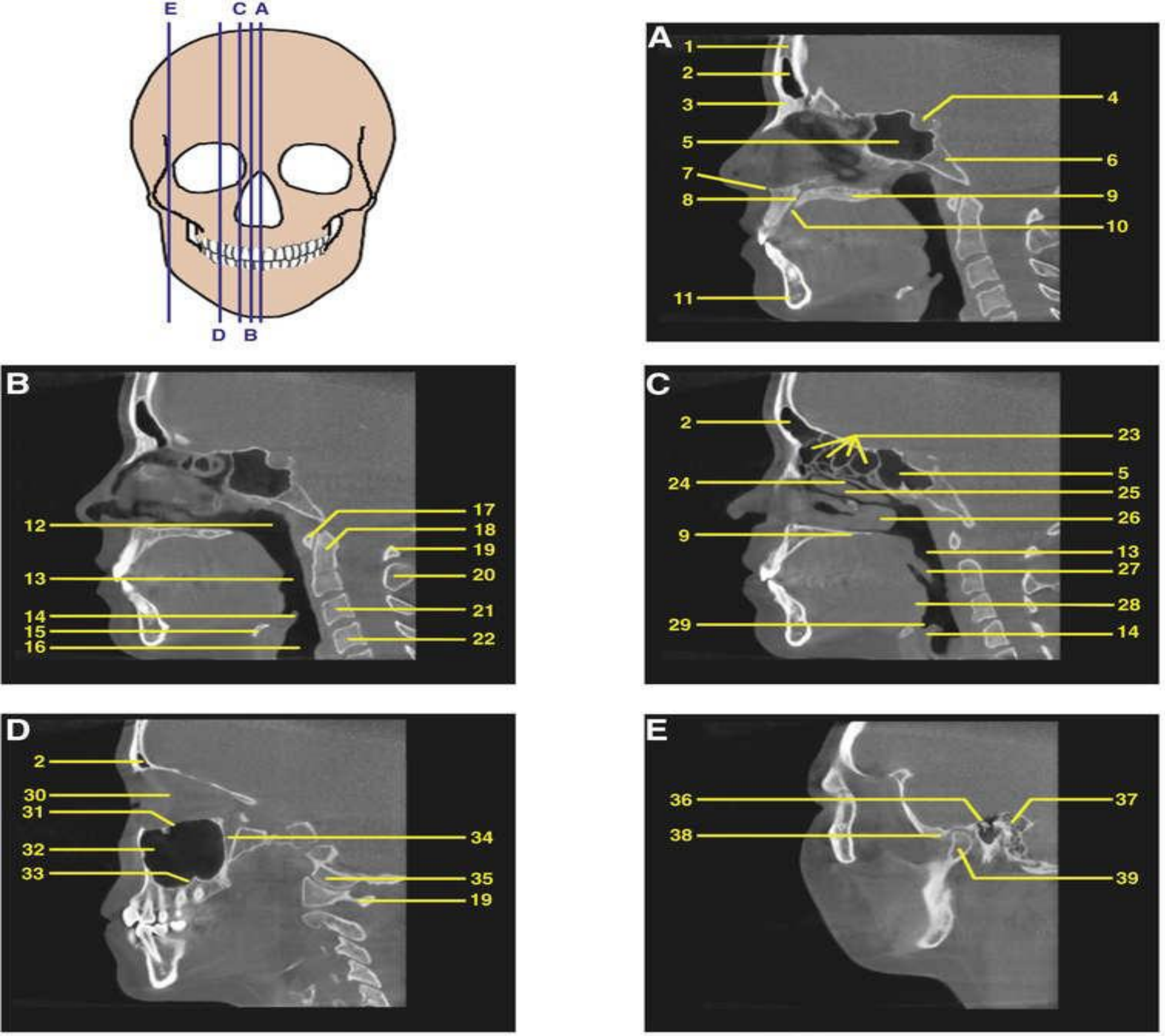
1. Frontal bone
2. Frontal sinus
3. Nasal bone
4. Maxillary bone
5. Nasal septum
6. Inferior nasal turbinate
7. Ethmoid air cells
8. Nasolacrimal duct
9. Infraorbital canal
10. Maxillary sinus
11. Nasopalatine canal
12. Incisive foramen
13. Orbit
14. Middle nasal turbinate
15. Zygomatic process of the maxilla
16. Mandible
17. Crista galli of ethmoid bone
18. Fronto-zygomatic suture
19. Uncinate process
20. Infraorbital ethmoid air cells (Haller cells)
21. Ostium of maxillary sinus
22. Infundibulum
23. Hiatus semilunaris
24. Frontal recess
25. Ethmoid bulla
26. Inferior meatus



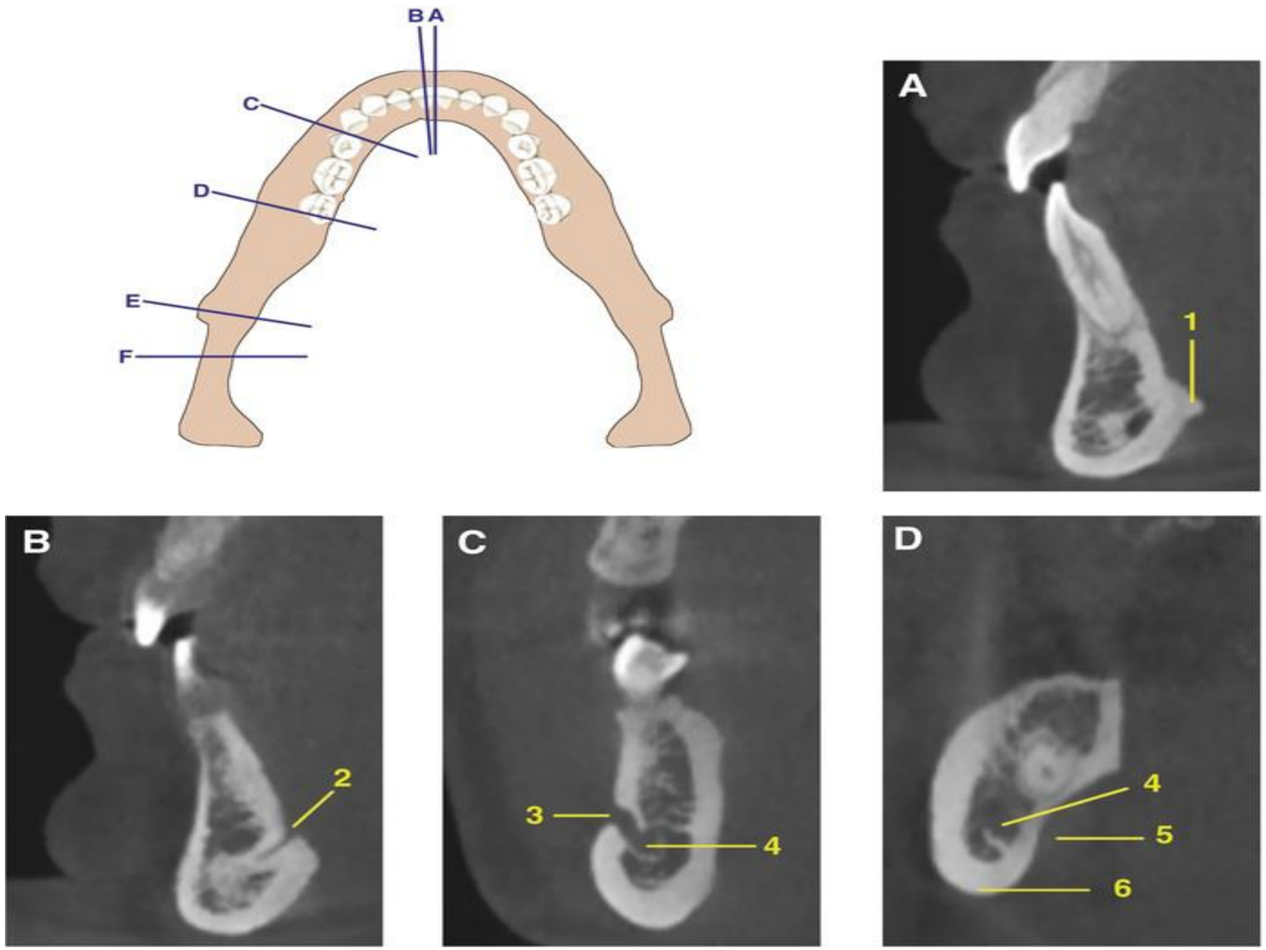
1. Ethmoid air cells
2. Superior nasal turbinate
3. Middle nasal turbinate
4. Zygomatic arch
5. Maxillary sinus
6. Inferior nasal turbinate
7. Hard palate (floor of nasal cavity)
8. Sphenoid bone
9. Inferior orbital fissure
10. Perpendicular plate of ethmoid bone
11. Coronoid process of mandible
12. Maxillary tuberosity
13. Inferior alveolar canal
14. Sphenoid sinus
15. Pterygopalatine fossa
16. Lateral pterygoid plate
17. Medial pterygoid plate
18. Mandibular ramus
19. Floor of sella turcica
20. Anterior clinoid process
21. Optic canal
22. Foramen rotundum
23. Pterygoid (vidian) canal
24. Nasopharyngeal airway
25. Squamous temporal bone
26. Zygomatic process of temporoal bone
27. Sphenosquamousal suture
28. Foramen ovale
29. Palatine tonsils
30. Hyoid bone

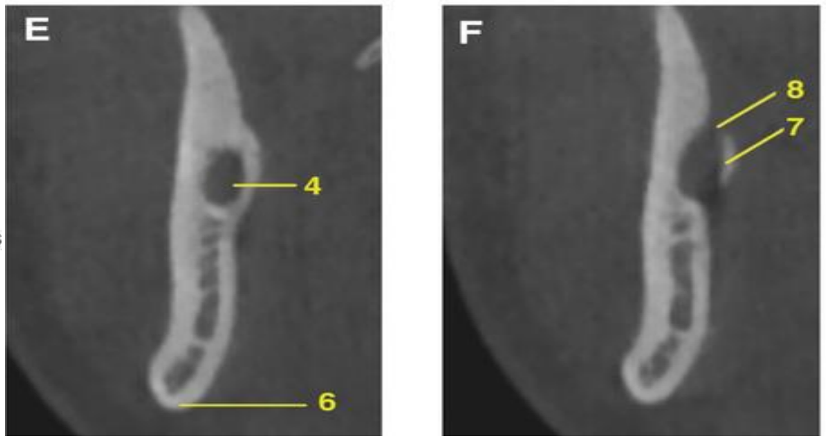


1. Glenoid fossa
2. Mandibular condyle
3. Foramen spinosum
4. Basiocciput
5. Carotid canal
6. Petrooccipital suture
7. Styloid process
8. Oropharnygeal airway
9. Epiglottis
10. Semicircular canal
11. External auditory meatus
12. Odontoid process of C2
13. Ossicles of ear
14. Occipital condyles
15. Lateral mass of C1
16. Mastoid air cells
17. Internal auditory meatus
18. Jugular foramen
19. Jugular bulb
20. Body of C2
21. Body of C3
22. Foramen magnum
23. Mastoid process
24. Occipito-mastoid suture



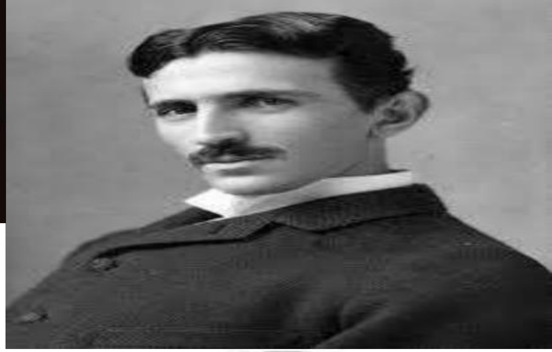
1. Frontal bone
2. Frontal sinus
3. Nasal bone
4. Sella turcica
5. Sphenoid sinus
6. Clivus
7. Anterior nasal spine
8. Nasopalatine canal
9. Hard palate
10. Incisive foramen
11. Mandibular symphysis
12. Nasopharyngeal airway
13. Oropharyngeal airway
14. Epiglottis
15. Hyoid bone
16. Hypopharynx
17. Anterior arch of C1
18. Odontoid process of C2
19. Posterior arch of C1
20. Spinous process of C2
21. Body of C3
22. Body of C4
23. Ethmoid air cells
24. Hiatus semilunaris
25. Middle turbinate
26. Inferior turbinate
27. Soft palate
28. Base of tongue
29. Vallecula
30. Orbit
31. Floor of orbit/Roof of maxillary sinus
32. Maxillary sinus
33. Floor of maxillary sinus
34. Pterygopalatine fossa
35. Occipital condyle
36. Ossicle of middle ear
37. Mastoid process
38. Articular eminence
39. Mandibular condyle



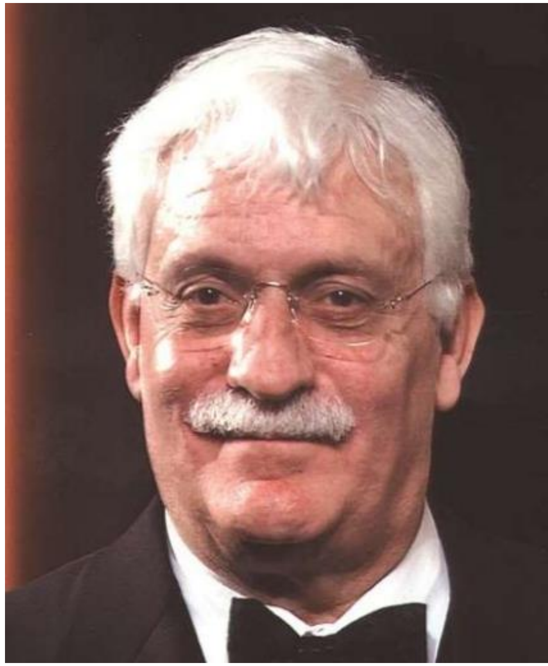


1. Genial tubercle
2. Lingual foramen
3. Mental foramen
4. Inferior alveolar canal
5. Submandibular fossa
6. Inferior border of mandible
7. Lingula
8. Mandibular foramen

HISTORY OF MRI



Isidor Rabi (1898-1988)



Nikola Tesla discovered the Rotating Magnetic Field in 1882 in Hungary
In 1956, the "Tesla Unit" was proclaimed.
All MRI machines are calibrated in "Tesla Units".The strength of a magnetic field is measured in Tesla or Gauss Units. 1 Tesla = 10,000 Gauss
Low-Field MRI= Under 0.2 Tesla (2,000 Gauss)
Mid-Field MRI= 0.2 - 0.6 Tesla (2,000 - 6,000 Gauss)
High-Field MRI= 1.0 - 1.5 Tesla (10,000 - 15,000 Gauss).
In 1937, Professor Isidor I. Rabi, observed the quantum phenomenon dubbed nuclear magnetic resonance (NMR). He recognized that the atomic nuclei show their presence by absorbing or emitting radio waves when exposed to a sufficiently strong magnetic field.
Raymond Damadian, a physician, discovered that hydrogen signal in cancerous tissue is different from that of healthy tissue because tumors contain more water.
More water means more hydrogen atoms. When the MRI machine was switched off, the bath of radio waves from cancerous tissue will linger longer then those from the healthy tissue .
In 1973, Paul Lauterbur, a chemist, produced the first NMR image. On July 3, 1977, first human scan was made as the first MRI prototype. (The process took 5 hours).

