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College of Dentistry

Advantage and disadvantage of dental x ray :

systematic review

A Project submitted to

College of Dentistry, University of Maysan, in Partial Fulfillment for the Degree of Bachelor of Dental Surgery (B.D.S.)

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Acknowledgment

First of all, I thank "Allah" almighty for granting me the will and strength to accomplish this research and I pray that his blessings upon .me may continue throughout my life

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My great appreciation and thanks to all teaching staff in college of Dentistry. Finally, to all those whom I forgot to mention their names for their kind efforts helping me to compose this review of literature.

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1-1- Introduction:

The use of X-rays is an integral part of clinical dentistry, with some form of radiographic examination necessary on the majority of patients. As a result, radiographs are often referred to as the clinician's main diagnostic aid. The range of knowledge of dental radiography and radiology thus required can be divided conveniently into four main sections: • Basic physics and equipment — the production of X-rays, their properties and interactions which result in the formation of the radiographic image

Radiation protection — the protection of patients and dental staff from the harmful effects of X-rays

Radiography — the techniques involved in producing the various radiographic images

Radiology — the interpretation of these radiographic images. Understanding the radiographic image is

central to the entire subject.

The studies of human tooth structures come under the field of dental anatomy. The teeth are made up of a group of hard substances present in the oral cavity. Teeth are generally used to masticate the food, provide shape to mouth and also used in producing the speech. the main parts of the tooth are crown and root. Each tooth is an organ consisting of three layers: Enamel, Dentin and Pulp.

Enamel is the densest structure found in the human body. Enamel is the outer most radiopaque layer of the crown of a tooth.

Dentin is found beneath the enamel layer of a tooth and surrounds the pulp cavity Dentin appears radio-opaque and makes up the majority of the tooth structure. Dentin is not as radiopaque as enamel. The pulp cavity consists of a pulp chamber and pulp canals. It contains blood vessels, nerves, and lymphatics and appears relatively radiolucent on a dental image When
viewed on a dental image, the pulp cavity is generally larger in children than in adults because it decreases in size with age due to the formation of secondary dentin. The size and shape of the pulp cavity vary with each tooth.

Review:

2-1- Supporting Structures:

The alveolar process, or alveolar bone serves as the supporting structure for teeth. The alveolar bone is the bone of the maxilla and the mandible that supports and encases the roots of teeth Alveolar bone is composed of dense cortical bone and cancellous bone.

2-2- The anatomic landmarks of the alveolar process:

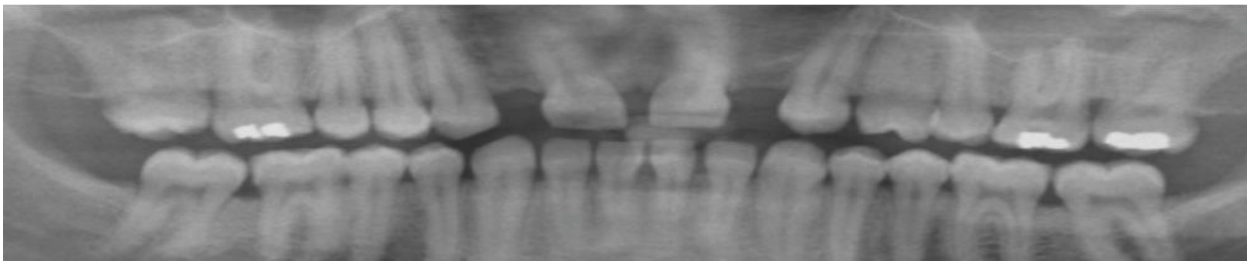
include the lamina dura, the alveolar crest, and the periodontal ligament space. Lamina Dura The lamina dura is the wall of the tooth socket that surrounds the root of a tooth. It is made up of dense cortical bone. Appearance On a dental image, the lamina dura appears as a dense

radiopaque line that surrounds the root of a tooth. The defects that affect the teeth are either of genetic origin or of odontogenic origin.

Normal infants develop their primary dentition (milk teeth, deciduous teeth) of 20 pr-imary teeth, while adults develop their permanent dentition by replacing the pr-imary teeth in addition to adding other permanent teeth posteriorly, making 32 teeth in total. Any disturbances in these numbers can lead to abnormalities in occlusion, function, and aesthetic. In contrast, hyperdontia is when the number of teeth exceeds the normal number and hypodontia is lowered the normal number.

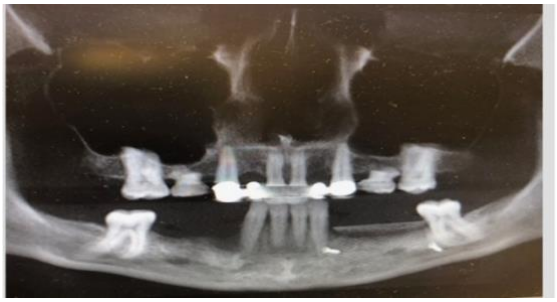
2-2-1- Hypodontia:

A reduced number of teeth could manifest clinically as a single missing tooth or multiple missing teeth. Hypodontia is the general term used when the normal number of teeth is reduced. More accurately, one to four missing teeth is hypodontia, more than four missing teeth should be termed oligodontia, and anodontia is the correct term when there is complete absence of teeth. Hypodontia can affect both dentitions as it is genetically determined. If there is an abnormality of number in the primary dentition, then there is a 40% chance of a numerical abnormality in the permanent dentition.



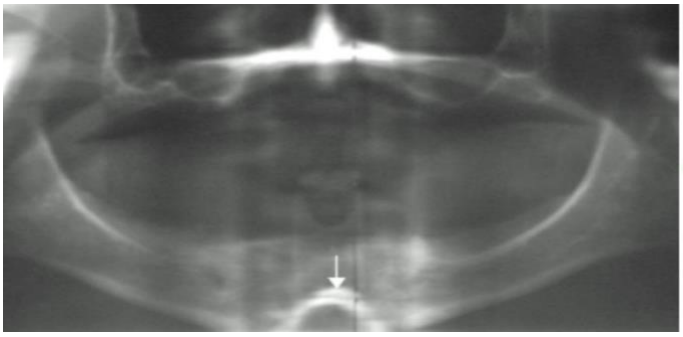
2-2-2- Oligodontia:

These cases are more commonly associated with syndromes where other organs are also affected. An example is ectodermal dysplasia, where the affected patients usually only have a few conical deformed teeth. Existing teeth are abnormally positioned within the bone of the arches with significant spacing. In most instances, erupted teeth tend to be located anteriorly, with no teeth in the premolar and molar areas.



2-2-3- Anodontia:

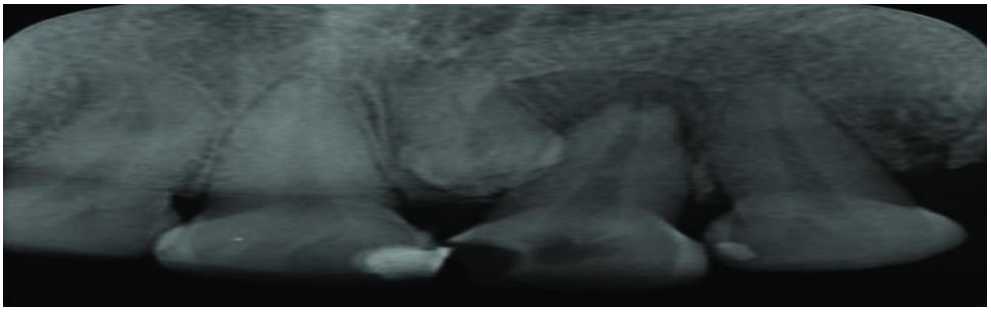
There are no teeth in either arch, and the clinical appearance is of a reduced vertical face height and protuberant lips. This appearance is due to the reduced vertical height resulting from missing teeth and the absent alveolar process. The prevalence of anodontia is very low. These patients are her wise healthy and usually free from any systemic disease an exception being the association ectodermal dysplasia.



2-3- Supernumerary: Conical, Tuberculate, and of Supplemental Mesiodens.

