

Radiology

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Image Gently

- www.imagegently.org
- "One size does not fit all. When we image, image gently"
- Initiative of the Society for Pediatric Radiology
- Medical and dental professionals respect ALARA (as low as reasonably achievable) when exposing patients to ionizing radiation and to individualize and personalize prescription of radiographs for each patient
- AAPD and AAOMR endorse this initiative

X-Ray Basics

- Early diagnosis
 - Caries
 - Eruptive or developmental problem
 - Pathology
- Selection depends on each individual child
 - Age of child
 - Size/findings in the oral cavity
 - Patient cooperation
- Exam first
- Minimum amount of radiation



ADA/FDA guidelines

- Serve as an adjunct to the dentist's professional judgement



Radiographic Principles

- Ionizing radiation regulations
 - Federal government establishes performance standards for x-ray generating equipment
 - State/local agencies govern users (facility design, shielding, use and maintenance of equipment)

X-ray Basics

- ma (milliamperage) quantity of the x-ray
- Kvp (kilovoltage) quality of the beam
 - High kvp-> lowers contrast
 - Low kvp->increases contrast
- Time -how long it travels
 - Longer->darker
 - Fraction of second
 - Second
 - Impulses
 - Larger patients more exposure time
- Best is 7ma, 70kvp and change time accordingly

Dental Radiographs

- Dental radiographic exposures contribute to approximately 2.5% of total health care x-ray dosage
- Used to diagnose oral disease and monitor dentofacial development and progress of therapy



Health Benefit Will Outweigh Risk From Exposure If.....

- Examination is clinically indicated and justified
- Technique is optimized to ensure high quality diagnostic images
- Principles followed to minimize exposure to patient, staff and public



Radiographs

- Current guidelines require review of medical/dental history and clinical examination to determine need for x-rays
- Obtain prior radiographs
- Order x-rays only if diagnostic yield will affect patient care
- Review all radiographs for caries, periodontal bone loss, developmental anomalies and occult disease
- Have a systematic way of looking at the x-rays

Low Caries Risk Patient- Rate of caries progression determines frequency of BW

- Primary teeth
 - Approximately one year for caries to progress through outer half of enamel and another year through inner half
 - 12-24 month is appropriate
- Permanent teeth
 - Averages 3 years to progress through enamel
 - Although immature permanent teeth susceptible to faster progression
 - 18-36 months for adolescent

High Caries Risk Patient- Rate of caries progression determines frequency of BW

- Primary Teeth/ Permanent Teeth
 - Posterior BW at 6-12 month intervals if proximal surfaces cannot be examined visually



X-Rays

- Use largest image receptor to obtain maximum information
 - Size #2 films to evaluate erupting permanent teeth
- Have parent (not staff) hold film/immobilize child during x-ray if necessary (provide shielding- gloves, apron)
- If cannot obtain diagnostic x-ray confer with parent to determine appropriate management techniques
 - Advanced behavior management modalities
 - Deferral
 - Referral
- Consider relative risks and benefits

Review in Environment Free of Distraction

- Reduce room illumination to level of displayed images
- Eliminate glare
- Use magnification
- Utilize systematic approach
- Conventional films- opaque mount
- Digital images- use software that allows adjustments of contrast, brightness



Radiation Safety

- Be familiar with state/local regulations
- ALARA =As Low As Reasonably Attainable
 - Do all that is possible to minimize exposure
- Use fastest image receptor available
 - Intraoral
 - Change from D to F speed film
 - Modern digital image receptors
 - Reduces dose by factor of at least 2
 - Extraoral
 - High speed (400 or greater)
 - Rare earth screen film systems or digital imaging systems



Radiation Safety

- Rectangular Collimation
 - Reduces radiation dose by factor of 4 to 5
 - No adverse influence on image quality
- Beam-receptor alignment devices (eg. XCP)
 - Decrease number of retakes
- Use 70 kVp or higher intraoral x-ray techniques
- Lead apron/thyroid collar
- Operator behind barrier or at least (6 feet) 2m from tube head during exposure at location of minimum exposure
- Never in the primary radiation beam



Radiation Safety

- Require personal dosimeters for clinical staff members
 - Some agencies require for all occupationally exposed personnel
 - Helps identify undesirable practices and sources of high exposure
 - Demonstrates compliance with individual dose limits and documents annual and lifetime dose
- Pregnant employees- no specific guidelines if using standard radiation precautions