MECHANISM OF ACTION

Magnetic field temporarily realigns hydrogen atoms in your body.
Radio waves cause these aligned atoms to produce signals
Signals used to create cross-sectional MRI images

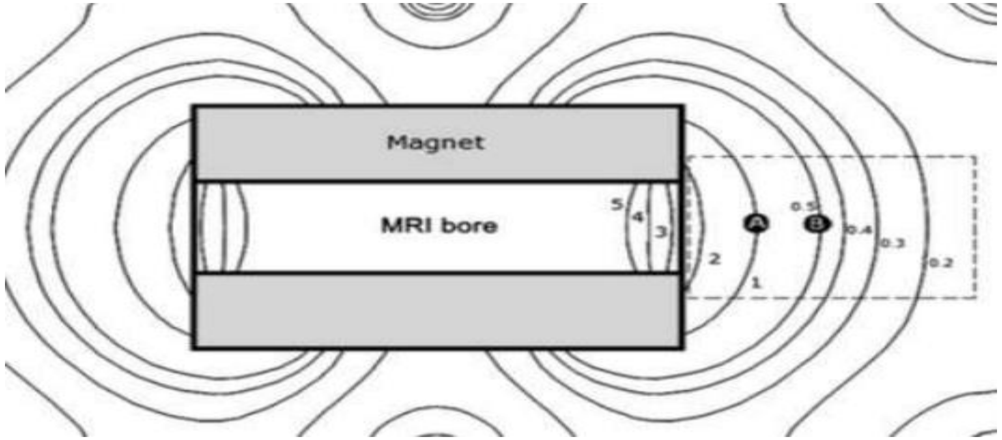
COMPONENTS OF MRI MACHINE

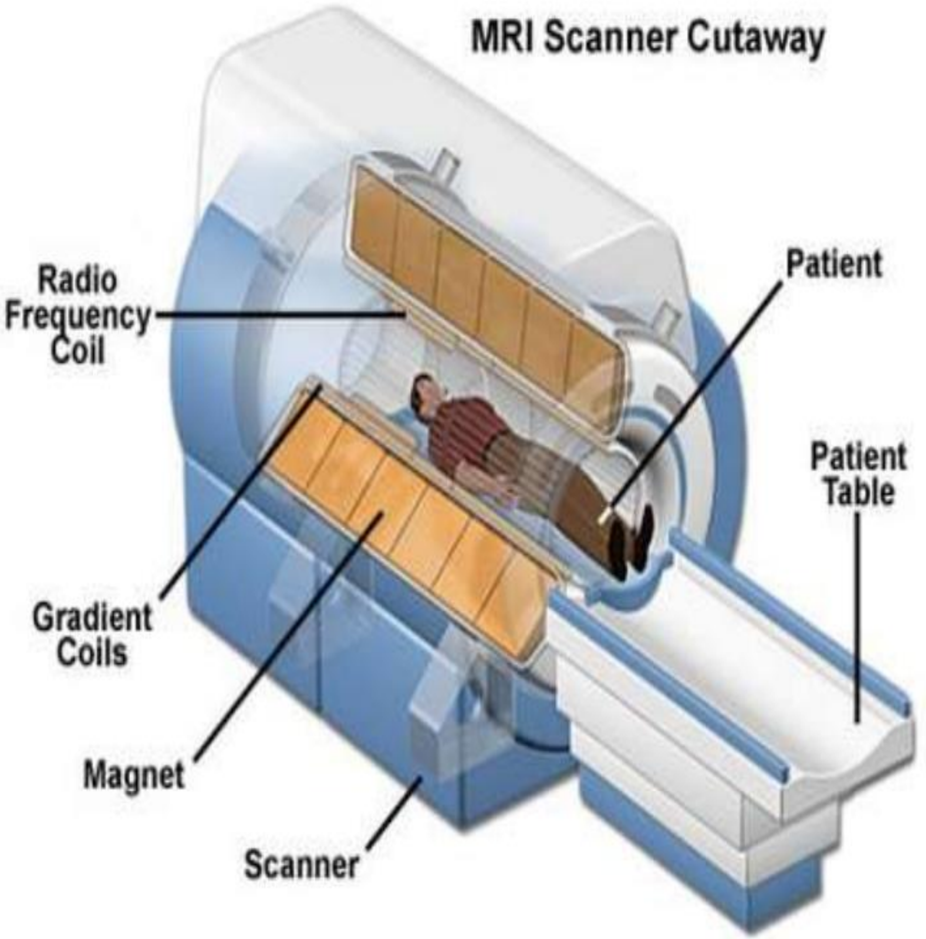
Magnet:

There is a horizontal tube that runs through the magnet and is called a bore.

Most MRI magnets use a magnetic field of 0.5 to 2.0 tesla. (Earth's magnetic field is only 0.5 gauss.)

The magnetic field is produced by passing current through multiple coils that are inside the magnet



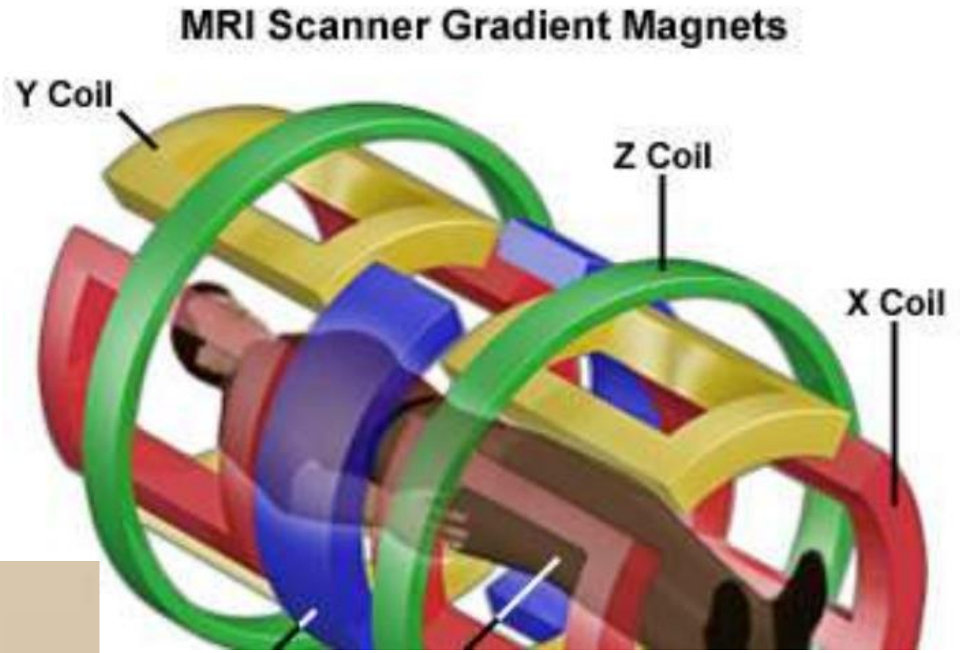


Gradient Coils:

There are ***three*** different **gradient coils** located within the **main magnet.**

Each one of these produce three different magnetic fields that are each less strong that the main field.

The gradient coils create a variable field (x, y, z) that can be increased or decreased to allow specific and different parts of the body to be scanned by altering and adjusting the main magnetic field.

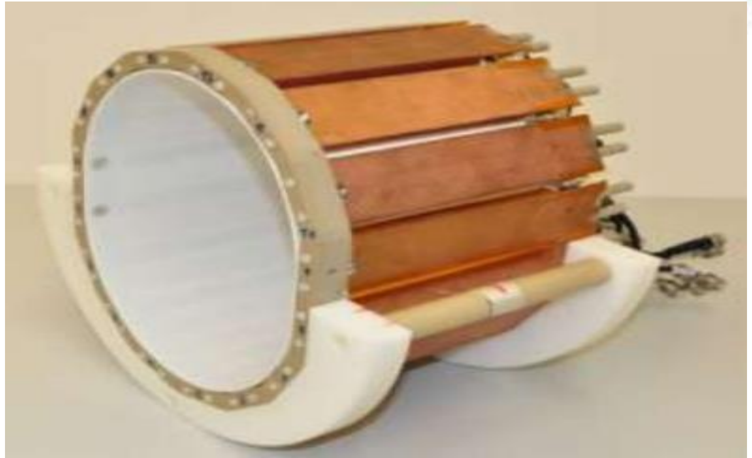


Radio Frequency (RF) coils:

Transmit radio frequency waves into the patient's body.

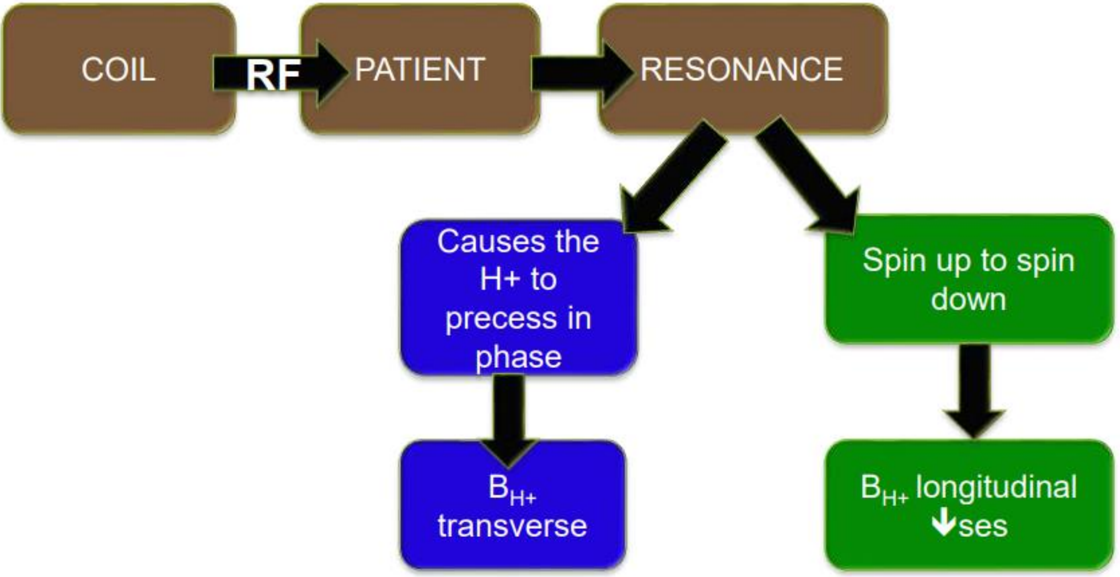
There are different coils located inside the MRI scanner to transmit waves into different body parts.

If a certain area of the body is specified, then all the RF coils usually become focused on the body part being imaged to allow for a better scan.

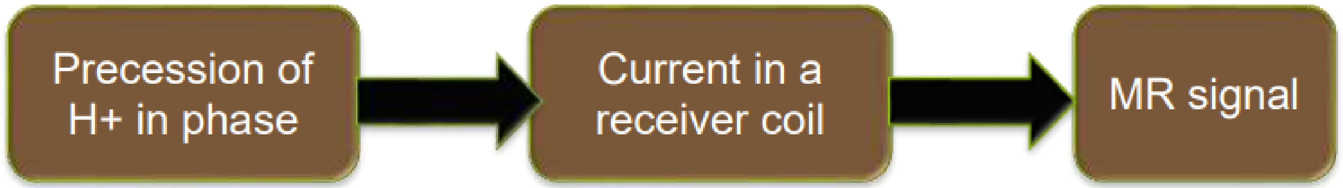


RESONANCE :

Energy ↓ to energy ↑ provided by radiofrequency(RF) spectrum of EM spectrum.
When RF =larmor frequency → resonance.



MAGENTIC RESONANCE SIGNAL



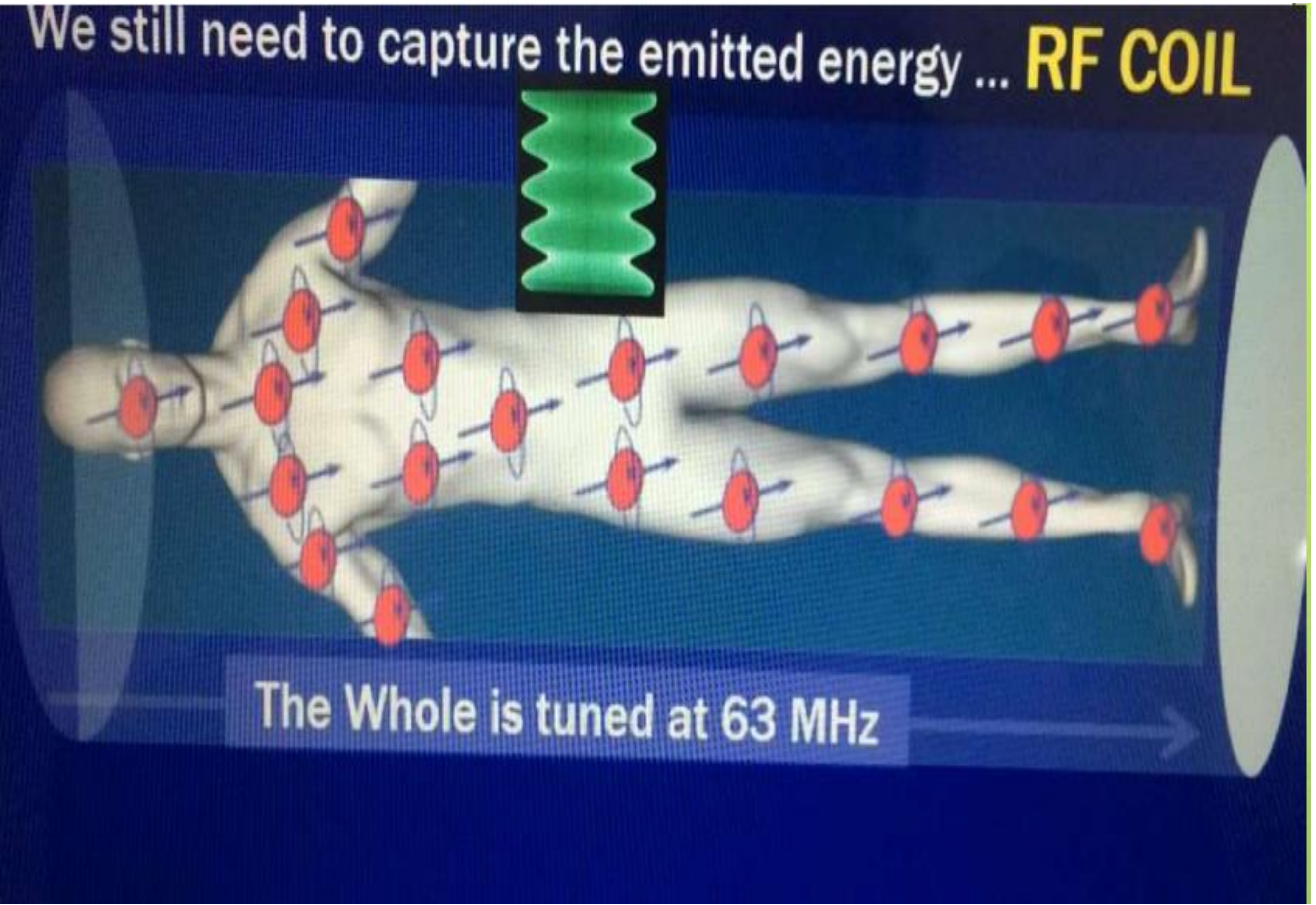
T1 RELAXATION TIME

It is an exponential process and the time required for 63% of the magnetization to return to equilibrium (the time constant) by this transfer of energy.