Located in the maxillary midline and empirically called mesiodens, they can be conically shaped, tuberculate shaped, or supplemental (identical to a normal tooth). These cases are more usually seen as a single tooth but not. Uncommonly as a pair of extra teeth on the palatal side of the crowns of the upper central incisors. They are usually found on routine radiographic examination with no clinical signs or symptoms (more commonly conical) when permanent incisor eruption is delayed (more commonly tuberculate). They can also sometimes interfere with the position of primary centrals following their eruption, even causing early loss of the primary incisors.

A proper radiographic evaluation of the region will clarify the exact cause of delayed or interrupted eruption of permanent teeth. Surgical removal of the supernumerary teeth is normally the treatment of choice. The child's age will dictate the appropriate time for surgical intervention, avoiding unwanted damage to the immature permanent teeth crown and root. If the timing of the surgical intervention is appropriate, the unerupted permanent teeth may erupt without orthodontic traction. If surgical intervention is delayed and the permanent incisor root is nearly mature, then traction will normally be required. If a supplemental sup-ernumerary erupts, then a decision will need to be made whether to extract the supernumerary supplemental tooth or the normal tooth. This decision will be influenced by which extraction gives the best orthodontic result.



2-4- supernumerary para molar:

These teeth are positioned beside and between molar teeth in either the maxilla or mandible. The shape of these teeth is very similar to the normal dentition and most commonly similar to premolars. While the removal of paramolars is usually encouraged, their potential use has been suggested to replace severely destroyed molars. They are usually found on routine radiography.

2-5- supernumerary natal and new natal teeth:

Those teeth that are present in the mouth at birth are known as “natal teeth,” while “neonatal” teeth appear in the oral cavity shortly after birth. They are usually seen in the lower incisor region. Signs of teeth in the mouth have been reported as early as 26 weeks in uterine life in premature babies. The incidence is from 1 in 700 to 1 in 6000 live births. It is believed that only 10% of such teeth are supernumerary. In 90% of cases, they are the normal primary mandibular central incisors. Occasionally these, teeth are seen in certain syndromes, such as Elli -s–Van Creveld syndrome, pachyonychia c-ongenita, steatocystoma multiplex, and Hallorann–Streiff syndrome. Riga–Fede syndrome or disease is when an ulcer under the tongue forms in the presence of teeth. Reasons for the removal of natal or neonatal teeth are: painful breast feeding, ulceration of the tongue, or mobility endangering.

2-6- Defects in proportion and size of teeth:

° Large size _ macrodontia

In general, maxillary central incisors are 9 mm wide, while maxillary lateral incisors are 7.5 mm wide. Any size above these figures is considered enlarger or macrodont.

° small size _ microdontia

Peg laterals are clear examples of reduced size (microdontia). General enlargement of all teeth is noted in some endocrine conditions – for example, growth hormone excess.

° short roots

The shortness of the root is judged in comparison with a normal root. Various environmental and genetic factors can cause the root to be underdeveloped, examples of which are the results of radiotherapy and dentine dysplasia .

2-7-Disturbances of Teeth Morphology

Each tooth is formed in a specific shape, with all angles and dimensions dictated by the genetic code.

2-7-1-Dens Invaginatus

The enamel and dentine fold into their own structure, producing a cleft. This is usually seen on the lingual aspect of the upper inc -isor teeth and more commonly on lateral incisors, and is reported in both dentitions. In more severe cases, the invagination may leave a path to the pulp, leading to early pulp -al necrosis after eruption. In some c -ircumstances, the folding is extreme and produces the radiographic image of an inverted tooth inside the involved tooth – a condition termed dens in dente has suggested the following classification:

Type I: Invagination limited to the crown Type II: Invagination below the Cemento Enamel Junction (CEJ(

Type III: Invagination fully extended to the apex of the tooth

2-7-2-Dens Evaginatus (Talon Cusp)

This condition manifests with a prominence covered with , usually but not exclusively seen on the occlusal sur -face of the buccal cusp in premolar tooth, with a high incidence in Asian and Caucasian populations. It is more common in lower premolars, and the enamel prominence contains dentine and pulp in nearly 50% of cases. Evaginated odontome is another term used to describe this condition. Supernumerary teeth have also been reported with the condition. Both primary and permanent dentitions may be involved, and the evaginations may be bilateral. Merril has classified dens evaginatus into two groups: (i) originating from the lingual crest of the buccal cusp, and (ii) originating from the middle of the occlusal surface. Extension of the evaginatus to the incisal

edge of a tooth forms a “talon” cusp. Mitchell introduced the term in 1982, and Mellor and Ripa (1970) later named it “talon cusp” because of its likeness to the talon of an eagle (Figure 4.32). A classification based on size and shape was introduced by Hattab et al. (1996:(

Type I (talon): An extra cusp on the palatal or labial surface of a primary or permanent tooth at half its clinical height.

Type II (semi-talon): An extra cusp of more than 1 mm, but less than half of the clinical crown. This excess part is either isolated or conjoint with the palatal surface of the tooth.

Type III (trace talon): A large cingulum with different shapes of conical, bifid, or tubercle-like projections.In radiographic images, talons appear as radio-opaque structures overlying

normal anatomy. The pulp portion of the talon may be visible and superimposed on normal pulp horns. In larger evaginated masses, the pulp is more easily visible. No clear etiology has been determined for talon cusps. The highest incidence is on primary maxillary lateral incisors and permanent maxillary central incisors. They are usually unilateral, but bilateral cases have been reported. Talon cusp may affect occlusion, function (speech

(a) (b)

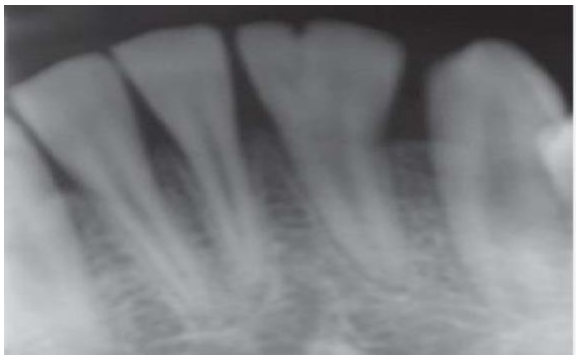
and trauma to the lip), and aesthetics. Care must be taken to correctly diagnose talon cusp on unerupted teeth and thereby avoid unnecessary surgical interventions. There is a higher potential for caries development in the deep grooves at the junction of talon cusps and the involved teeth. Fissure sealing or adhesive restorations in the grooves are required. Treatment involves occlusal adjustment without pulp exposure; otherwise, a pulpotomy (preferable) or pulpectomy may be necessary. Fluoride therapy can reduce sensitivity after occlusal adjustments.

2-7-3- Peg-shaped Laterals

The shape and size of the tooth is reduced with a classic tapered appearance, giving it a conical shape . The basic structure and composition are unchanged. The aesthetics is dramatically affected, and restoration at an early age with ceramic or composite laminate veneers is the treatment of choice, with full porcelain crowns being an option in severe cases.

2-7-4- Fusion

Two adjacent teeth have fused together coronally and are seen clinically as one tooth. This may occur between two teeth of the normal dentition, or between one tooth of the normal dentition and a supernumerary tooth. In true fusion between two teeth of the normal dentition, the number of teeth in the arch is reduced .



2-7-5-Gemination

The tooth germ is divided into two germs in its late development stage, resulting in a tooth with bifid or cleft crown. The cleft usually involves the full crown length, with an appearance of two teeth clinically. Aguiló et al.

(1999) has introduced a classification of the different types of geminated teeth based on their morphology:

Type I : A divided crown with a single root. The crown is usually oversized, with an incisal notch, and associated with a pulp chamber of two horns. The overall size of the root and pulp is normal.

Type II: Both crown and root sizes are increased, with no notch or groove, and a single large pulp chamber and pulp canal.

Type III: Conjoint crowns are cervical, with a vertical groove and two pulp chambers

merging to a common single nerve trunk in a larger-than-normal root canal.

Type IV: Two identifiable crowns and roots are attached with a groove throughout the entire length of the tooth.