Radiation Safety

- Parent (not personnel) hold the image receptor and immobilize child during x-rays
- Shield the parent

Radiation Safety

- Technique charts to assure staff uses proper exposures
- Training staff to ensure optimal quality radiographs
- Quality assurance program for equipment
- Time/temperature for processing as recommended by manufacturer
- Incorporate shielding design in new office construction
- Post warning signs

Technological Advances Digital Imaging



- Direct digital radiography (DR)
 - Solid state detectors (charged coupled devices)
 - Small box like image receptor which enable instant image on monitor when exposed to xrays
 - Complementary metal oxide semiconductors (CMOS)
 - Small box like image receptor which enable instant image on monitor when exposed to xrays
- Phosphor storage plates(PSP)
 - Thin film like plates which can be viewed on a monitor after scanning when exposed to xrays
- Indirect digital radiography
 - Image initially recorded on conventional film and later digitally processed to produced electronic image

Digital Receptors

- Exposure times of PSP comparable to E/F analog film
- Exposure times of CCD and CMOS shorter
- Digital xrays are considered PHI (protective health information)
- Transmission must be encrypted and done over a HIPAA compliant data sharing system

Digital Sensors

- Gendex
- Planmeca
- Kodak
- Schick
 - Schick 33 with replaceable cord



ScanX



Advantages of DR/CR over Conventional Film

- Image obtained may be immediately available
- No darkroom requirement
- Elimination of processing chemistry
- Image may be electronically manipulated
- Easily stored and transmitted
- Radiation dose may be less

Disadvantages of DR/CR over Conventional Film

- Smaller receptor for DR than conventional film (may require more exposures)
- Thicker receptors (CCD, CMOS, CID) make positioning difficult
- More retakes
- Young children may not tolerate wired sensors/ chew on cables
- PSP imaging cannot be bent without permanent artifact (prone to bite marks and scratches)
- Image quality
- Resolution is less and diminishes further when printed
- Need for additional equipment (computers)
- Limited standards, apparatus, and software to evaluate performance of dental digital imaging systems
- Expensive (wired sensors)

Sensor Vs. Phosphor Plates

Sensor

- Solid state x-ray detector technology
- Uses bulky nonflexible intraoral receptor
- Sized to typical dental films
- Thicker because of electronics
- Wired to the computer and uses software to capture and display images

Phosphor Plate

- Flexible receptor like traditional film
- Not attached to a device
- Processed through a scanning or reading device to convert image to digital format

Risks and Effects

- Major biological risks
 - Carcinogenesis
 - Fetal effects
 - Mutations
- Risks from low doses extrapolated from high dose data
 - Japanese atomic bomb survivors (Chernobyl)
- Risk of carcinogenesis is small but significant
 - Only obtain radiographs if expect diagnostic yield that will influence patient care
- Tissues of growing children more sensitive than that of adults
 - The younger the individual the faster the tissues grow and the higher the risk of developing a fatal cancer from being exposed to ionizing radiation
- Juvenile thyroid is among most sensitive organs to radiation induced tumors
 - Benign and malignant
 - Risk decreases significantly with age at exposure
 - Risk disappearing after age 20

(TAP FOR ENLARGED VIEW)

TABLE 1. ESTIMATED FATAL CANCER RISKS FROM SEVERAL RADIOGRAPHIC EXAMINATIONS (ESSENTIALS OF DENTAL RADIOGRAPHY AND RADIOLOGY)

X-ray diagnostic investigation	Estimated risk of a fatal cancer (radi)
2 dental radiographs (DMX) (Digital, circular collimation)	1 in 2 million
2 dental radiographs (DMX) (Digital, circular collimation)	1 in 20 million
Dental panoramic radiograph	1 in 1 million
Skull lateral radiograph	1 in 670,000
Lateral skull radiograph	1 in 1 million
Frontal skull radiograph	1 in 1 million
Computed tomography of the thorax	1 in 2,500
Computed tomography of the skull	1 in 10,000

(TAP FOR ENLARGED VIEW)