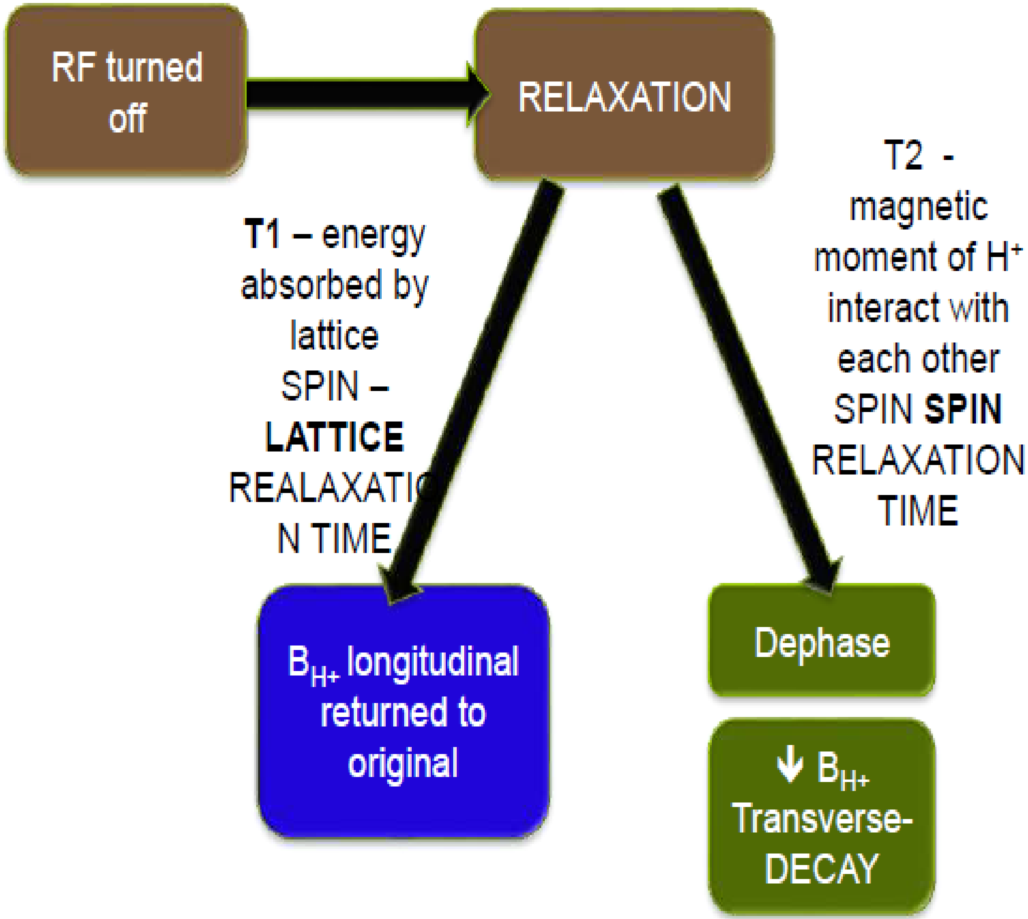
T2 RELAXATION TIME

Time constant that describes the exponential rate of loss of transverse magnetization.

T2 occurs more rapidly then T1



T1 and T2 RELAXATION



How does it work?

Images are constructed when protons in different tissues return to equilibrium state at different rates.

Five variables effect these rates

Spin Density: Concentration of nuclei in tissue processing in a given region under a magnetic field.

T_1: Longitudinal relaxation time

T_2: Transverse relaxation time

Flow: Shows blood flow, CSF flow

Spectral Shifts: Angle/zoom the picture is taken from

Basic MRI Scans

T_1-weighted: Differentiate fat from water

Water is Darker, fat is brighter

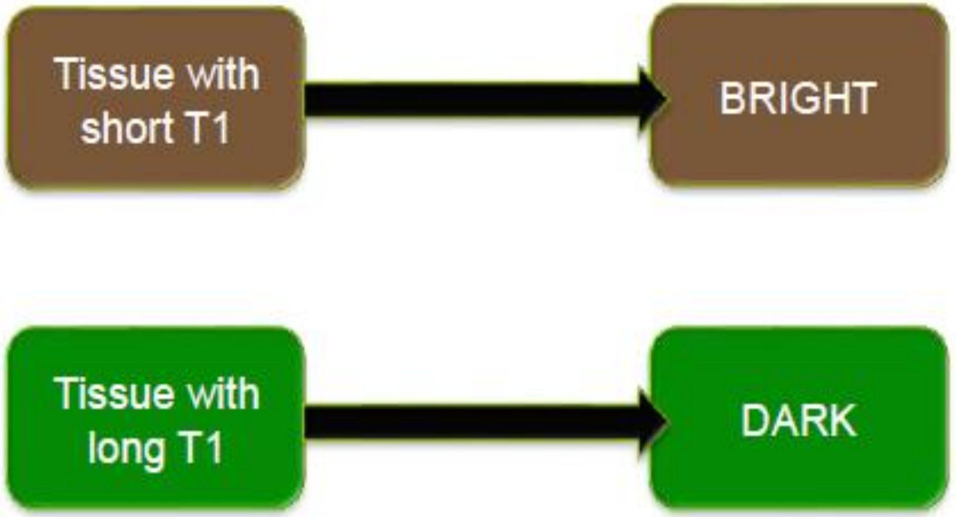
Provide good gray matter/white matter contrast in brain.

T_2-weighted: Differentiate fat from water

Fat shows darker, and water lighter.

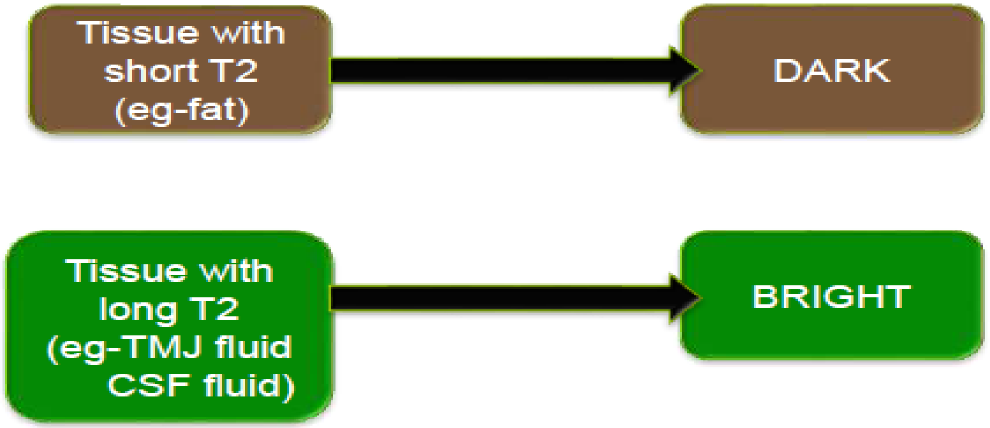
Good for imaging edema

Abnormal accumulation of fluid beneath the skin or in one or more cavities of the body.



USE

- anatomy



USE

- Pathology- since pathologic tissue has more water.

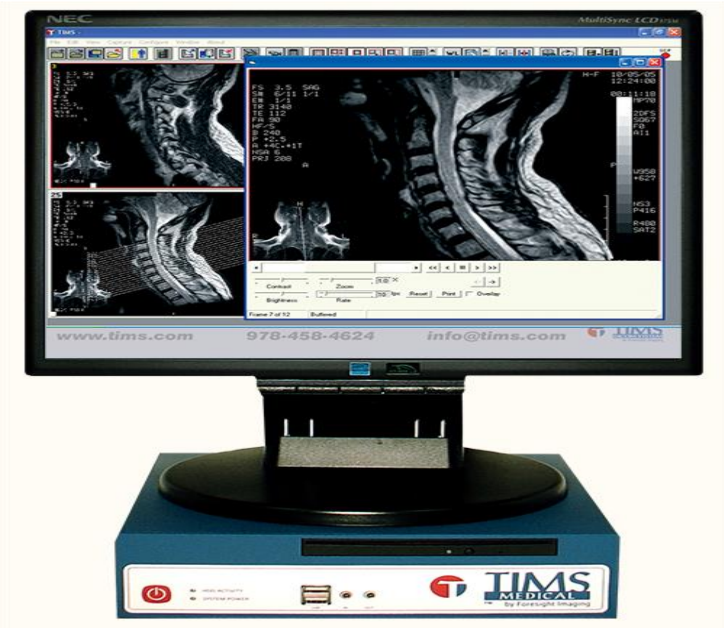
Patient Table: This component simply slides the patient into the **MRI machine**.The position at which the patient lies down on the table is **determined by the part of the body** that is being scanned.Area under examination is placed in the exact

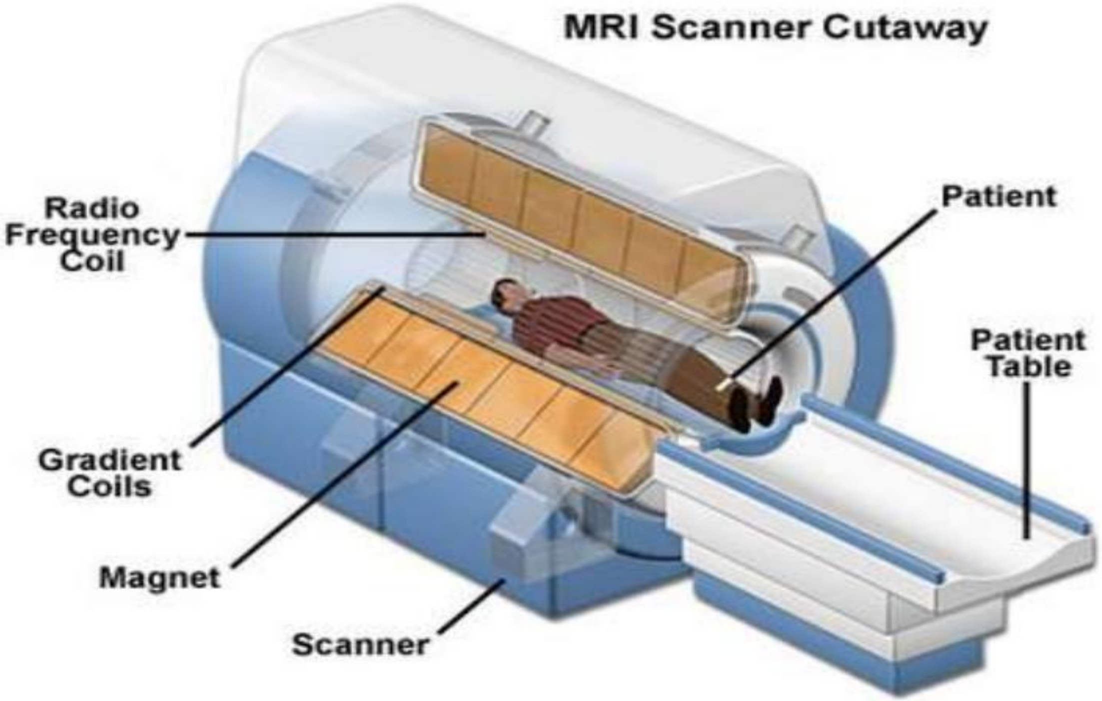
centre of the magnetic field (**isocentre**).

Antenna/Computer System

The antenna detects the **RF** signals emitted by a patient's body and **feeds this information into the computer system**.

The computer system: function is to receive, record, and analyze the images of the patient.**interprets** the data produce an understandable image





ADVANTAGES

scanning and detection of abnormalities in soft tissue

MRI scan can provide information about the blood circulationThere is no involvement of any kind of radiations in the MRI,Painless images may be acquired in multiple planes (Axial, Sagittal, Coronal, or Oblique) without repositioning the patient.

MRI images demonstrate superior soft tissue contrast than CT scans and plain films making it the ideal examination of the brain, spine, joints and other soft tissue body parts

functional MRI allows visualization of both active parts of the brain during certain activities and understanding of the underlying networks

DISADVANTAGES:

MRI scans are considered to be a safe procedure providing you do not have any implants or objects on you that must not go in the scanner.

The powerful magnetic fields generated by the MRI scanner will attract metal objects

The magnetic field of the MRI scanner can also pull on any metal-containing object in your body, such as medicine pumps and aneurysm clips.