Fusion and gemination are relatively easy

to be distinguished and properly diagnosed if there

are no supernumerary elements

involved. However, with supernumerary elements involved, the original description – of either a reduced number of teeth in the arch with one tooth being larger (fusion), or the increased number of teeth in the arch with one large cleftic tooth (gemination) – does not follow. Some clinicians prefer to call all larger teeth “double teeth,” and then to describe accurately by clinical and radiographic examination the coronal, radicular, and pulpal morphology

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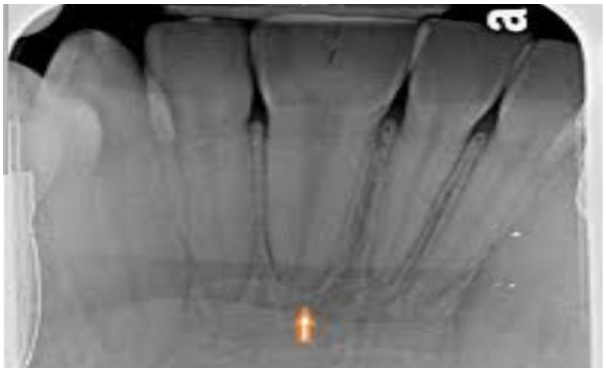
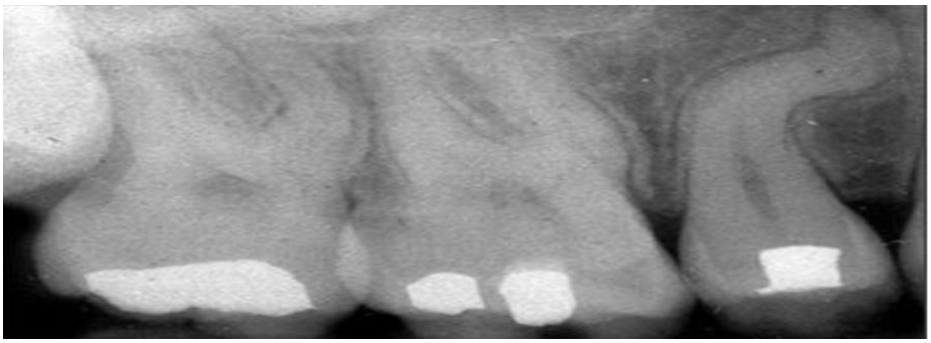


2-7-6-Dilaceration

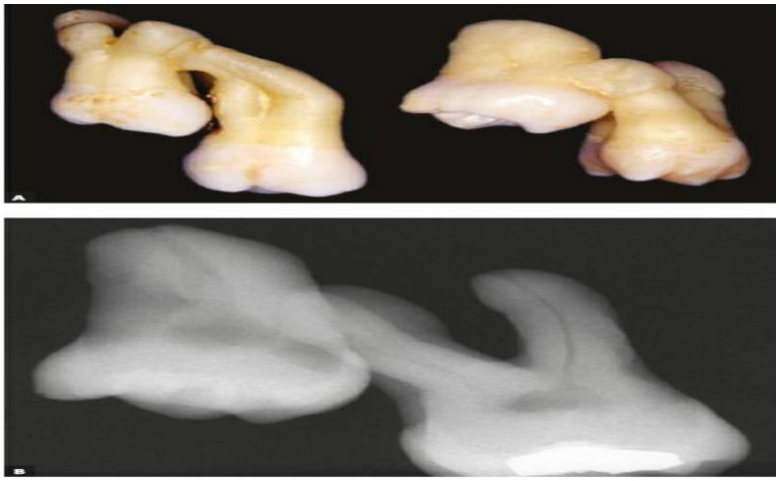
Dilaceration is the name given to those teeth with bends or changes in the long axis of their crowns, crown-roots, or roots . This is usually following trauma to

the developing tooth bud. The severity of dilaceration is dictated by the severity of original trauma, and dilacerated teeth may not erupt normally. A decision will need to be made whether the tooth is viable or not.



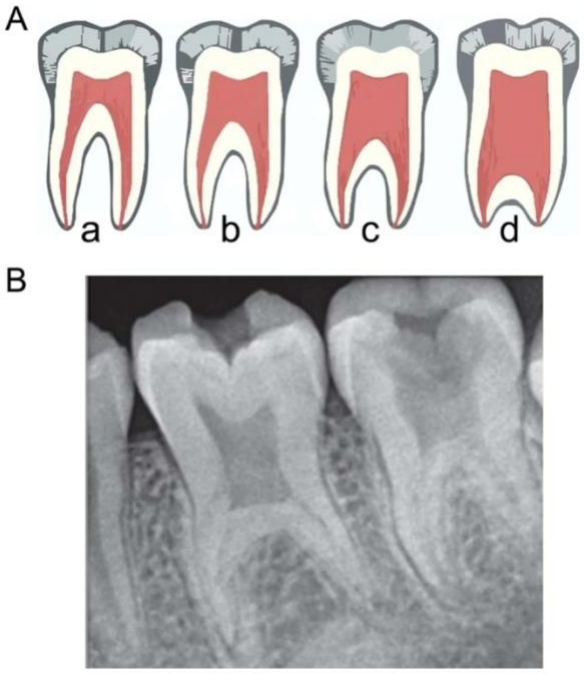
2-7-7-Concrescence

This is the case in which two independent adjacent teeth are pathologically connected at their root surface .



2-7-8- Taurodontism

The furcation areas on the molar teeth are located more epically than normal, and the pulp chamber appears elongated as a result. This anomaly is detected in radiographs and is seen in both dentitions, but is -commoner in the permanent dentition. Pulp treatment of such teeth is difficult. Down syndrome, tricho-dento-osseous syndrome, hypophosphatemia, dentinogenesis imperfecta associated with osteogenesis imperfecta, and vitamin D resistance are associated with enlarged dental pulp and the radiographic appearance of Taurodontism



2-8-Defects of Teeth Structures

2-8-1- Enamel Defects

Enamel Hypoplasia

a) Localized hypoplasia: These are small defects on a single tooth or on multiple teeth. The size of the defects is determined by the exposure time and severity of the causative agent, and the defects appear in entire dentitions and in both dentitions (primary and permanent), as genes provide genomic data for all teeth when undergoing production and secretion. These defects are traceable within

Figure 4.49 Double-rooted compound odontome at the site of: (a) upper right lateral incisor; and (b) upper left lateral incisor.

(a)

generations of the affected families, and risk can be predicted for future generations depending on the mode of genetic inheritance.

Amelogenesis imperfacta

The entire tooth structures of both dentitions are usually affected. Several types are recognized. These are inherited through xlinked or autosomal genes, and therefore defects are expected to be passed through

generations. The following classification is the most clinically popular one:

a) Hypoplastic (type I): Normal enamel calcification is disrupted, causing generalized thinner enamel mixed with areas of4.1 Genetically Originated Defects 43

near-normal enamel. This can result in rounded corners and angles in the tooth. Teeth in this group appear more trans lucent white in color.

Hypoplastic AI teeth formation is often associated with anterior open bite.

b) Hypocalcified (type II): This type of the defects is considered the most severe and most frequent, with the calcification process being affected. This

means the lay down of enamel has taken place normally, but it has not undergone the normal calcification process, resulting in the formation of poorly mineralized enamel. Tooth surface is porous and affected by external stain, deepening its existing yellow to a brown appearance, while the surface erodes easily and quickly in normal daily

(a) (b)

function. Vertical loss of facial height associated with this type leads to early malocclusion, including deep bite.

c) Hypomature (Type III): This is the least structural defect of enamel among the various types of AI. Disruption of enamel formation occurs on various parts of the tooth surface enamel along with some normal formation, leading to the formation of pits and notches on the smooth surfaces with degrees of surface roughness. These defects are in fact areas where enamel formation has failed to continue its normal crystallization, leaving behind gaps as pits and lines. These teeth are normal in size, shape, and strength, but the pits at their surfaces serve as retentive points for food debris and stains. These teeth look light yellow to brown in color.

d) Mixed – hypoplastic hypomature (type IV): Mixed AI normally presents clinically with characteristics of two of the AI types, and therefore appears to have the more severe clinical appearance of each individual anomaly and damaged structure . Signs and symptoms of the types are presented together, including -tissue loss and discoloration. These cases may

also taurodontism.