TABLE 2. MULTIPLICATION FACTORS WITH REGARD TO AGE FOR ASSESSING RISK TO DEVELOP A FATAL CANCER FROM BEING EXPOSED TO IONIZING RADIATION

Age category	Multiplication factor for the risk estimation to develop a fatal cancer
< 10 yrs	X 3
10-20 yrs	X 2
20-30 yrs	X 1.5
30-50 yrs	X 0.5
50-80 yrs	X 0.3
> 80 yrs	X 0

(Adapted from Whittaker, 2007²⁴)

(TAP FOR ENLARGED VIEW)

TABLE 3. ILLUSTRATIONS OF THE EFFECTS OF AN ACUTE EXPOSURE TO DIFFERENT DOSES OF IONIZING RADIATION

Dose	Main acute effects following large whole body doses of radiation
Up to 2500 μ Sv	Nil
2500 to 10 000 μ Sv	Changes in blood, lower WBC counts
10 000 to 20 000 μ Sv	Vomiting within 3 hours, fatigue, loss of appetite and blood changes (still reversible - recovery within a few weeks)
20 000 to 60 000 μ Sv	Vomiting within 2 hours, dramatic changes in the blood, hair loss within 2 weeks (recovery within 1 month to a year in 70% of cases)
60 000 to 100 000 μ Sv	Vomiting within the hour, dramatic blood changes, death follows within 2 weeks in more than 80% of all cases)
> 100 000 μ Sv	Brain damage, coma, death

Risks and Effects

- Critical organs
 - Eye (cataract)
 - Hematopoietic (leukemia)
 - Gonads (genetic disorders, mutations, infertility, fetal malformations)
 - Skin (cancer)
 - Thyroid (cancer)
 - Pregnancy (birth defects)
 - Breast (cancer)

Risks and Effects

- Gonadal absorbed dose from a typical dental x-ray procedure is equivalent to 1 hour of natural background radiation

Risks and Effects

- Pregnancy
 - Radiation exposure to thyroid during pregnancy is associated with low birth weight
 - Common dental projections- rarely if ever deliver measurable absorbed doses to fetus or embryo
 - Used protective collar and apron if exposure required
 - If dental care to be delayed until after delivery then x-rays should be delayed as well
 - X-rays are safe for pregnant woman according to the American College/Congress of Obstetricians and Gynecologists which also encourage patient to see a dentist during pregnancy

Please note...

- Baseline anterior periapical or occlusal films in primary dentition are indicated if:
 - Proximal surfaces cannot be visualized probed or there is history of trauma, clinical pathology, or anomalies
 - If no history of trauma, clinical pathology or anomalies then routine follow up exposures during the primary dentition not indicated
- Gagging can be helped with distraction, topical lidocaine or nitrous

Bitewings-BW

- May be oriented horizontally or vertically
- Reveals coronal half of maxillary and mandibular teeth, interproximal contacts, portions of interdental alveolar septa
- Primarily used for:
 - Detecting/monitoring occlusal and interproximal caries
 - Crestal alveolar bone levels
- Secondarily used for:
 - Erupting patterns
 - Caries/restoration proximity to pulp spaces
 - Primary molar furcation pathology
 - Developmental anomalies



BW



- Primary and mixed dentition
 - 1 film/side to include distal half of canine and erupted posterior dentition
- Adult dentition
 - 1-2 films/side depending on tooth size and alignment
- Insert film horizontally and rotate
- Tab held against occlusal surfaces as patient closes in centric
- Vertical angle is 8-10 degrees
- Cone parallel to bite tab
- Frequency of radiographic exam based on caries risk assessment
- 0 film (1 and 2 possible)

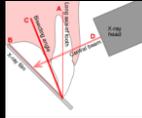
Periapical/Occlusal Films

- Indicated for identified or suspected pathosis
- Evaluate dental development, dentoalveolar trauma or deep carious lesions
- Should include crown and at least 2mm beyond apices
- Occlusal radiographs also for
 - Unsatisfactory PAN due to abnormal incisor relationship
 - Localizing tooth position
 - Pathology (sialoliths, buccolingual extent of pathological lesions, traumatic bone injury)
 - Palatal expansion

Periapical/Occlusal Films

Techniques

- Paralleling
 - Long axis of tooth parallels image receptor
- Bisecting angle
 - Central ray directed perpendicular to a plane that bisects the angle created by the long axis of the tooth and film