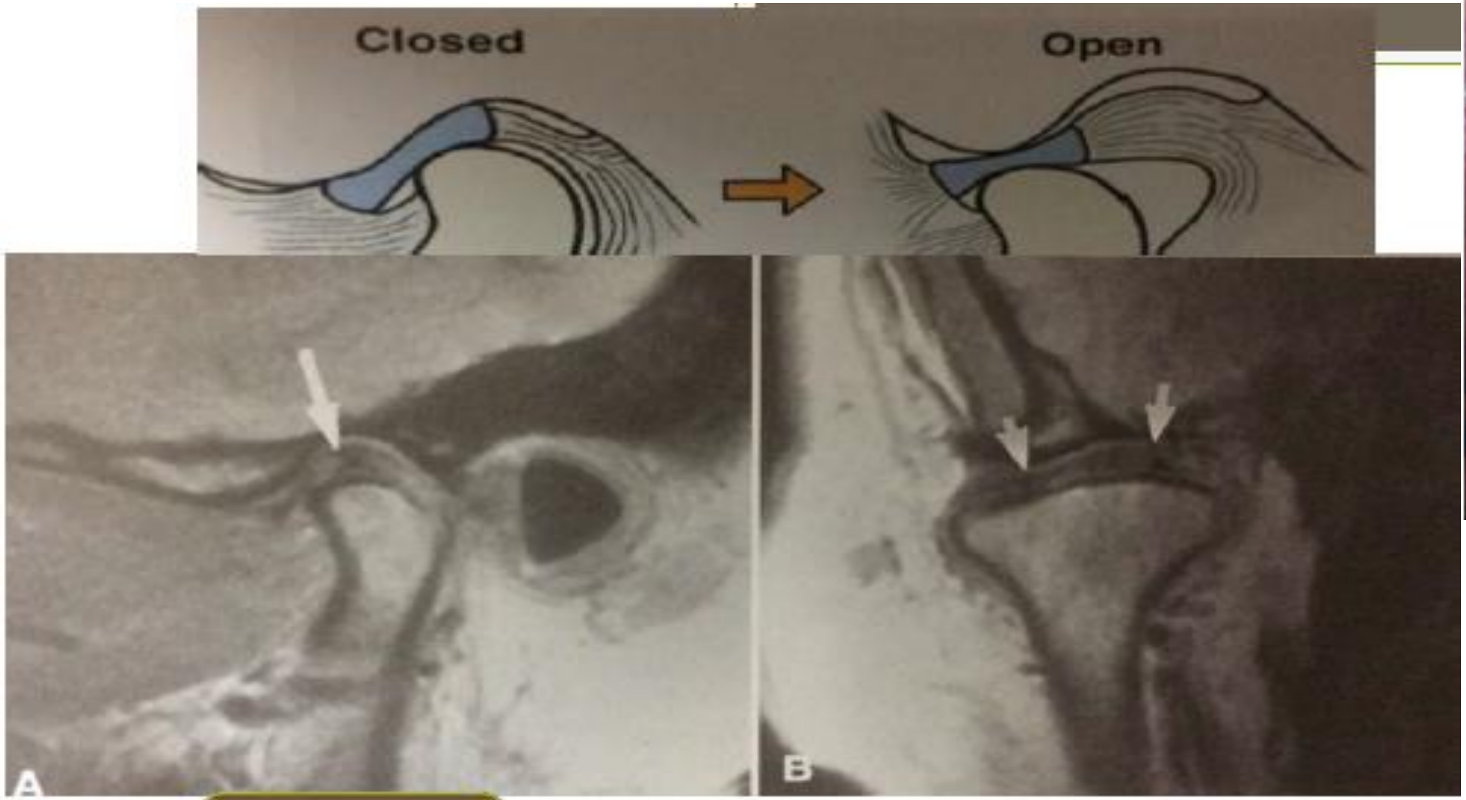
Medical implants may heat up during the scan as a result of the technology.

MRI scans can cause heart pacemakers, defibrillation devices and cochlear implants to malfunction.

Expensive

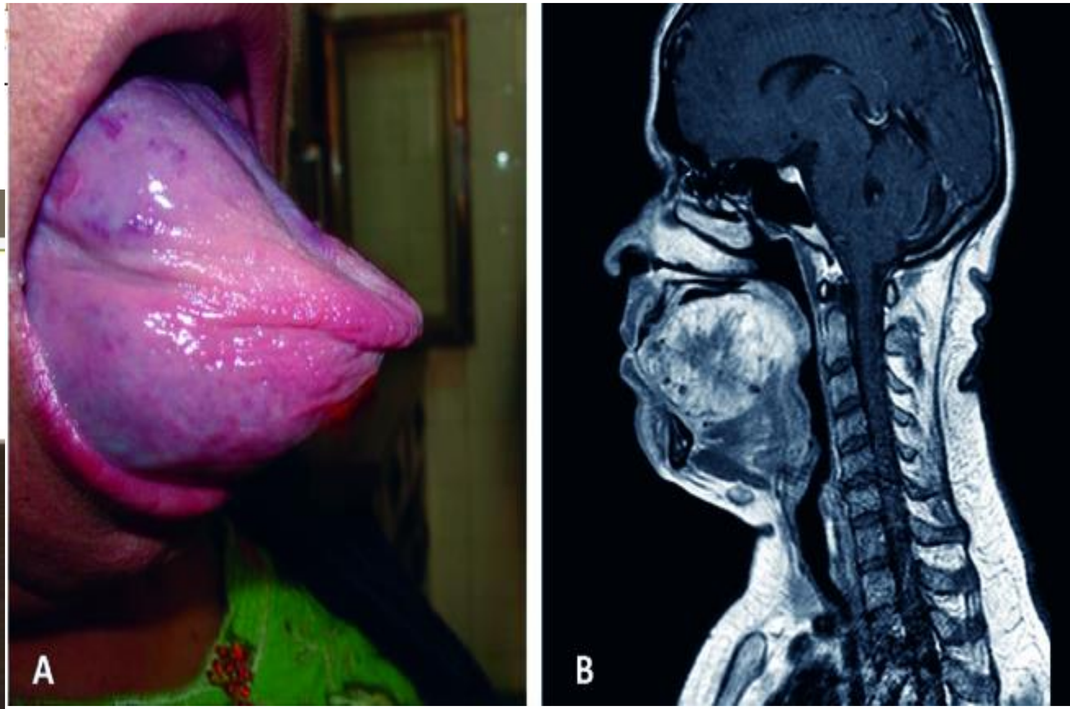
APPLICATIONS

- Soft tissue condition – position and integrity of disk of TMJ
- Soft tissue disease –
- tongue, cheek, salivary gland, neck – neoplasia
- lymph nodes - malignant involvement
- Perineural invasion - by malignant neoplasia
- Extent of penetration of carcinoma- in cortex of mandible– SWIFT
- Neoplasia - Gadolinium enhanced

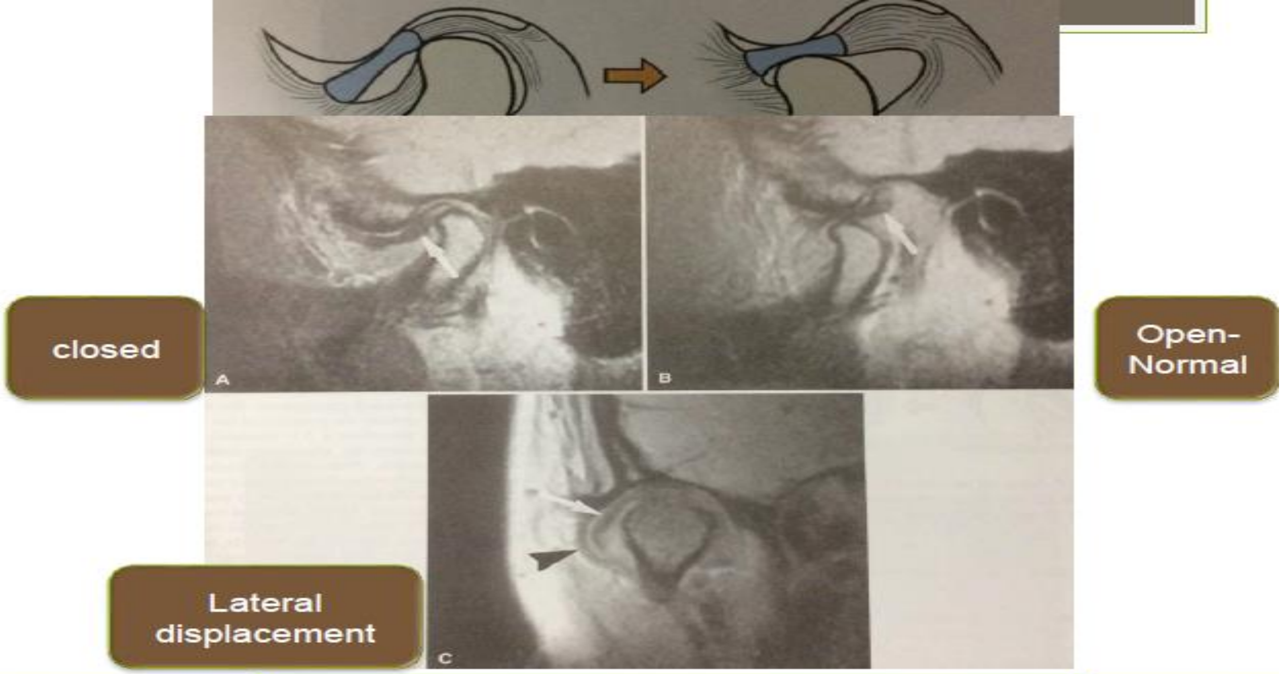


closed

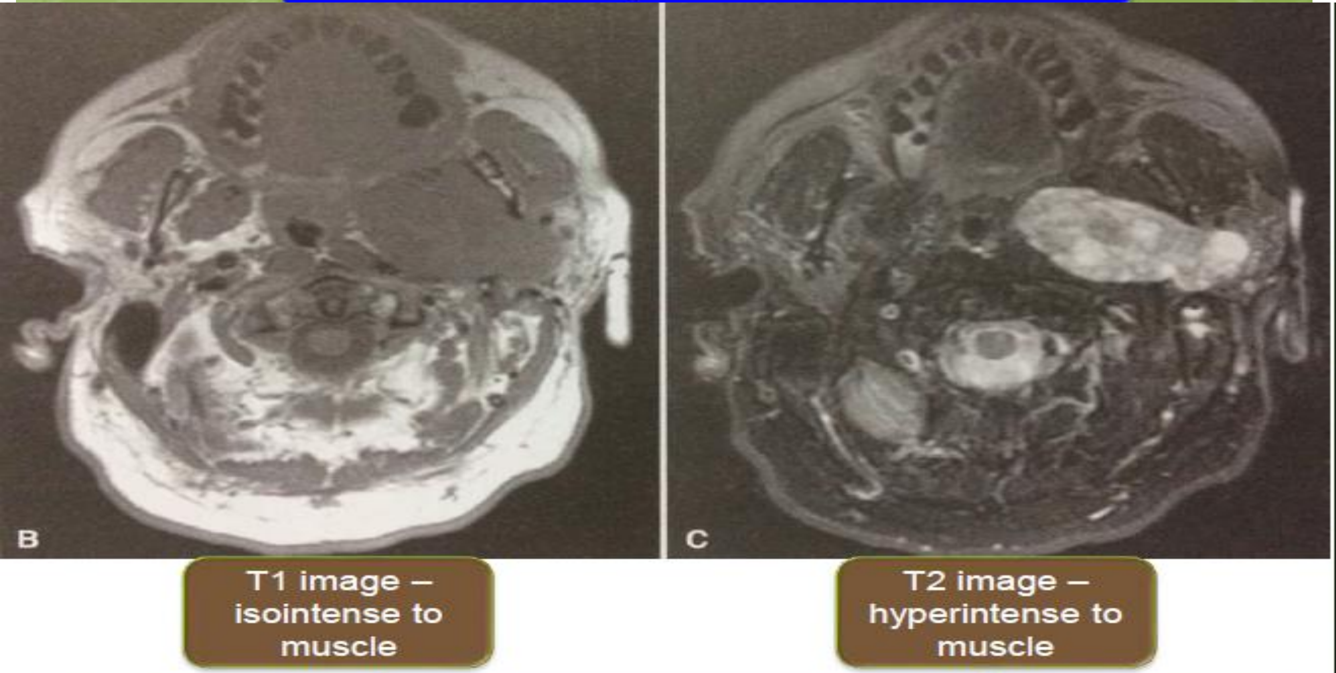
NORMAL TMJ



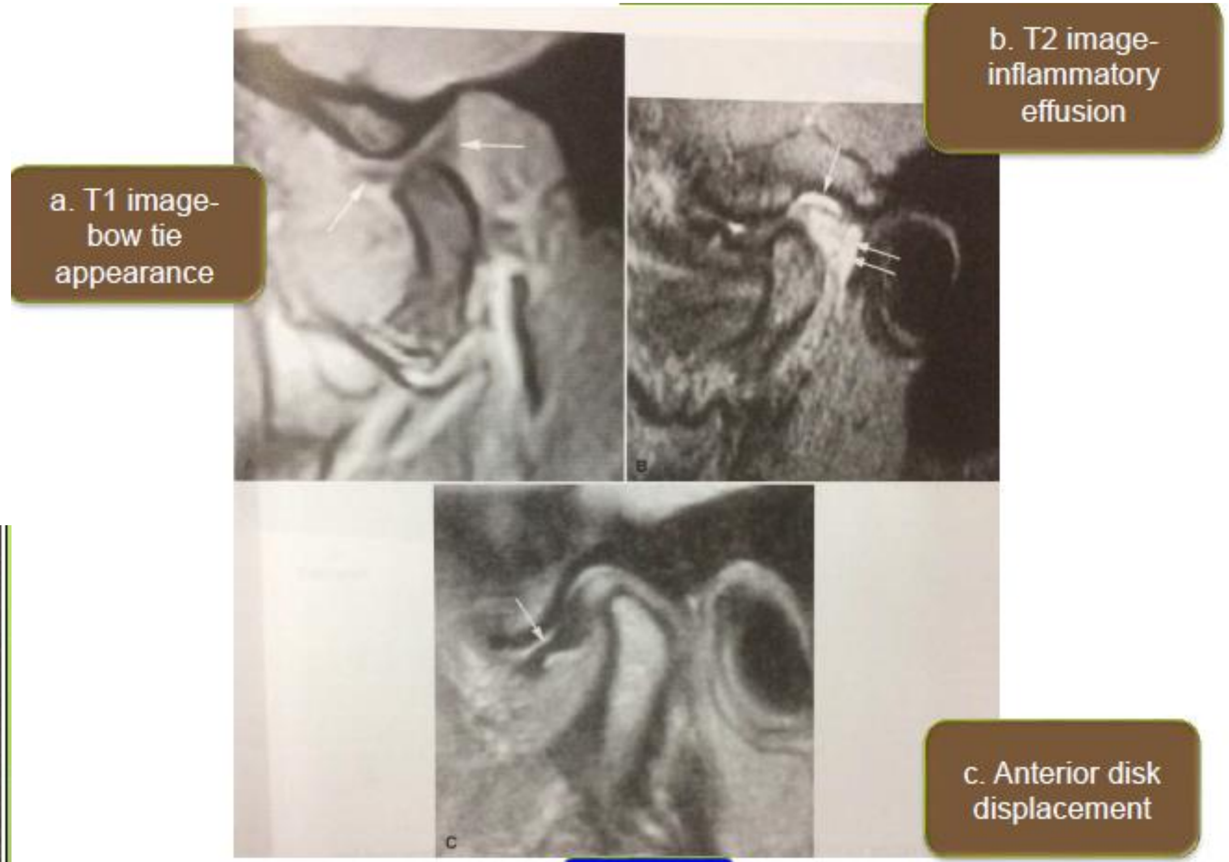
Huge congenital haemangioma of the tongue



Anterior disk displacement with reduction



PLEOMORPHIC ADENOMA



TMJ

CT scan vs. MRI

CT scans are more widely used than MRIs and are typically less expensive.
MRIs, however, are thought to be superior in regards to the detail of the image. The most notable difference is that CT scans use X-rays while MRIs do not.
Other differences between MRI and CT scans include their risks and benefits:

Risks

Both CT scans and MRIs pose some risks when used. The risks are based on the type of imaging as well as how the imaging is performed.