Syndromic cases of AI can be associated with blindness after the patients reach their third decade of life. Others can be associated with failure of eruption and anterior open bite . All children and adults with AI

be associated with require high-quality restorative care to main tain teeth function and to provide

acceptable aesthetics. a) Congenital Defects These defects are associated with disturbances occurring prenatally (before birth) and natally (around birth). They are termed congenital as the affected infant is born with the condition despite being clear of any genetic anomaly.

b) Environmental (Acquired) Defects These are defects that are localized and not

systemic, caused by environmental factors, and not representative any genetic defect. One frequently seen example is an undeveloped permanent

tooth germ affected by

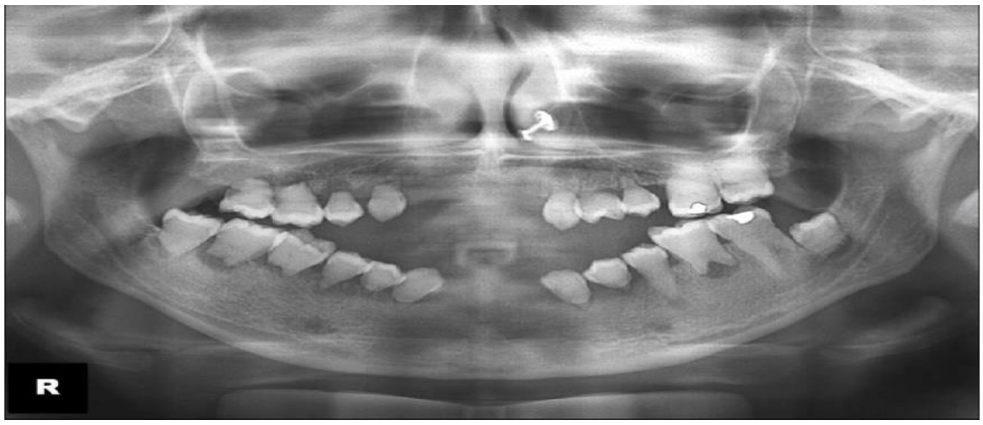
trauma or infection in a primary predecessor tooth .

2-8-2- Dentine Defects

Dentine can be affected through a mechanism similar to that of enamel, but with more collagen parts being affected than mineral (dentine is less mineralized than enamel). Dentin defects range from some dysplasia (such as dentinal dysplasia) to incomplete formation of dentinogenesis imperfecta.

Dentinal Dysplasia

Dentinal dysplasia and dentinogenesis imperfecta are the most frequent developmental problems seen in dentine. Dentine dysplasia presents clinically with slightly darker crowns, frequent mobility, and abscesses commonly without caries .



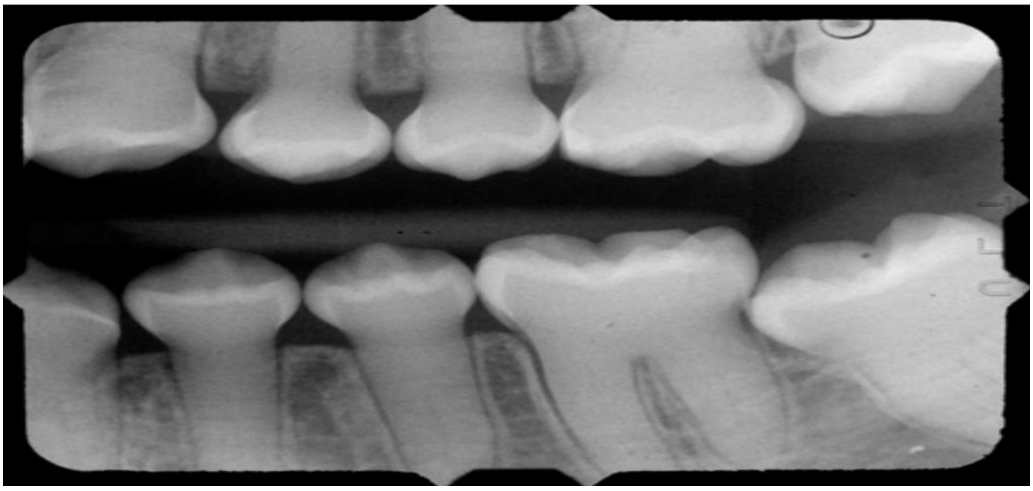
Dentinogenesis Imperfecta

This usually presents clinically with massive attrition of the coronal structure leaving pulp stumps. There is rarely pulp exposure due to

obliteration of pulp spaces with abnormal dentine . Three types of dentinogenesis imperfecta were described by Shields et al. in 1973:

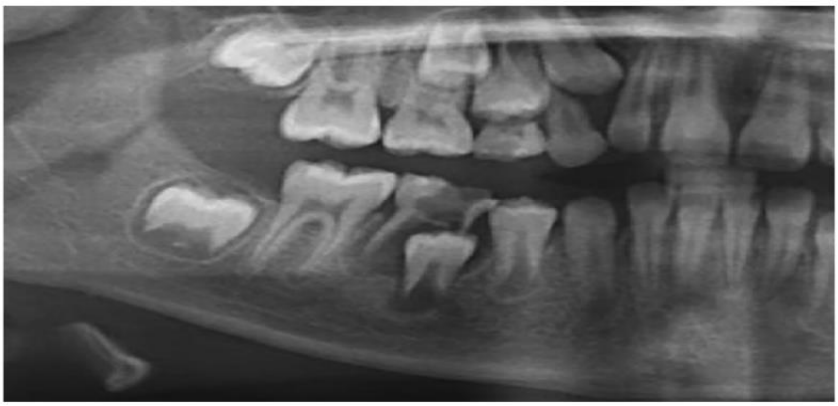
a) Type I, associated with osteogenesis imperfecta

b) Type II, affecting only the teeth c) Type III, Brandywine type “shell” teeth (isolate in Maryland (USA)



Dentine Cyst

Newly erupted teeth are seen to have large dentinal lesions before caries could have developed. They are routinely symptomless

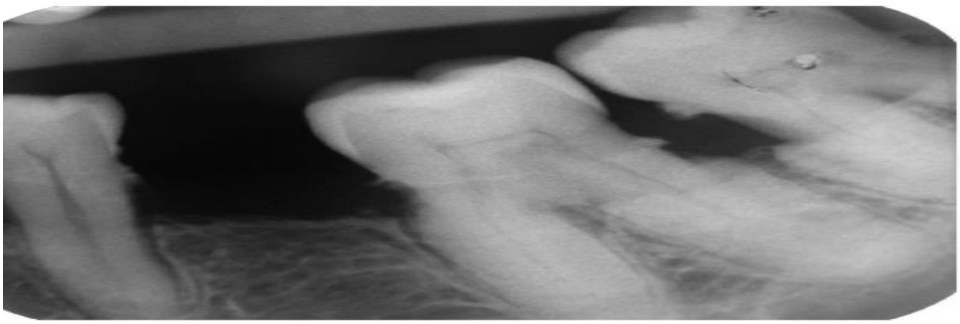


2-8-3- Cementum Defects

Cementum formation can also be defective as a result of changes in the proportion of formation and secretion. Classification is based on the amount of cementum produced.

Hypercementosis

Increased volume of cementum will cause its excessive accumulation around the roots of the involved teeth. This condition has no clinical sign, and it is usually detected in radiographic evaluations. The appearance of abnormally thickened apical areas of these teeth is termed “clubbing ”



Hypocementosis

This happens when a thinner layer of cementum is formed as compared to normal, and is associated with the abnormal insertion of periodontal ligaments and fibers, leading to early-onset periodontal problems and subsequent tooth loss. It is commonly a generalized condition and is

routinely associated with other systemic disturbances, including hormonal problems.

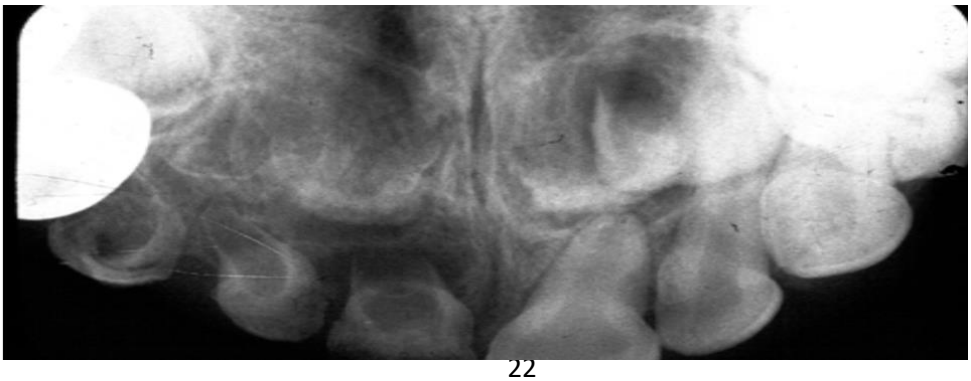
Acementosis

This is a very rare condition in which cementoblast cells are faulty and therefore unable to secrete and form normal cementum. As cementum plays the role of a protective layer on the root of the tooth, its absence is considered a major fault. The remaining tooth structure and outline are normally formed, but the tooth cannot survive due to the absence of cementum and the failure of the periodontal attachment.

2-9- Enamel Dentin Cementum Defects

Regional Odontodysplasia

This rare condition commonly affects only one quadrant in any individual. It affects all three hard dental structures in both dentitions and appears radiographically as shadow-like images of the teeth – hence the term “ghost teeth ”



Odontogenesis

Imperfecta This condition can be seen in both dentitions. The deficient formation of enamel is associated with that of dentine, causing marked reductions in radio-opacity, with large pulp chambers and thin enamel and dentine. Due to their poor prognosis, management usually involves full mouth extraction and teeth replacement using removable prosthetic denture before the child can receive implants

Aplasia (Anodontia)

This is a very rare condition in which no teeth develop in either dentition. There is no alveolar bone (dental ridges), and this results in a short vertical face height, giving the clinical appearance of an aged person.

3 -safe dosage of dental radiology

As with other medical procedures, x-rays are safe when used with care. Radiologists and x-ray

technologists have been trained to use the minimum amount of radiation necessary to obtain the needed results .

Properly conducted imaging carries minimal risks and should be performed when clinically indicated .

The amount of radiation used in most examinations is very small and the benefits greatly outweigh the risk of harm.

Lower voltages produce higher-contrast images and higher entrance skin doses. Higher voltages produce lower contrast images. Thus, the diagnostic purposes of the radiograph should be used to determine the selection of kilovolt setting .

A setting above 90 kV(p) will increase the patient dose and should not be used. The optimal operating potential of dental x-ray units is between 60 and 70 kVp

For extra-oral panoramic examination automatically determines parameter values contingent on the anatomy of the patient's head, with a voltage

range of 57–90 kV and a maximum current of 16 mA.

In extra-oral lateral cephalometric examination, the parameters are set at 90 kV, 13 mA and 16 s.

For intraoral radiography, a kilovoltage of 60-70 kV is recommended when direct current generated by constant potential is used and a kilovoltage of

65-70 kV is recommended when alternating current produced by pulsating potential. A kilovoltage lower than 60 kV gives absorbed dose to the skin without any benefits for the radiographic examination. On the other hand, little benefit is gained when kilovoltage higher than 70 kV

is used.

The optimal kV for dental CBCT imaging, and its dependence on the diagnostic task and patient

characteristics, are still somewhat unclear. It has been

demonstrated that, within the 60-90 kV range, 90 kV produced the best image quality when the same radiation dose was used.

Thus, the actual optimal tube voltage for CBCT imaging is likely to be above 90 kV. Slight or moderate reduction of mA compared with the manufacturer's default settings has been found to be possible depending on the diagnostic task.

4 -Dental x-ray equipment:-

There are several dental X-ray sets available from different manufacturers. They are essentially very similar and can be either fixed (wall-mounted or ceiling-mounted) or mobile. They all consist of three main components:-

- A tube head.
- An extension arm.
- The control panel.

Ideal requirements

The equipment should be:-

• Safe and accurate.

• Capable of generating X-rays in the desired energy range and with adequate mechanisms for heat removal.

• Small.

• Easy to manoeuvre and position.

• Stable, balanced and steady once the tube head has been positioned.

• Easily folded and stored.

• Simple to operate.

• Robust.

4-1- Tube Head (Tube Housing):-

The tube head (sometimes called tube housing, is a tightly sealed heavy metal (usually cast aluminum), lead-lined housing that contains the dental x-ray tube, insulating oil, and step-up and step-down transformers.

The metal housing performs several important functions:

1- Protects the x-ray tube from accidental damage.

2- Increases the safety of the x-ray machine by grounding its

high-voltage components (the x-ray tube and the transformers) to prevent electrical shock.

3- Prevent overheating of the x-ray tube by providing a space filled with oil, gas, or air to absorb the heat created during the production of x-rays.

4- Lined with lead to absorb any x-rays produced that do not contribute to the primary beam that exits through the port in the direction of the position indicating device (PID).

Older dental x-ray machine tube heads are heavy and bulky.

The trend is toward using lighter weight materials and miniaturized solid-state components. Reducing the size and the weight of the tube head helps make it easier for the operator to position.

X-ray tube:-

The x-ray tube, located inside the tube head, is a glass bulb from which the air has been pumped to create a vacuum. A cathode (the negative electrode) and an anode (the positive electrode) are sealed within the vacuum tube, and the two protruding arms of the electrodes permit the passage of the current through the tube with minimum resistance.

The cathode:-

Consists of a tungsten filament in a focusing cup made of molybdenum. The purpose of the cathode is to supply the electrons necessary to generate x-rays. Electrons are generated in the x-ray tube at the cathode. The hotter the filament becomes, the more electrons are produced.

The anode:-

The anode Is the target for the electrons.It Is composed of a tungsten target (a small block of tungsten) that is embedded in the larger copper stem. The copper around the target conducts the heat away from the target, thus reducing the wear and tear on the target. The purpose of the tungsten target is to serve as a focal spot and convert the bombarding electrons into x-ray photons. The x-rays at the center of this beam are known as the central ray.

4-2- The extension arm:-

The extension arm encloses the wire between the tube head to the control panel. It also has an important function in positioning the tube head. The extension arm folds up and can be swiveled from side to side. If the extension arm Is left in an extended position when the machine is not in use, the weight of the tube head can cause it to become loose, and the tube head will drift (slip out of position) after it is positioned for an exposure.

4-3- CONTROL PANEL:-

X-ray control panel means a device which controls input power to the X-ray high-voltage generator and the X-ray tube.

The control panel of an x-ray unit contains:-

1-The master switch.

2- Indicator light.

3- Exposure button.

4- Indicator light.

5- Control devices (time, milliamperage [mA] selector, and kilovoltage [kV] selector.

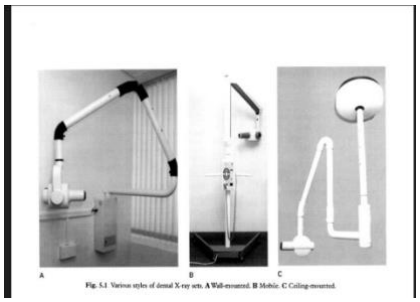


Fig. 5.1 Various styles of dental X-ray sets. A Wall-mounted. B Mobile. C Ceiling-mounted.

5- X-RAY Film processing Theory

A simplified approach to the stages involved in converting the green film emulsion into the black/white/grey radiograph

Stage 1: Development:-The sensitized silver halide crystals in the emulsion are converted to black metallic silver to produce the black /grey parts of the image.

Stage 2: Washing:-The film is washed in water to remove residual developer solution.

Stage 3:- Fixation :-The unsensitized silver halide crystals in the emulsion are removed to reveal the transparent or white parts of the image and the emulsion is hardened.

Stage 4: Washing:-The film is washed thoroughly in running water to remove residual fixer solution.

Stage 5: Drying the resultant black/white/grey radiograph is dried.

6 -X-ray Processing Room Requirement:-

Darkroom:-

-At least 4 x 5 feet.A well planned dark room makes the processing easier, which should be of at least 4 ×5 feet (1.2 × 1.5 m) .

-Light proof.

-Well ventilated.

-Safe lighting.

-White illumination.

Characteristics of darkroom:-

1- Convenient location and adequate size.

2- Ample working space with adequate storage.

3- Lighting.

4- Temperature and humidity controlled.

5- Darkroom plumbing.

6- Miscellaneous.

Location:

Darkroom should be located near the area where the x-ray units are installed.

Darkroom size is determined by the following factors:

1- Volume of radiographs processed and number of persons using the room.