CT scan risks include:

- **harm to unborn babies**
- **a very small dose of radiation**
- **a potential reaction to the use of dyes**

MRI risks include:

- **possible reactions to metals due to magnets**
- **loud noises from the machine causing hearing issues**
- **increase in body temperature during long MRIs**
- **claustrophobia**

You should consult a doctor prior to an MRI if you have implants including:

- **artificial joints**
- **eye implants**
- **an IUD**
- **a pacemaker**

Benefits

Both MRIs and CT scans can view internal body structures. However, a CT scan is faster and can provide pictures of tissues, organs, and skeletal structure.
An MRI is highly adept at capturing images that help doctors determine if there are abnormal tissues within the body.
MRIs are more detailed in their images

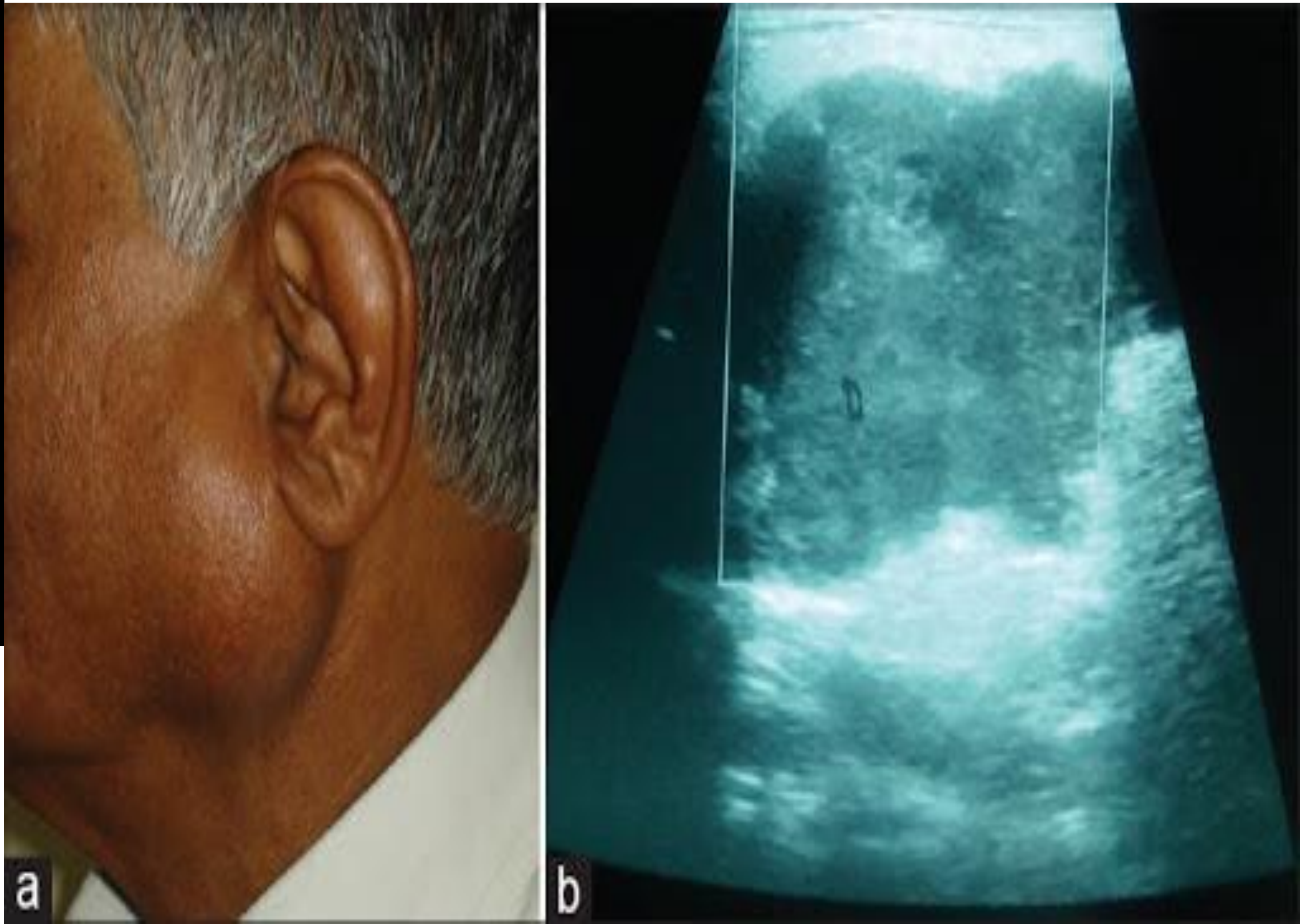
Claustrophobia

—people with even mild claustrophobia may find it difficult to tolerate long scan times inside the machine. Familiarization with the machine and process, as well as visualization techniques, sedation, and anesthesia provide patients with mechanisms to overcome their discomfort. Additional coping mechanisms include listening to music or watching a video or movie, closing or covering the eyes, and holding a panic button.

The open MRI is a machine that is open on the sides rather than a tube closed at one end, so it does not fully surround the patient. It was developed to accommodate the needs of patients who are uncomfortable with the narrow tunnel and noises of the traditional MRI and for patients whose size or weight make the traditional MRI impractical.

Newer open MRI technology provides high quality images for many but not all types of examinations

ULTRASONOGRAPHY



PROF. ABBAS AY TAHER

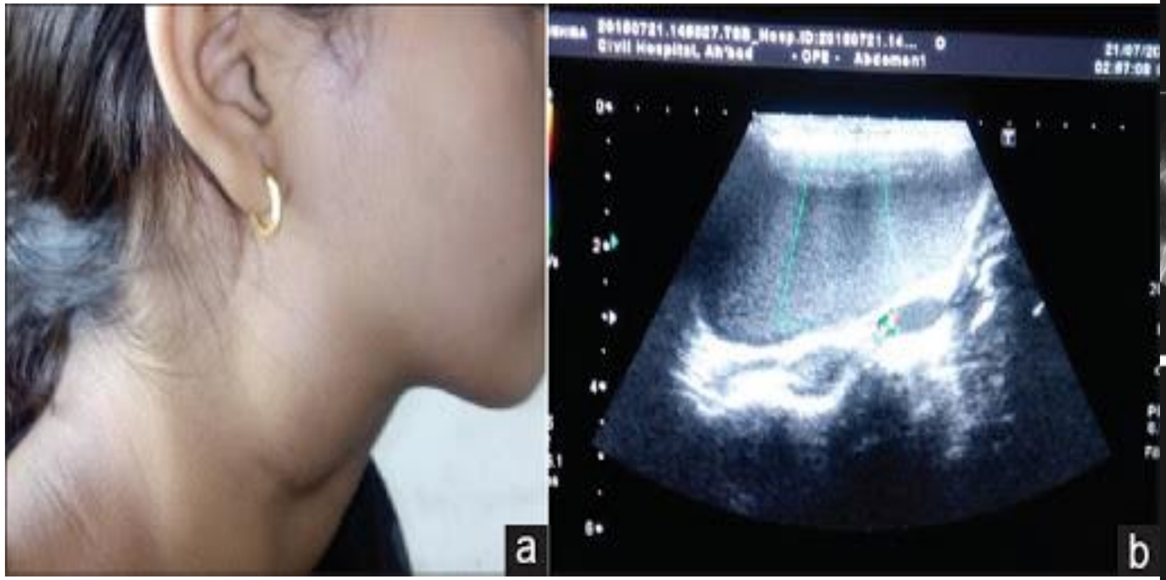
ULTRASOUND WAVE

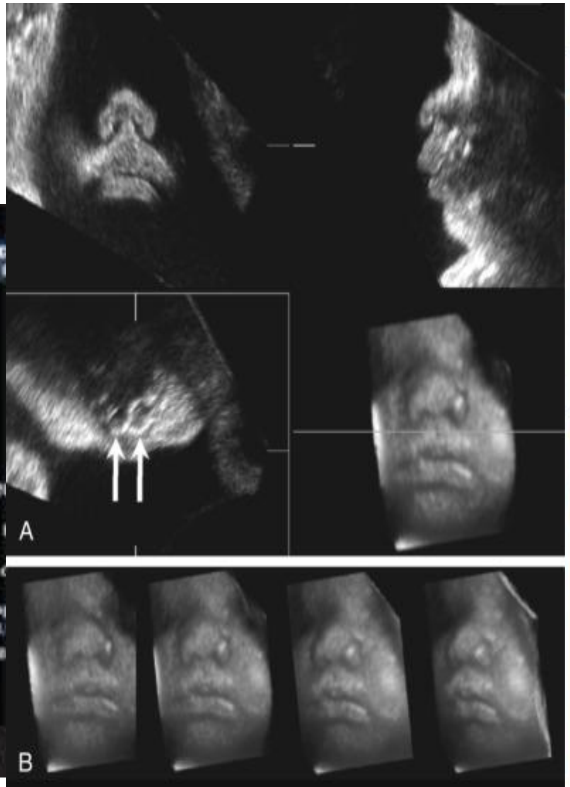
Ultrasound is an oscillating sound pressure wave with a frequency greater than the upper limit of the human hearing range .

It is approximately 20 kilohertz (20,000 hertz) in healthy, young adults. Ultrasound devices operate with frequencies from
20 kHz up to several gigahertz.

Sound waves are described in terms of :

1. **Frequency: cycles per second, or hertz (Hz)**
2. **Velocity of propagation**
3. **Wavelength: millimeters (mm)**
4. **Amplitude: decibels (dB)**





Sound waves: 2-10 MHz

Waves are propagated through different tissues at different velocities

Boundary of two tissues causes impedance mismatch

Sound waves are reflected back at different frequencies Differentiation of tissues

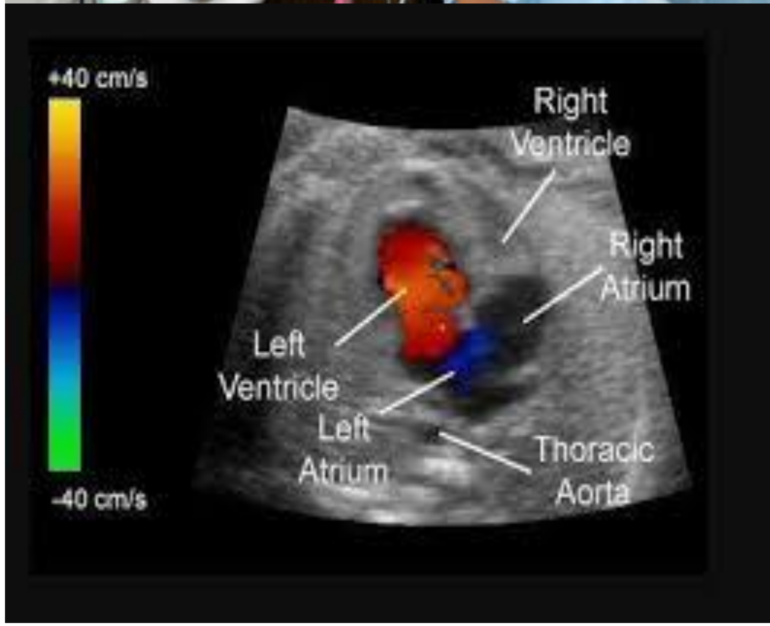
The phenomenon perceived as sound is the result of periodic changes in the pressure of air against the eardrum.

The periodicity of these changes lies anywhere between 1500 and 20,000 cycles per second ([Hz]).

By definition, ultrasound has a periodicity greater than 20 kHz.

Diagnostic ultrasonography (sonography), the clinical application of ultrasound, uses vibratory frequencies in the range of 1 to 20 MHz.

Ultrasound is safe and painless. It produces pictures of the inside of the body using sound waves. Ultrasound imaging is also called ultrasound scanning or sonography. It uses a small probe called a transducer and gel placed directly on the skin. High-frequency sound waves travel from the probe through the gel into the body. **The probe collects the sounds that bounce back.**
A computer uses those sound waves to **create an image**.
Ultrasound exams do **not use radiation (as used in x-rays).**
Because images are captured in **real-time**, they can show the structure and **movement of the body's internal organs**. They can also show **blood flowing through blood vessels**.
Ultrasound imaging is a **noninvasive medical test** that helps physicians diagnose and treat medical conditions.
Conventional ultrasound displays the images in **thin, flat sections of the body.**
Advancements in ultrasound technology include three-dimensional (3-D) ultrasound that formats the sound wave data into 3-D images.
A Doppler ultrasound study may be part of an ultrasound examination.
Doppler ultrasound is a special ultrasound technique that evaluates movement of materials in the body. It allows the doctor to see and evaluate blood flow through arteries and veins in the body.

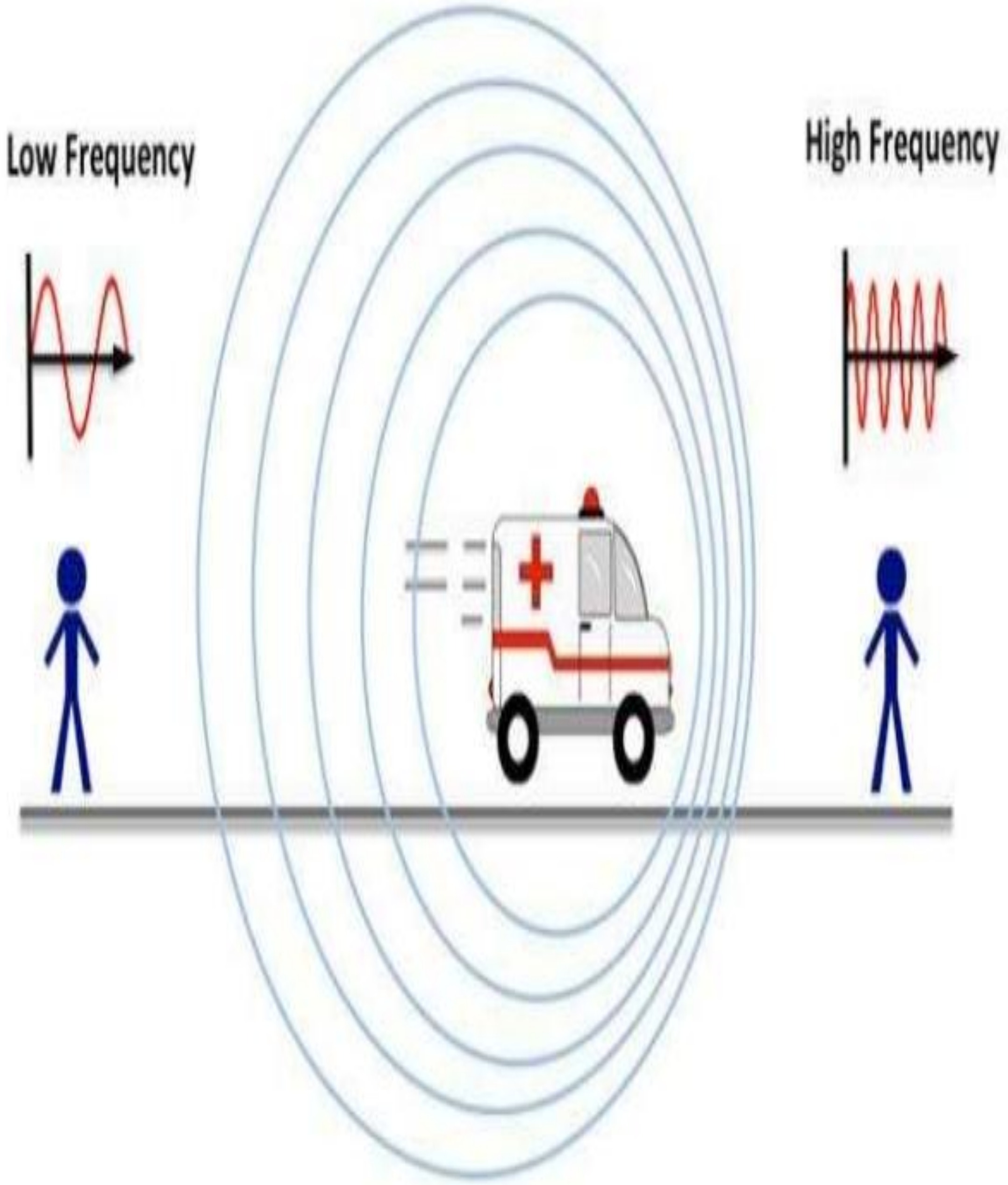


Doppler Ultrasound Imaging

	Definition
Frequency (*f*)	The number of cycles per second in an ultrasound wave: f = cycles/s = Hz
Velocity of propagation (c)	The speed that ultrasound travels through tissue
Wavelength (λ)	The distance between ultrasound waves: $\lambda = c/f = 1.54/f$ (MHz)
Amplitude (dB)	Height of the ultrasound wave or "loudness" measured in decibels (dB)