2- Working Space: Adequate counter area where films can be unwrapped. A clean, organized work area is essential which should be free of processing chemicals, water, dust, and debris.

3- Storage Space: Adequate space for storage for chemical processing solutions, film cassettes etc.

4- Lighting: The room must be completely dark and must exclude all visible light. Any leaks of white light in the darkroom causes film fog

7 -Type of dental x-ray:-

There is two basic type

Intraoral radiography and Extraoral radiography.

7-1 Intraoral radiography:-In these radiographs, the films are placed inside the oral cavity.Intraoral radiographs can be divided into three categories, periapical projections, bitewing projections, and occlusal projections. Periapical radiographs should show all of a tooth, including the surrounding bone. Bitewing radiographs show only the crowns of teeth and the adjacent alveolar crests. Occlusal radiographs show an area of teeth and bone larger than periapical radiographs.

7 -1-1- The intraoral radiography Periapical examination:- The periapical view is taken for both anterior and posterior teeth. The purpose of periapical radiographs is to image the apices of the teeth and the surrounding bone. Two intraoral projection

techniques are commonly used for periapical radiography, the paralleling technique and the bisecting-angle technique.

Main indications

The main clinical indications for periapical radiography include:

• Detection of apical infection/inflammation.

• Assessment of the periodontal status.

. After trauma to the teeth and associated alveolar bone.

• Assessment of the presence and position of unerupted teeth.

• Assessment of root morphology before extractions.

• During endodontics.

• Preoperative assessment and postoperative appraisal of apical surgery.

• Detailed evaluation of apical cysts and other lesions within the alveolar bone.

• Evaluation of implants postoperatively.

A-Intraoral radiography Periapical radyography:-Paralleling Technique.

PARALLELING TECHNIQUE The central concept of the paralleling technique (also called the right-angle or long-cone technique) is that the x-ray receptor is supported parallel to the long axis of the teeth and the central ray of the x-ray beam is directed at right angles to the teeth and receptor.

ADVANTAGES

• Produces images with minimal dimensional distortion.

• Minimizes superimposition of adjacent structures.

• Long axis of the tooth and recording plane of the image receptor can be visually located making it easier to direct the x-rays appropriately.

• Many choices of image receptor holders on the market with external aiming devices specifically designed to make paralleling simple and easy to learn.

• With appropriate image receptor holding devices, takes less time than trying to locate the position of an imaginary bisector.

Disadvantages:-

-Parallel placement of the image receptor may be difficult to achieve on certain patients, children, adults with small mouths, low palatal vaults, or the presence of tori, patients with sensitive oral mucosa or an exaggerated gag reflex, edentulous regions.

-These same conditions may increase patient discomfort when the image receptor impinges on oral tissues.

Theory:-

1- The film packet is placed in a holder and positioned in the mouth parallel to the long axis of the tooth under investigation.

2- The X-ray tube head is then aimed at right angles (vertically and horizontally) to both the tooth and the film packet.

2- By using a film holder with fixed film packet and X-ray tube

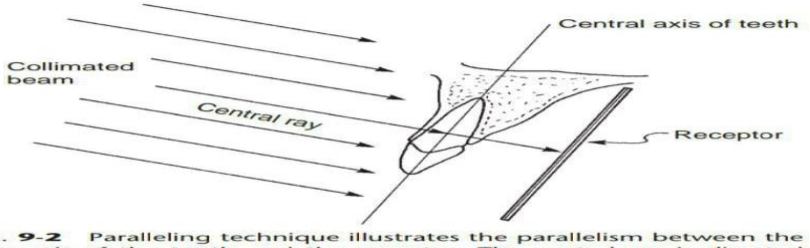


FIG. **9-2** Paralleling technique illustrates the parallelism between the long axis of the tooth and the receptor. The central ray is directed perpendicular to each.

B- **Intraoral radiography The Periapical Examination:-Bisecting Technique**

The bisecting angle technique is accomplished by placing the receptor as close to the tooth as possible. The central ray of the x-ray beam should be directed perpendicular to an imaginary line that bisects or divides the angle formed by the long axis of the tooth and the plane of the image receptor.

Advantages:-

• Positioning of the film packet is reasonably comfortable for the patient in all areas of the mouth.

• Positioning is relatively simple and quick.

• If all angulations are assessed correctly, the image of the tooth will be the same length as the tooth itself and should be adequate (but not ideal) for most diagnostic purposes.

Disadvantages:-

• The many variables involved in the technique often result in the image being badly distorted.

• Incorrect vertical angulation will result in foreshortening or elongation of the image.

• The periodontal bone levels are poorly shown.

• The shadow of the zygomatic buttress frequently overlies the roots of the upper molars.

• The horizontal and vertical angles have to be assessed for every patient and considerable skill is required.

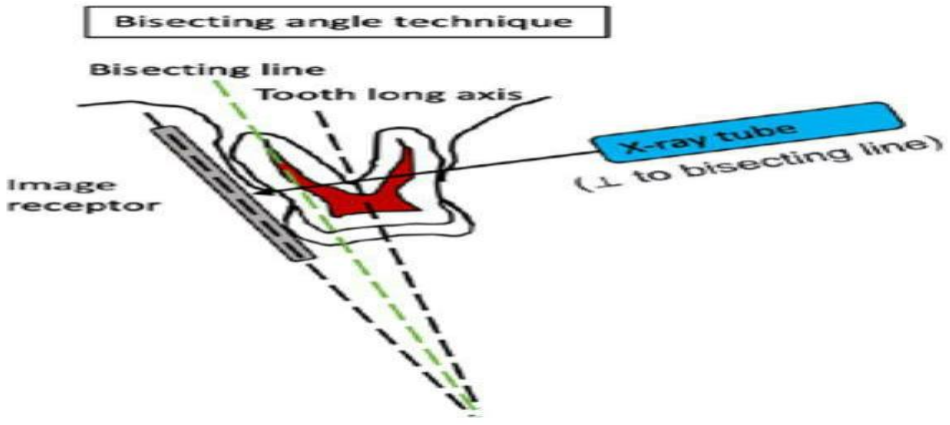
• It is not possible to obtain reproducible views.

• Coning off or cone cutting may result if the central ray is not aimed at the canter of the film, particularly if using rectangular collimation.

• Incorrect horizontal angulation will result in overlapping of the crowns and roots.

• The crowns of the teeth are often distorted, thus preventing the detection of a proximal caries.

• The buccal roots of the maxillary premolars and molars are foreshortened.



7-1-2- The intraoral radiography:-Bitewing examination.

The bitewing radiographic image is used to examine the interproximal surfaces of the teeth and is particularly useful for the detection of dental caries and the evaluation of alveolar bone levels. The receptor is placed into the mouth parallel to the crowns of the maxillary and mandibular posterior teeth. The patient stabilizes the receptor by biting on a tab or bitewing holder.in adult we need 2 bitewing film on each sides of the jaw at premolar and molar area while in children of 12 years old we need one film on each side.

Bitewing film placement:-

1-Bite-Wing Beam Alignment Device:-

A beam alignment device is a device used to position an intraoral receptor in the mouth and maintain the receptor in position during the imaging procedure. The Rinn XCP Extension Cone Paralleling System is a commonly used beam alignment device in dental imaging. It simplifies the process of positioning intraoral receptors, eliminating the need for patients to stabilize them with bite-wing tabs. The system includes color-coded components, such as a red aiming ring, metal arm, and red plastic bite blocks, making it easy to assemble and position. It accommodates various sizes of receptors and can be used with both film and digital sensors. After each use, the device must be sterilized for reuse.

Advantages:-

• Simple

• Film packet held firmly in position and cannot be displaced by the tongue

• Position of X-ray tubehead determined by the holder, thus is less operator-dependent, ensuring that the X-ray beam is always at right angles to the film packet

• Avoids coning off or cone cutting of anterior part of film.

• Holders are autoclavable or disposable.

Disadvantages:-

• Position of the holder in the mouth is operator-dependent, therefore not 100% reproducible, so still not ideal for monitoring progression of caries

• Positioning of the film holder can be uncomfortable for the patient.

• Some holders are relatively expensive.

• Holders not usually suitable for children.

2- BiteWing Tab:-

It sounds like you're discussing techniques for capturing bite-wing images in dental radiography, particularly in cases where traditional methods may not be feasible. Using tabs or loops attached to the receptor can indeed provide stability during exposure, especially for patients with small mouths or limited openings. These alternative methods ensure accurate imaging without relying solely on beam alignment devices.

Advantages:-

• Simple.

• Inexpensive.

• The tabs are disposable, so no extra cross infection control procedures required.

• Can be used easily in children.

Disadvantages:-

• Arbitrary, operator-dependent assessment of horizontal and vertical angulations of the X-ray tubehead.

• Radiographs not accurately reproducible, so not suitable for monitoring the progression of caries.

• Coning off or cone cutting of anterior part of film is common

• The tongue can easily displace the film packet.

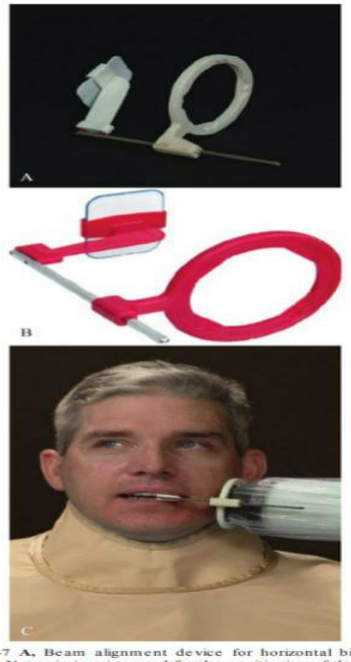


FIG 19-7 A, Beam alignment device for horizontal bite-wing images. Note aiming ring used for the positioning of the PID to ensure that the entire receptor is covered by the x-ray beam. B, Beam alignment device for vertical bite-wings. C, Rectangular collimation used with a bite-wing exposure.

FIG 19-8 A, Bite-wing tabs.

7-1-3- The intraoral radiography occlusal examination:-

occlusal examination:- it is view large areas of the maxilla (upper jaw) or the mandible (lower jaw) on one radiograph. The image receptor is placed in the mouth between the occlusal surfaces of the maxillary and mandibular teeth. The patient occludes (bites) lightly on the image receptor to stabilize it.

Main clinical indications

The main clinical indications include:

• Periapical assessment of the upper anterior teeth, especially in children but also in adults unable to tolerate periapical films.

• Detecting the presence of unerupted canines, supernumeraries and odontomes.

• As the midline view, when using the parallax method for determining the bucco/palatal position of unerupted canines.

• Evaluation of the size and extent of lesions such as cysts or tumours in the anterior maxilla.

• Assessment of fractures of the anterior teeth and alveolar bone. It is especially useful in children following trauma because film placement is straightforward.

Classification of occlusal view:-

Maxillary Occlusal Projections:-

Three maxillary occlusal projections are commonly used:

(1) topographic , (2) lateral (right or left), and (3) pediatric..

1- Topographic projection. The maxillary topographic occlusal projection is used to examine the palate and the anterior teeth of the maxilla.

2- Lateral (right or left) projection. The maxillary lateral occlusal projection is used to examine the palatal roots of molar teeth. It may also be used to locate foreign bodies or lesions in the posterior maxilla.

3- Pediatric projection. The maxillary pediatric occlusal projection is used to examine the anterior teeth of the maxilla and is recommended for use in children 5 years or younger.

Mandibular Occlusal Projections:-

Three mandibular occlusal projections are commonly used:

(1) topographic , (2) cross-sectional, and (3) pediatric.

1- Topographic projection. The mandibular topographic occlusal projection is used to examine the anterior teeth of the mandible.

2-Cross-sectional projection. The mandibular cross-sectional occlusal projection is used to examine the buccal and lingual **aspects of the mandible. It is also used to locate foreign bodies or salivary stones in the region of the floor of the mouth**

3- Pediatric projection. The mandibular pediatric occlusal projection is used to examine the anterior teeth of the mandible and is recommended for use in children 5 years or younger.

7 -2- Extra Oral Radiographs :-

In these radiographs, the films are placed outside the oral cavity, with the beam directed towards it. This type of radiography can be utilized for cases presenting clinically with large lesions, to study variations of the jaw, facial bones, to assess the growth of hard tissues developmental defects, trauma and the temporomandibular Joint.

A-Panoramic Radiograph :-

This is the most commonly used extra oral radiographic modality in dental practice. It produces single tomographic image of maxilla and mandible with shadows of supporting soft tissue structures. It provides a wide coverage of teeth and bones with comparatively minimal radiation exposure. One of the main advantages is its usefulness in patients with trismus. Patient cooperation is minimal and the radiographs are easy to interpret. This radiography requires an initial investment and images do not provide sufficient detail for periodontal or endodontic procedures often with overlapping of anatomic structures.

Advantages:-

• Increased coverage of supporting structures of the oral cavity.

• Reduced patient radiation dose over a film-based intraoral full mouth series of radiographs.

• Can be performed in less time than the exposure of a full mouth series of radiographs.

• Simple procedure to perform.

• May be performed on patients who cannot, or will not tolerate placement of an intraoral image receptor.

• Requires minimal patient instruction and cooperation.

• Infection control protocol minimized.

• Mounting time is eliminated.

• Aids in explaining treatment plan to patients.

Disadvantage:-

• Increased image distortion. The amount of vertical and horizontal distortion is not constant it varies from one part of the radiograph to another

• Reduced image sharpness.

• The size and shape of the focal trough is predetermined by the manufacturer, therefore not all patients' arches will be recorded equally well.

• Superimposition of structures (e.g., the spinal column) may make interpretation difficult.

• Soft tissue shadows present on the resulting image may mimic pathology.

• Ghost images present on the resulting image may hide pathology.

• Not useful in detecting incipient carious lesions or early periodontal changes.

• Simple procedure may be overused inappropriately.

• Cost of panoramic machine is significant.

B-Cephalometric Radiograph:-

This radiography is mostly used in Orthodontics to study the relationship of teeth to the jaw and jaws to the rest of skeleton

for treatment planning and orthognathic surgery. For this radiography, the equipment utilized is available with panoramic radiography and differs in head positioning.

The main clinical indications :- can be considered under two major headings — orthodontics and orthognathic surgery.

Orthodontics

• Initial diagnosis:-confirmation of the underlying skeletal and/or soft tissue abnormalities.

• Treatment planning.

• Monitoring treatment progress, e.g. to assess anchorage requirements and incisor inclination.

OrthoGnath surgery

• Preoperative evaluation of skeletal and soft tissue patterns.

• To assist in treatment planning.

• Postoperative appraisal of the results of surgery and long-term follow-up studies.

C- Skull and Maxillofacial Radiograph:-

This type of radiography, is used to diagnose trauma or lesions of the skull or maxillofacial region which cannot be detected using a panoramic radiography.

The technique, principles, interpretation and setup of this radiography exceeds the regular usage in a private dental practice

and is the choice of the dentist to invest time and money on this particular radiography.

If at all cases of suspected fracture of maxillofacial region do report, they can be referred to hospital with mention of the type of radiograph to be taken.

D- Radiography of Mandible (PA Mandible):-

Among the extra oral radiographs, this type of radiography is commonly used to diagnose fractures of posterior third, angle of the mandible as well as mandibular deformities.

The three types are

• PA Mandible - Posterior anterior view of mandible and ramus.

• Rotated PA Mandible - One side of the mandible.

• Lateral oblique - Anterior body of the mandible, Posterior body of the mandible, Ramus of the mandible in oblique angulations.

E-Radiography of Temporomandibular Joint:-

The most commonly used technique like panoramic radiography and other extra-oral radiograph cannot help in arriving to a specific diagnosis emphasises the relevance of temporomandibular radiography.

This technique helps to examine the TMJ bony relations and give a complete detail about the articular surface, condylar head and neck and the walls of temporomandibular joint and their supporting structures and bone also their defects.

The types of TMJ radiography commonly used are Transcranial, Transpharyngeal, Transorbital and Reverse Town Projection.

7-3- Digital imaging:-is a technique used to record dental images.

Unlike conventional dental radiography techniques,no film or processing chemistry is used. Instead, digital imaging uses an electronic sensor as well as specialized computer software that produces images almost instantly on a computer monitor.

Purpose and Use:-

• To detect lesions, diseases, and conditions of teeth and surrounding structures that cannot be detected clinically.