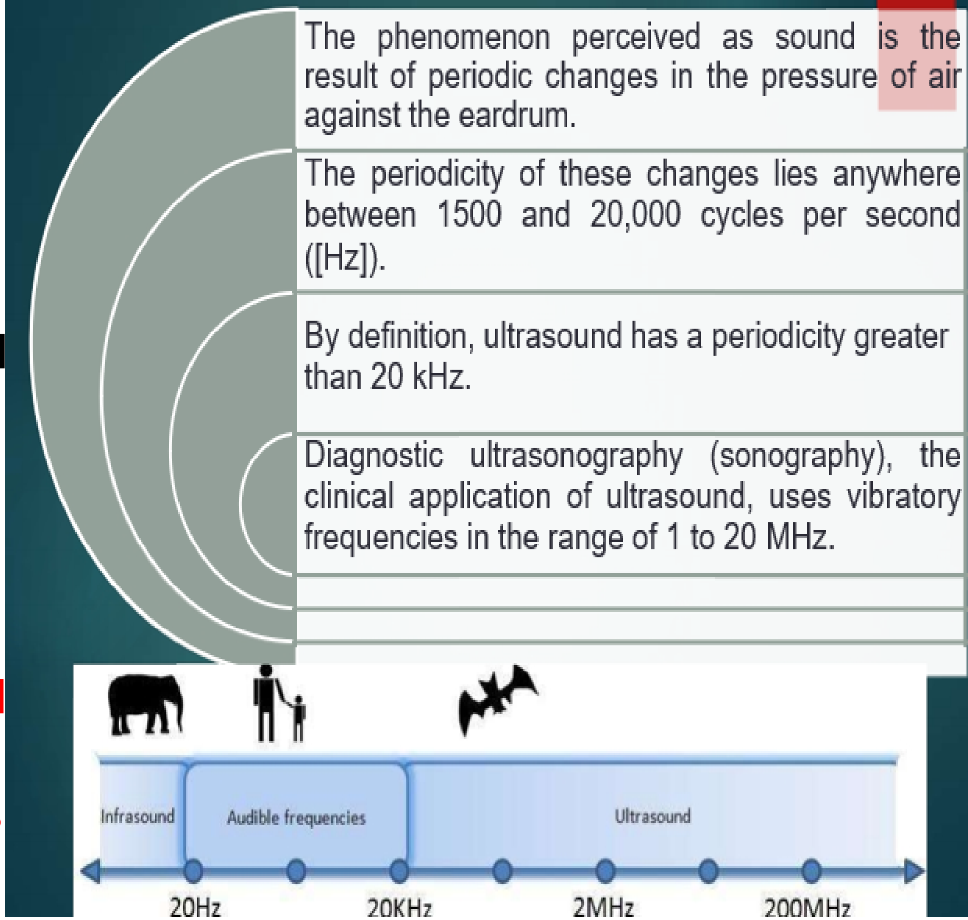
The Doppler effect (or the Doppler shift) is the change in frequency or wavelength of a wave (or other periodic event) for an observer moving relative to its source.

when an ambulance approaches an observer, the sirens wavelengths become compressed resulting with high frequency sound because the sound waves are are being squashed by the distance between the ambulance and your ear .
When an ambulance moves away from the observer, the wavelengths become less compressed and further apart resulting in a lower frequency sound .



HISTORY:

- Sonography was introduced in the **Medical field in early 1950's**. In diagnostic Ultrasound high frequency sound waves are transmitted in to the body by a **transducer** and **echoes from tissue interface** are detected and displayed on a screen. The transducer has a special property called piezoelectric effect i.e. they can convert sound waves in to electrical waves and vice versa.
- Dentistry in the **modern era** is emerging with the use of advanced imaging techniques such as computed tomography**(CBCT),**magnetic resonance imaging (MRI), **nuclear medicine (NM),** and ultrasound **(US),** of which **MRI** and ultrasound are the only imaging technique, which operate without **causing radiation hazards to the patients**
- Just like personal communication devices are continuously evolving and becoming more convenient, so are ultrasound technologies. A variety of compact, handheld devices have come onto the market in recent years. The iPhone now has a telesonography app and NASA has developed a virtual guidance program for non-sonographers to perform **ultrasounds in space**



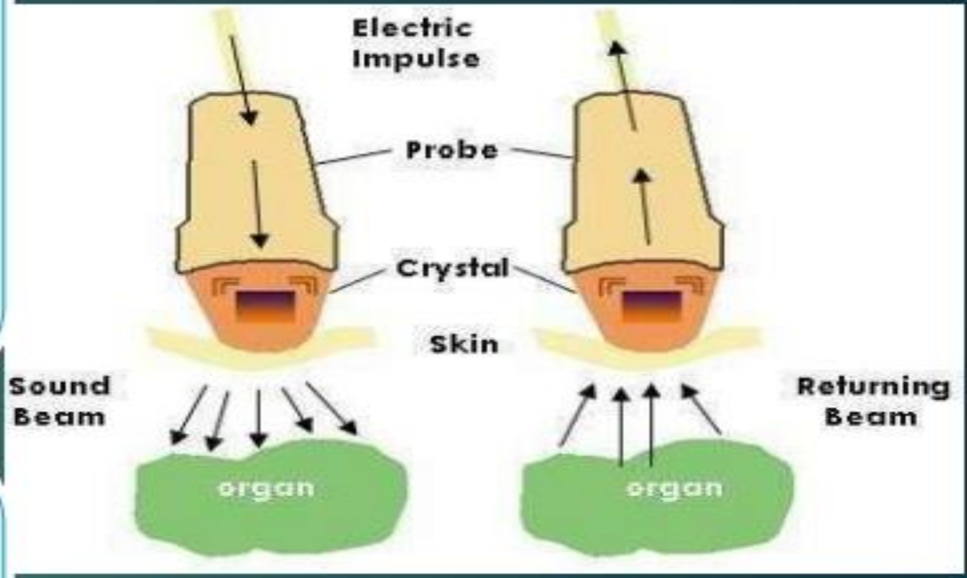
The shapes of scans from different transducers are –

1.Linear Arrays – Used for small parts, vascular and obstetric applications.

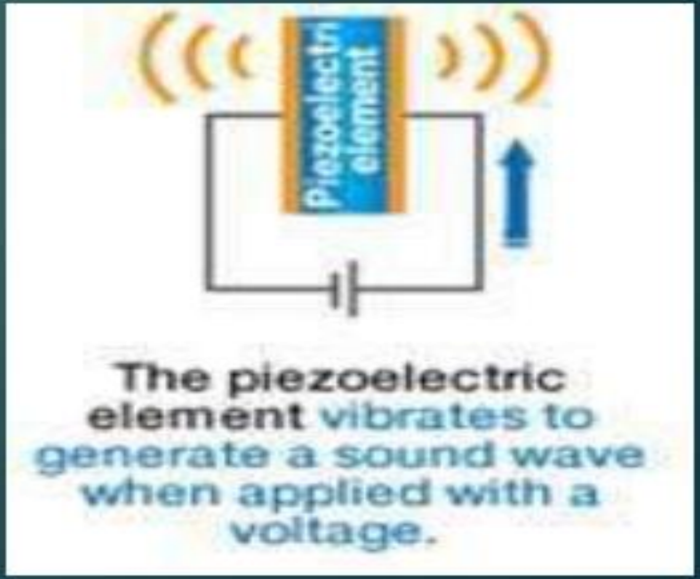
2.Curved Arrays – Used for abdominal and general ultrasound

3.Phased Arrays – Used for heart Echocardiogram

As the ultrasonic beam passes through or interacts with tissues of different acoustic impedance, it is attenuated by a combination of absorption, reflection, refraction,
and diffusion.



Sonic waves that are reflected back (echoed) toward the transducer cause a change in the thickness of the piezoelectric crystal, which in turn produces an electrical signal that is amplified, processed, and ultimately displayed as an image on, a monitor.



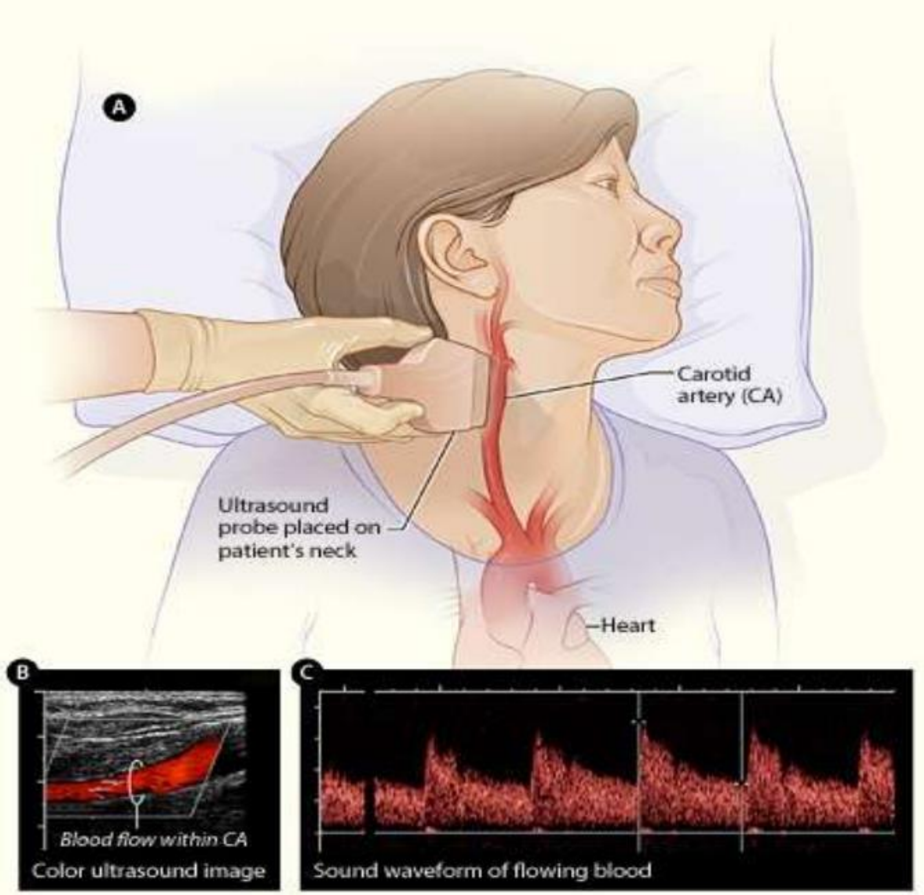
APPLICATION OF US IN MEDICINE AND DENTISTRY

Ultrasound imaging technique is used to scan the fetus, Measuring blood flow velocity(Stenosis), Vein and arterial Mapping(Blood clots), Heart abnormalities (Echocardiogram),

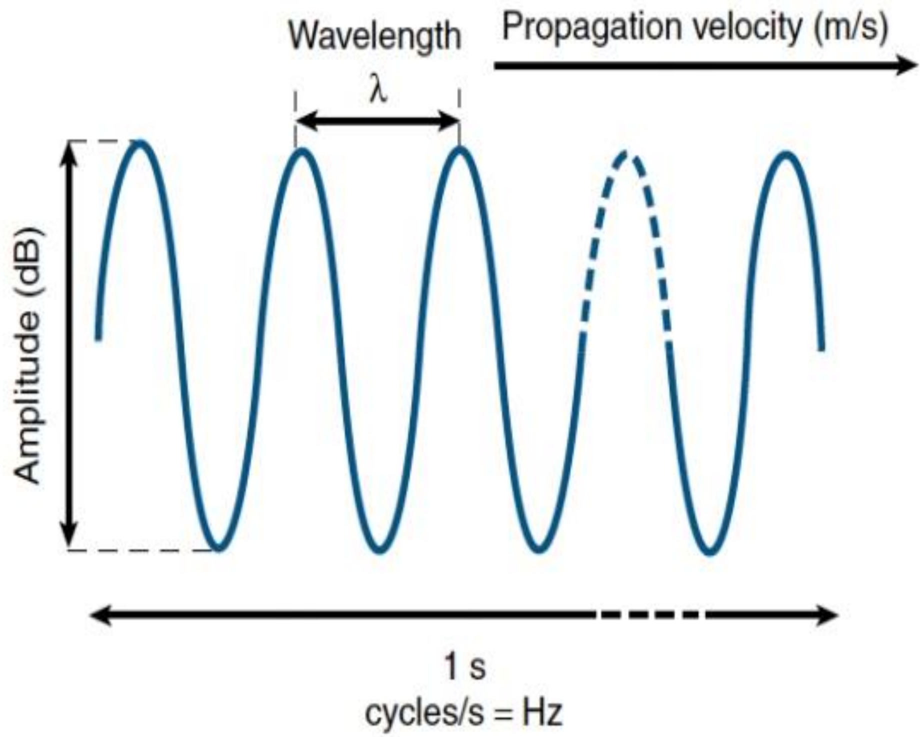
Ultrasound in dentistry is used for detection of fractures of the maxillo facial region i.e. nasal bone Fractures, orbital rim fractures, maxillary fractures, mandibular fractures, zygomatic arch fractures and for locating the position of mandibular condyles.

Ultrasound can be used to detect parotid lesions, where solid and cystic lesions are reliably differentiated and diffuse enlargement of the parotid gland (or) focal disease is readily shown by ultrasound. Also, detection of calculi in major salivary glands, TMJ imaging & vascular lesions.

On U/S benign lesions usually look well defined, homogeneous and hypo echoic, while malignant lesions tend to be ill defined and hypo echoic with heterogeneous internal architecture and enlarged cervical lymph node may be visible and reactive intra parotid lymph nodes may also be readily assessed.

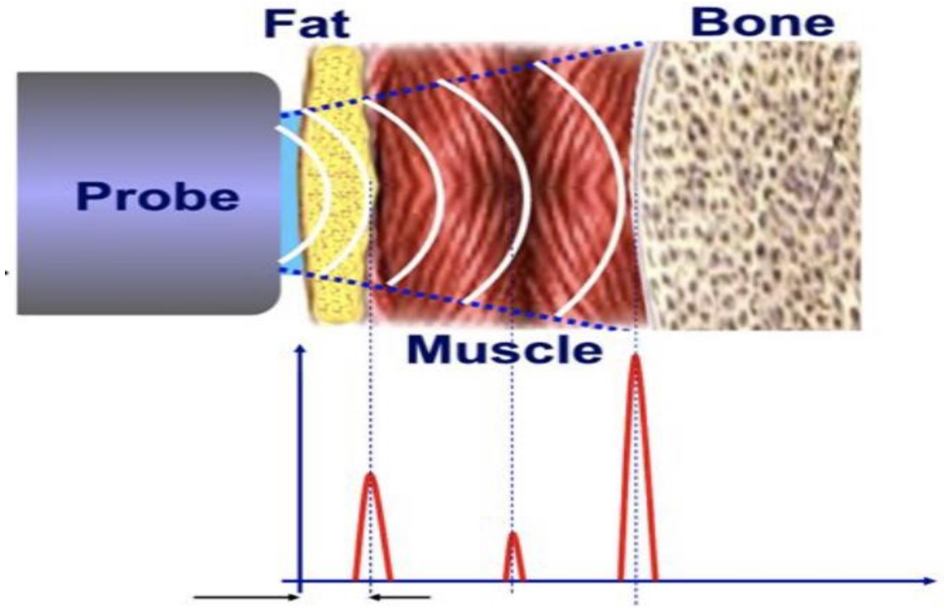


The use of spring – loaded device such as biopsy (or) magnum gun to discharge the needle also offers the advantage of precise and co- ordinated cutting action. This combined with ultrasound ensures that the needle is placed with in the lesion and does not exit the lesion and during biopsy of parotid gland there is chance of injuring the facial nerve (or) seeding neoplastic cells, under ultrasound guidance these can be avoided .



Ultrasound can provide the content of the lesion before any surgical procedure, both solid and cystic Contents could be identified in ultrasound. The mixed lesions should be considered neoplastic and should be biopsied before surgical procedure.

In ultrasound, color doppler sonography has been developed to identify vasculatures and to enable evaluation of the blood flow, velocity and vessel resistance together with surrounding morphology . It can be used for detecting the coarse of the facial artery and for detecting hemangioma .

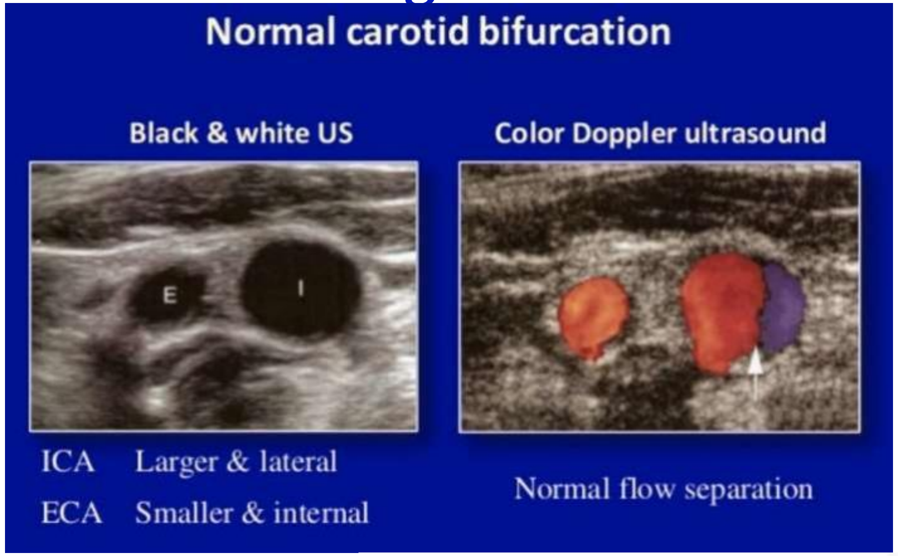


Lymph nodes – benign/malignant

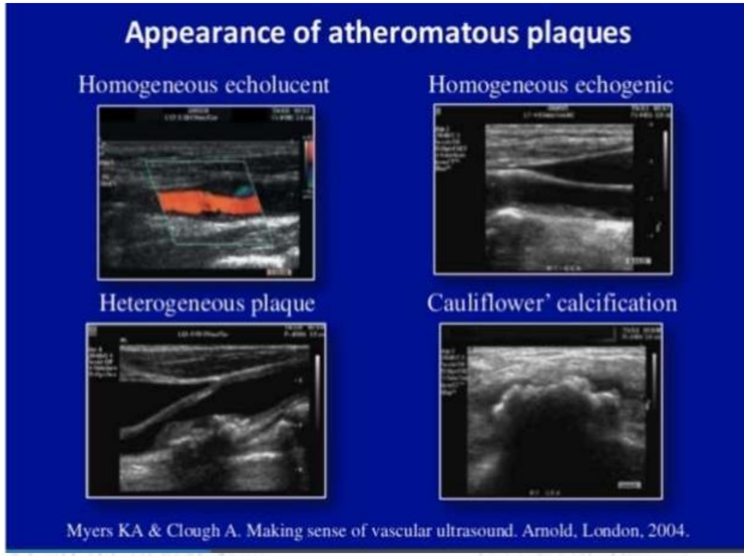
Primary lesions of the tongue

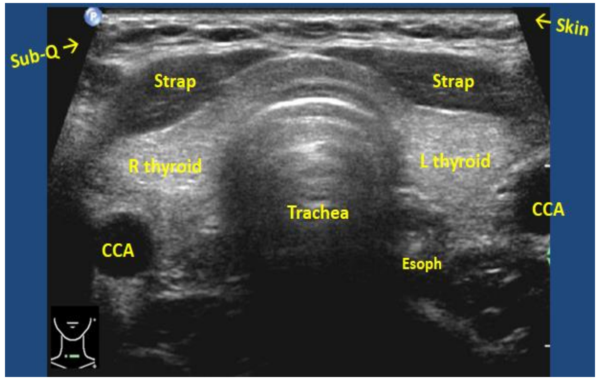
Longitudinal image

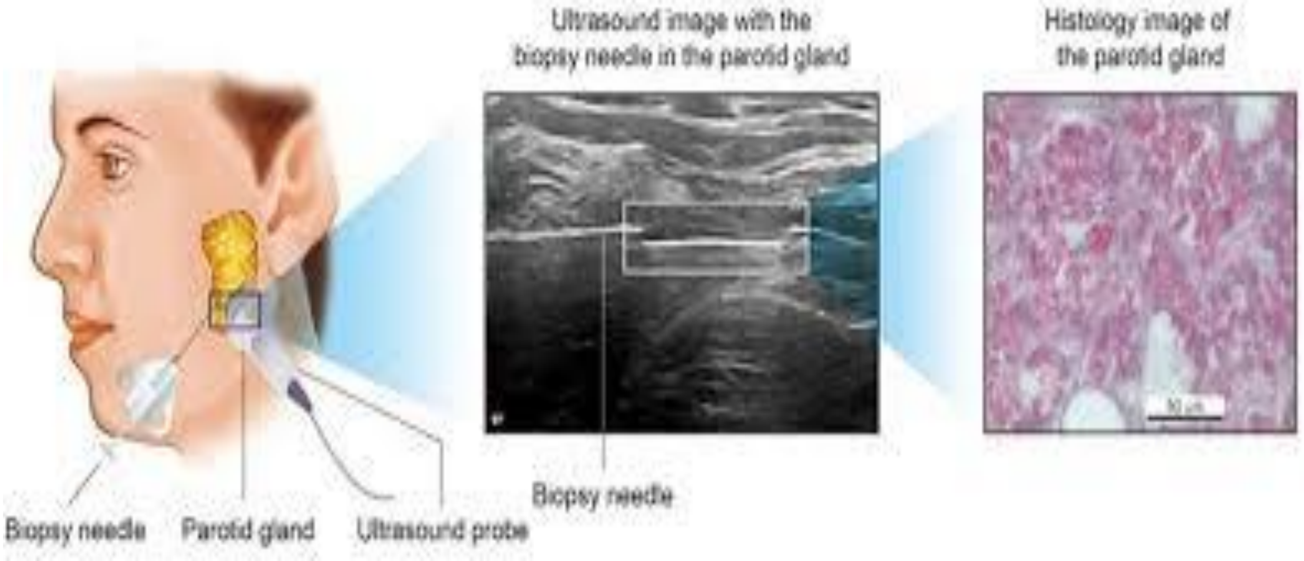
Transverse image



Echotexture and abnormal Finding







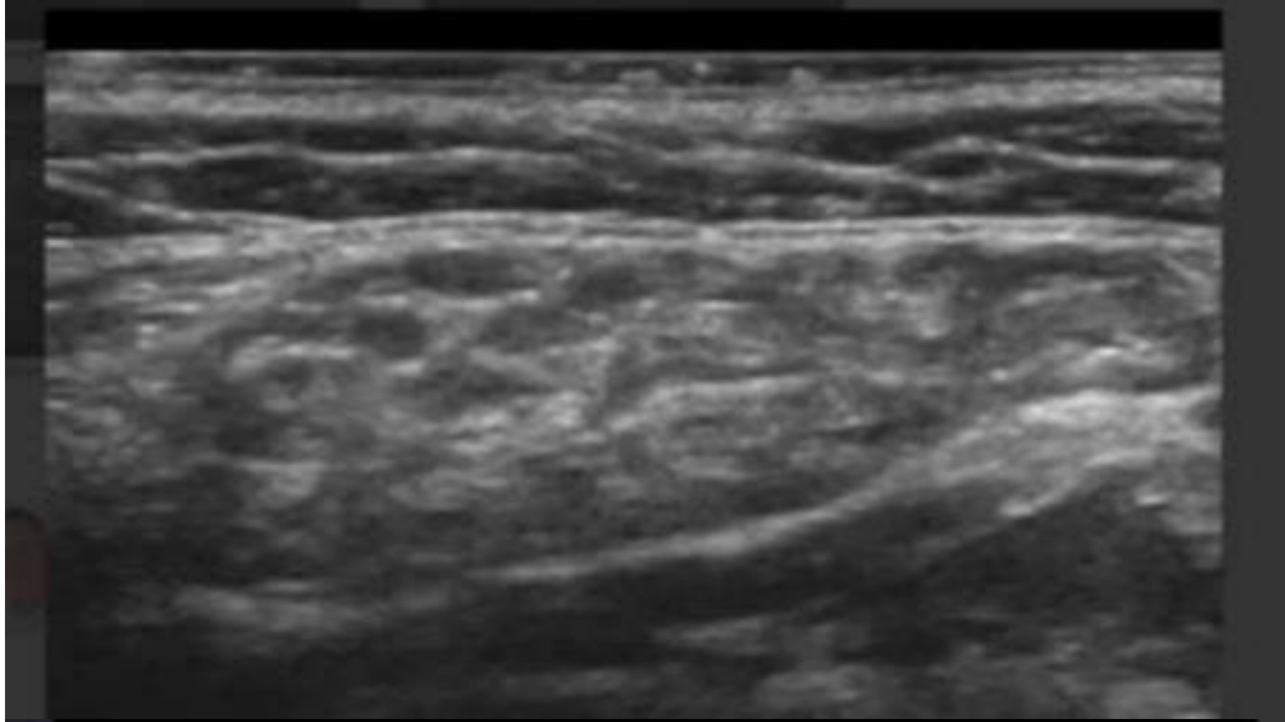
Ultrasound-guided parotid gland biopsy

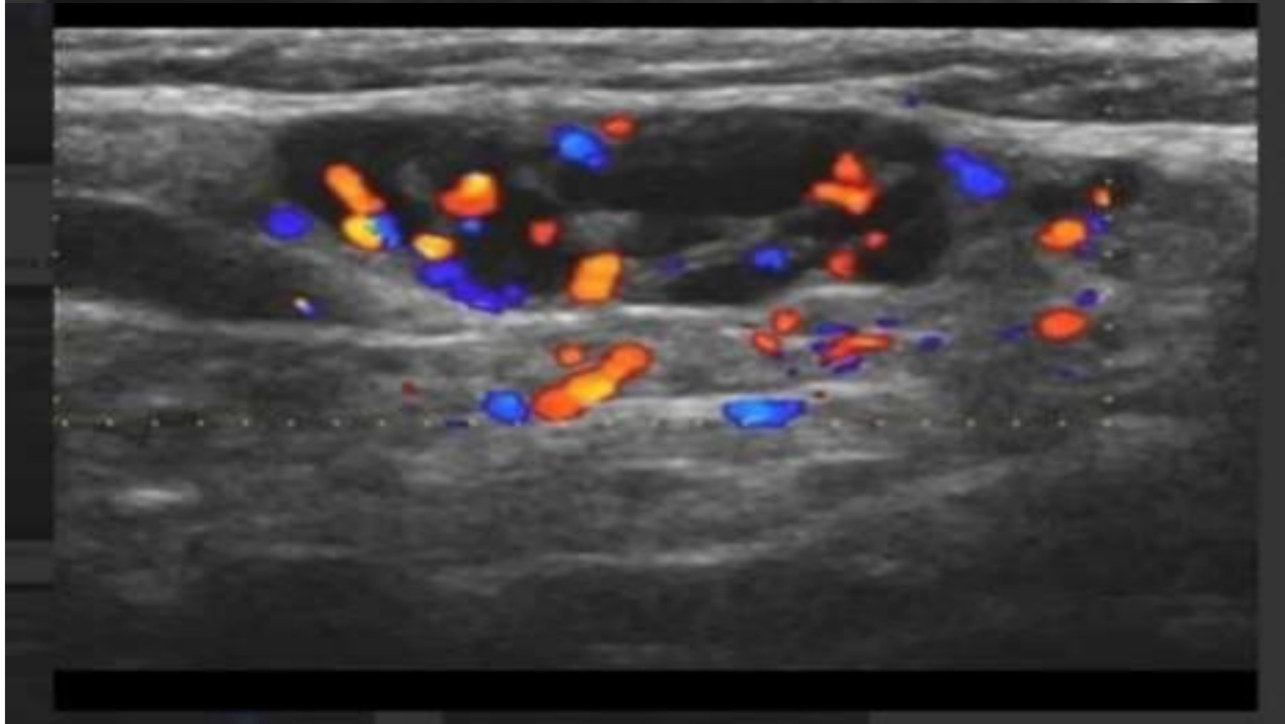
Sjogrens syndrome

Both parotid and submandibular glands appear relatively enlarged with multicystic changes and reticular pattern.