• To confirm or classify suspected disease.

• To localize lesions or foreign objects.

• To provide information during dental procedures (e.g., root canal therapy instrumentation and surgical placement of implants).

• To evaluate growth and development.

• To document the condition of a patient at a specific point in Time.

• To aid in the development of a clinical treatment plan.

Advantages:-

1. Superior gray-scale resolution:-A primary advantage of digital imaging is the superior gray-scale resolution that results. Digital imaging uses up to 256 shades of gray compared with the 16 to 25 shades of gray differentiated on conventional film.

2. Reduced exposure to x-radiation:-Another primary advantage of the digital imaging system is the reduction in patient exposure to x-radiation.

3-Increased efficiency:-Dental professionals can be more productive because digital imaging does not interrupt routine patient treatment or care.

4-Enhancement of diagnostic image. Features such as colorization and zooming allow users to highlight conditions such as bone resorption caused by periodontal disease or to help detect small areas of decay.

5-Effective patient education tool and eco-friendly alternative.

Disadvantages:-

1-Initial setup costs:-The cost depends on the manufacturer, the level of computer equipment currently in the office, and auxiliary features such as the intraoral camera. Maintenance and repairs must also be considered.

2-Sensor size and thickness:-Some digital sensors are thicker and less exible than intraoral film.

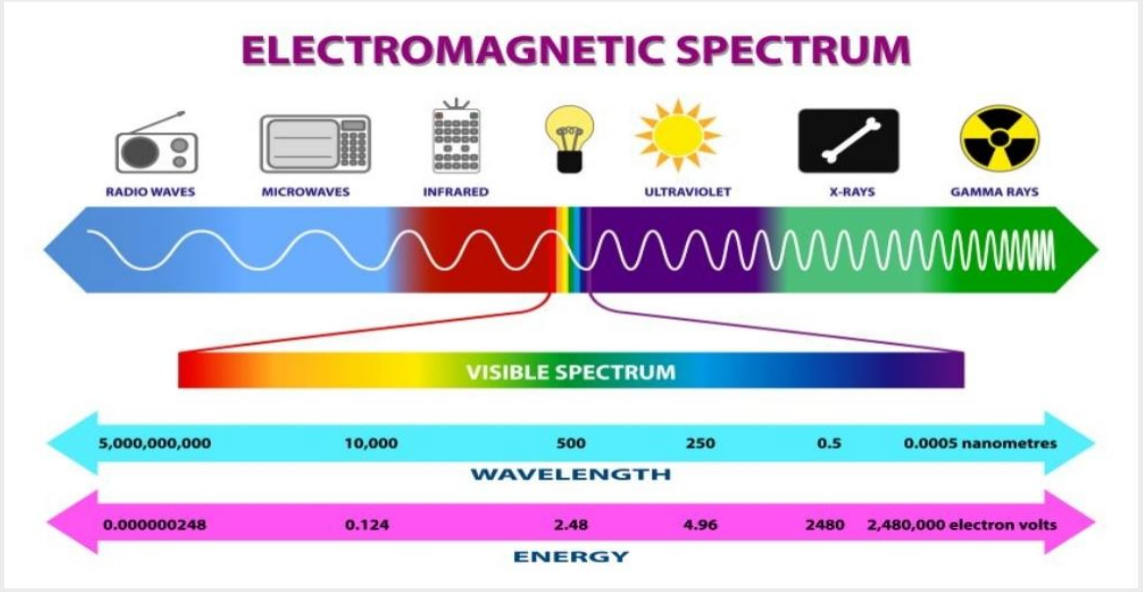
3-Infection control:-Digital sensors cannot withstand heat sterilization. Therefore, these sensors require complete coverage with disposable plastic barrier.

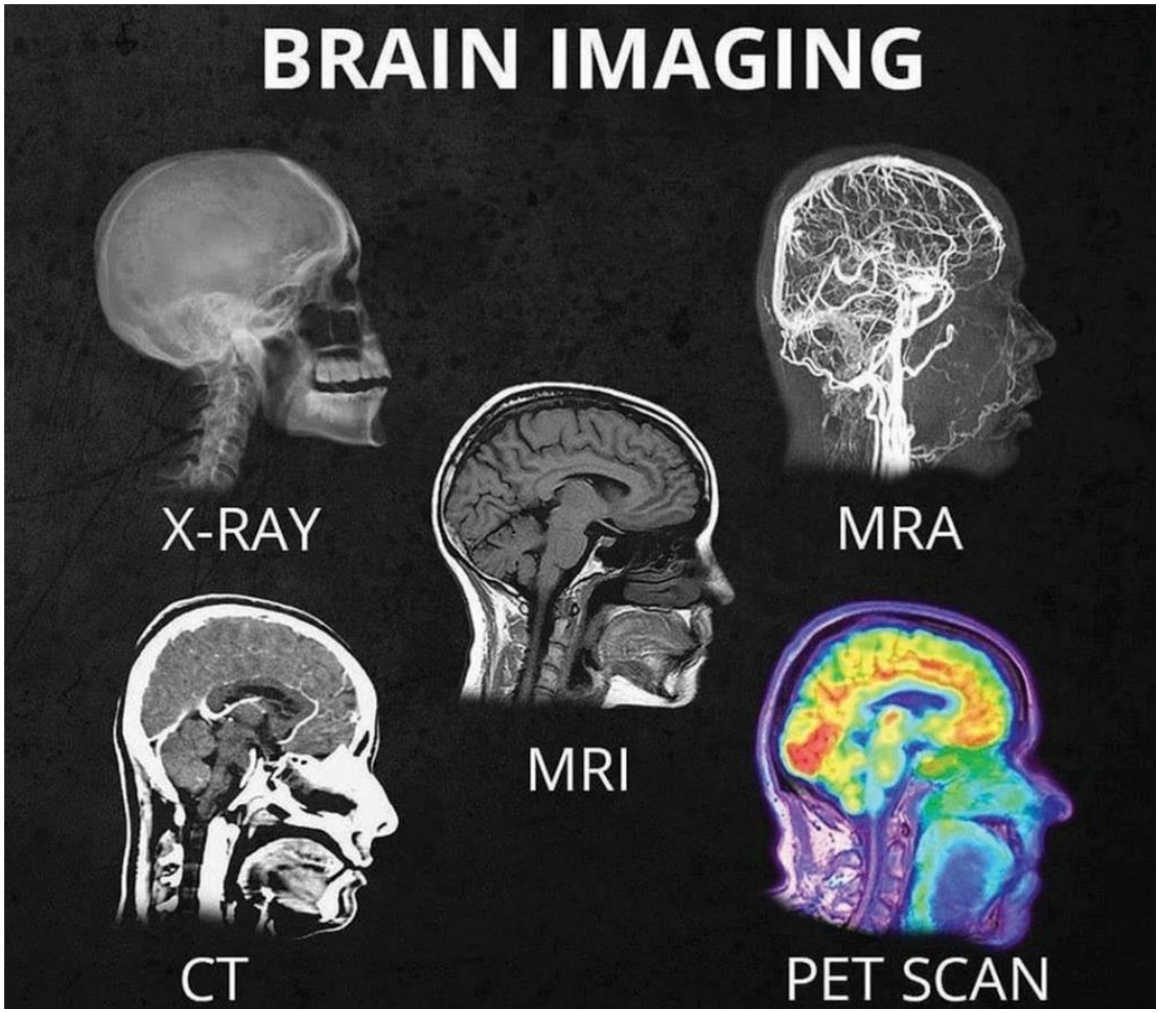
4-Legal issues. Because the original digital image can be enhanced, it is questionable whether digital images can be used as evidence in law suits.

8- CONCLUSION

1 -Because the interspaces between the the molecules of solid materials are very little , so the molecular bonding of them are very strong , and becuase the electromagnetic spectrum of x ray is 0.1 to 10 nanometers so , the x ray can be used successfully for take radiographical picture for the hard tissues and therefore help in the medical and dental diagnosis

2 -The soft tissues are less solid for the hard tissue due to their components , so the x ray can not be used for the diagnosis of soft tissues and they apper dark on the radiograph (radiolucency) , so we have alternative techniques to help in detection of soft tissue pathological conditions

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X-RAY
MRA
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PET SCAN

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