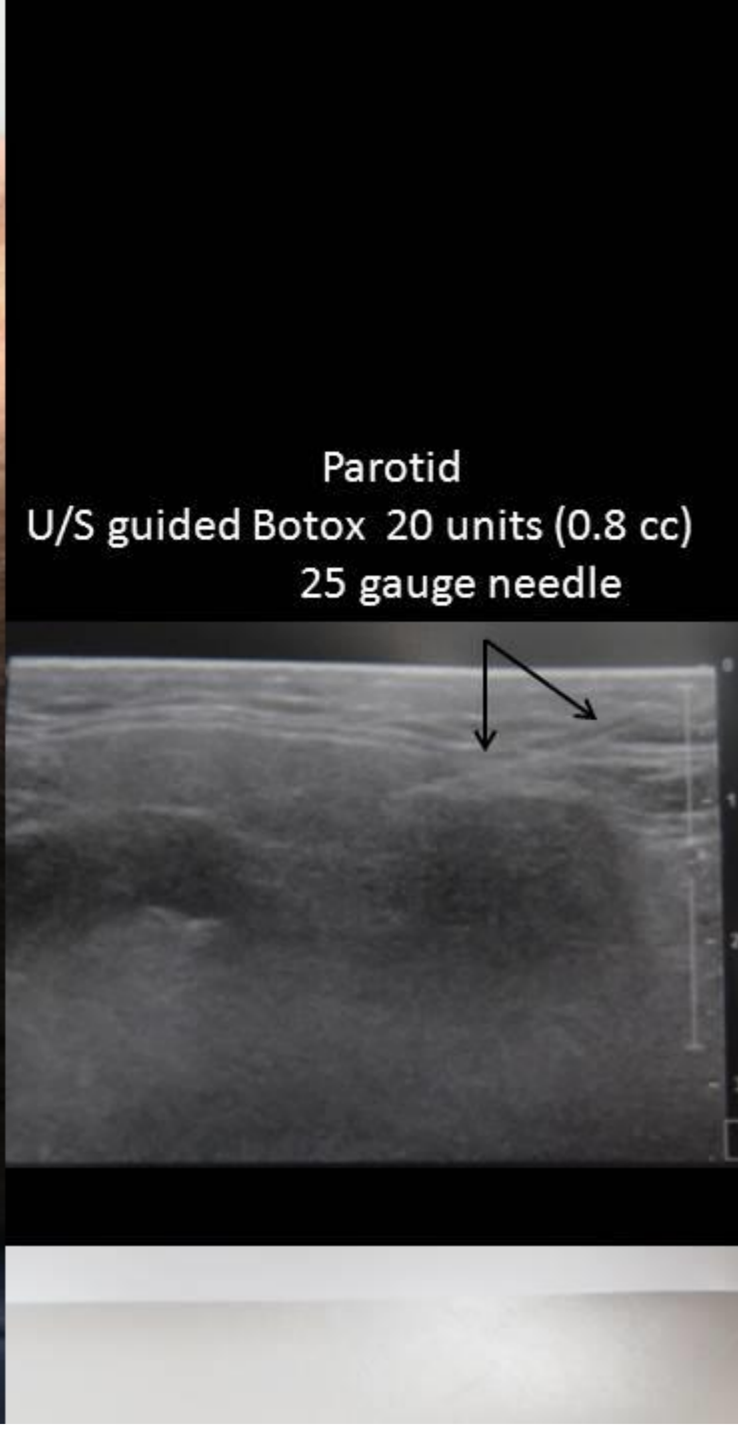
As many as one-half to two-thirds of patients with Sjögren's syndrome have characteristic changes in the structural features of their glands (resulting from inflammation).

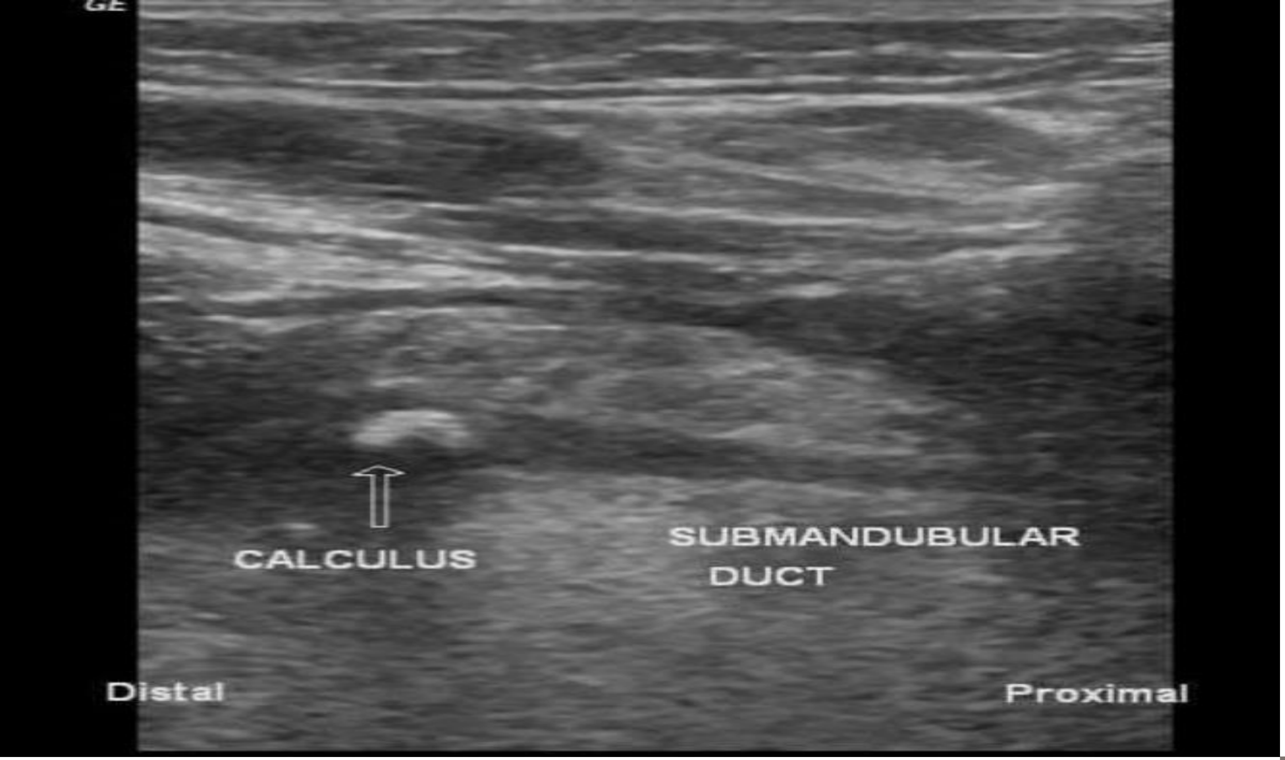
These changes can be successfully detected by ultrasonography and help secure the diagnosis of Sjögren's syndrome. These structural changes also correlate with disease severity and can provide useful information about the expected course of the disease. On occasion, patients with enlargement or an isolated growth of their glands will require a biopsy. This can be done with a special needle, using ultrasound to guide its placement in the gland.

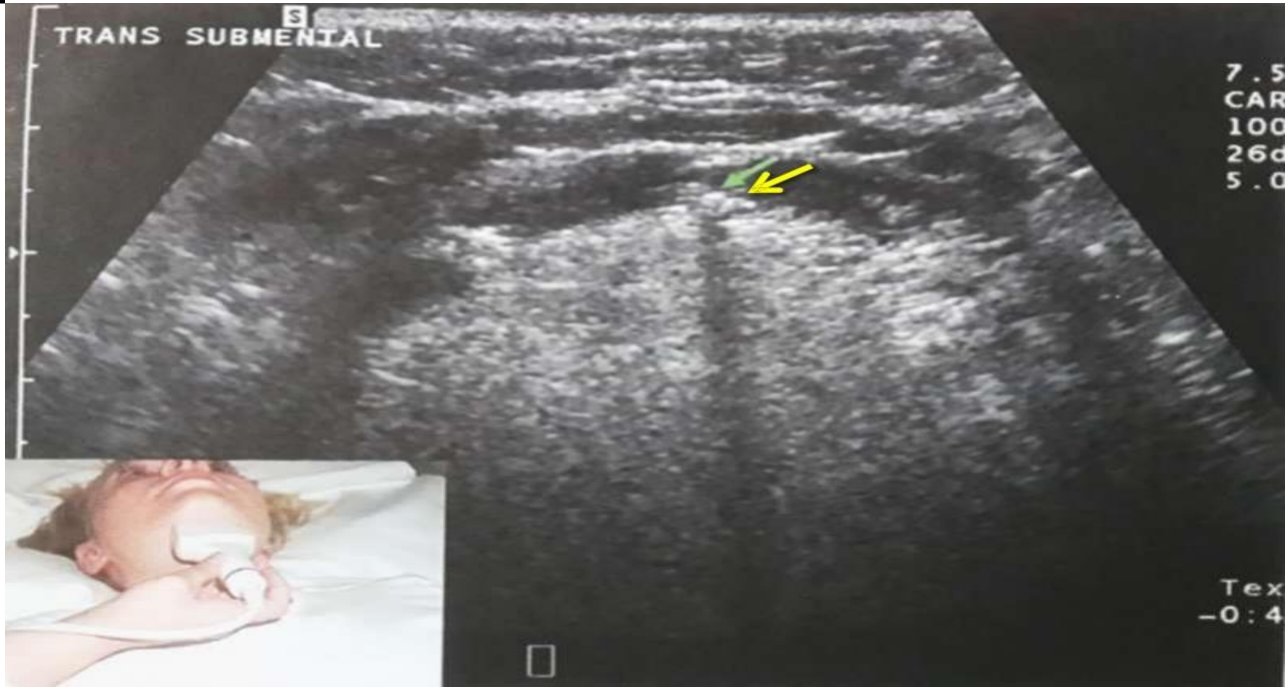




Ultrasound Guided FNA Fine Needle Aspiration Biopsy; Botulinum neurotoxin treatment of salivary gland disorders; Botulinum neurotoxin infusion to the parotid via Stensen's duct Research protocol (IRB approved)




CALCULUS
SUBMANDUBULAR
DUCT
Distal
Proximal

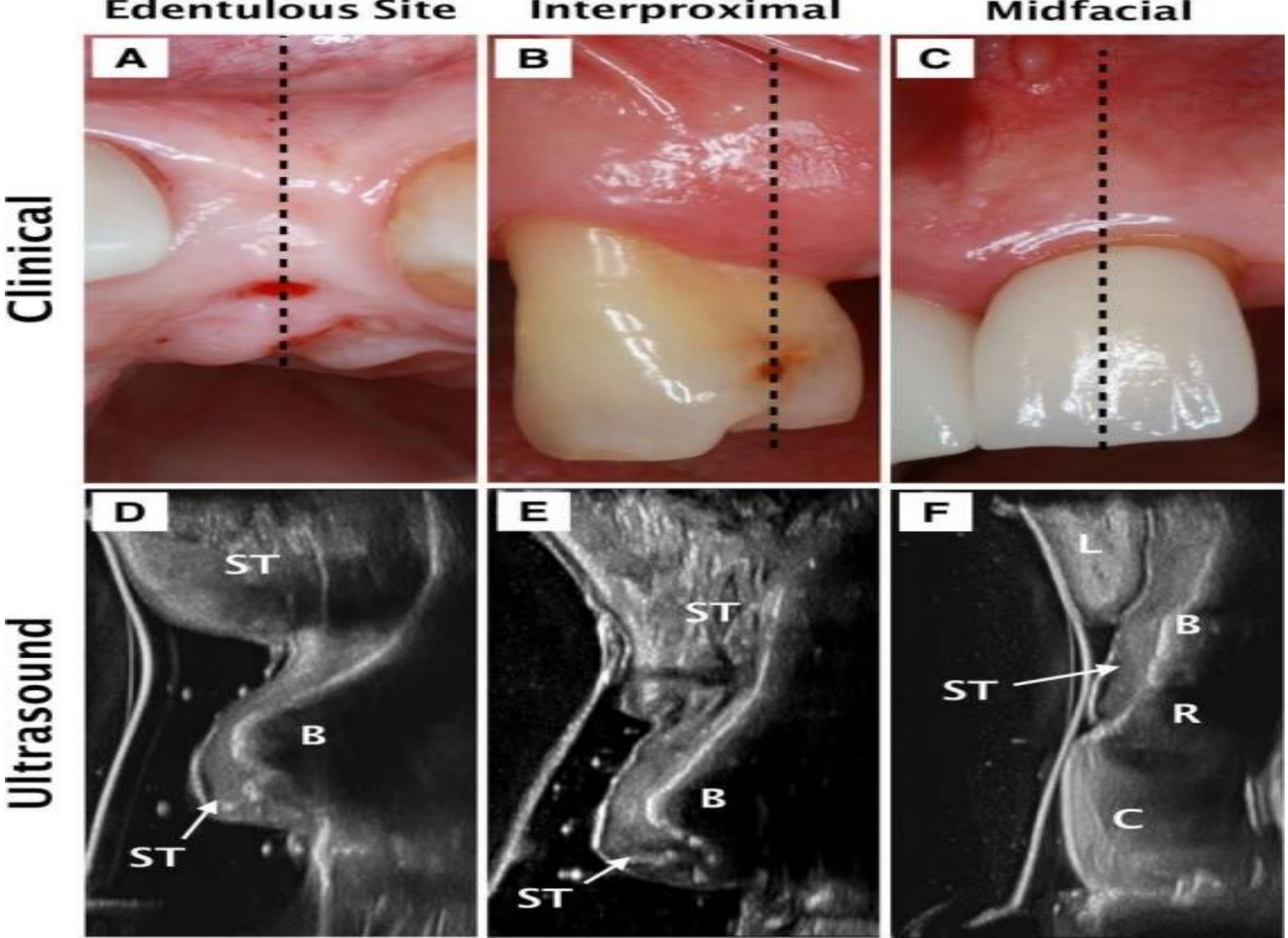

TRANS SUBMENTAL

Normal lymphnode of the neck. Health lymphnodes are generally hypoechoic apart from centre hyperechoic area(hilum of the nod

Metastatic lymphnode of the neck, apart from the large size also seen round shape and necrotic area shows hypoechoic, cystic in appearance lesions


TRANS
A
55DB C6 E5
LT
LATERAL
NECK
LONG
BELOW
EAR
1. 3.78 cm
2. 2.17 cm
1.0
2.0
3.0
4.0

B bone surf
C crown surf
L lip
R root surface
ST soft tissues



Advantages

Report is immediate and sonographer knows the results as they scan.

Real time imaging, live imaging

No radiation

Color and Power doppler (increase vascularity in lymph node or tumor shows progression to malignancy needs biopsy)

POCUS (Point of care US devices)

DISADVANTAGES

Ultrasound has **limited use** in the head and neck region **because sound waves are absorbed by bone**

Its use is therefore restricted to the superficial structures.

Technique is operator dependent. Images can be difficult to interpret for inexperienced operators.

Real-time imaging means that the radiologist must be present during the investigation.

THANK YOU


DENTIST WAGON V002
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11.10.02
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DR. KING SHULTZ
DENTIST.
EXTRACTIONS & FILLINGS