Periapical/Occlusal Films

- Maxillary occlusal film
 - Size 2
 - Vertical angulation 60 degrees with beam directed downward
- Mandibular occlusal
 - Size 2
 - Patients head positioned so that occlusal plane is at a -45 degree angle
 - Cone is aligned at a -15 degree angle upwards
 - Pt is reclining with chin extended
- Maxillary and mandibular pas beam at right angle to the film (parallel to bite tab/snap a ray)



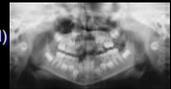
Film series

- 4 film series
 - Maxillary and mandibular anterior occlusals
 - 2 posterior bw
- 8 film series
 - Maxillary and mandibular anterior occlusals
 - 2 posterior bw
 - Right and left primary mandibular and maxillary pas
- 12 film series
 - 4 primay molar-premolar pas
 - 4 canine pas
 - 2 incisor pas
 - 2 posterior bw
- 16 film series
 - Same as 12 film and 4 permanent molar radiographs



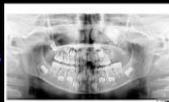
Panoramic Films

- A supplement to rather than a substitute for intraoral periapicals
- Includes the teeth, supporting structures, the maxillary region extending to the superior third of the orbit, entire mandible including the TMJ
- Used to diagnose fractures, cysts, and other anomalies
- Lack of image detail for diagnosing early carious lesions
- Contemporary films open the contacts with the use of a C-arm on the machine
 - This may not eliminate bw but can be used in initial exam and follow up if low caries risk
- No film in the mouth
- Difficult for some young children to stay immobile for 15 seconds
- Systematic way of review
- Count teeth
- Usually around age 8-9 (eruption of max lateral)



When to take a pan...

- Based on clinical exam
 - Suspected pathology
 - Orthodontic/developmental anomalies
- Age for routine screening
 - Once max lateral incisors erupt
 - Once 6's erupt
 - Once 6's and all 8 incisors erupt
 - Specific age
- How often?
 - Ortho
 - Insurance



Panoramic Advantages Compared to Intraoral Series

- Rapid acquisition of a single image encompassing entire dental arches and their supporting structures
- Useful for craniofacial trauma
- Without discomfort of intraoral image receptor placement
- Minimal problems of infection control
- Effective dose is approximately equal to 4 intraoral images, both using state of art technique
- Reduced cost

Panoramic Disadvantages Compared to Intraoral Series

- Image magnification/distortion
- Due to positioning difficulties, serial images show different distortions
- Resolution inadequate for definitive diagnosis of dentoalveolar trauma, incipient caries, pulpal pathology, beginning periapical lesions, root shape or resorption, or marginal periodontal disease
- Longer exposure time may prove difficult for /allow movement by uneasy patients
- Few manufacturers, models allow adjustment for patients varying dimensions

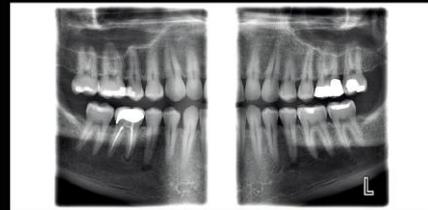
Planmeca ProMax 2D3S

- **Panoramic imaging**
 - In addition to the Standard panoramic program, the following programs are offered:
 - **Interproximal panoramic program:** generates an image, where interproximal teeth contacts are open.
 - Primarily used for caries detection.
 - **Orthogonal panoramic program:** produces an image with clearly visible alveolar crest for improved diagnostics.
 - Ideal for periodontal imaging and implant planning.
- **Extraoral bitewings**
 - The Bitewing program uses improved interproximal angulation geometry.
 - The result is a bitewing image pair with low patient dose and excellent diagnostic quality.
- **Sinus imaging**
 - The Sinus programs provide a clear view of the maxillary sinuses.
- **Horizontal and vertical segmenting for panoramic program**
 - With horizontal and vertical segmentation, exposure can be limited to the diagnostic region of interest.
 - Patient dose is reduced by up to 90% compared to full panoramic exposure.
- **TMJ imaging**
 - The TMJ imaging programs produce lateral or posteroanterior views of open or closed temporomandibular joints. The imaging angle and position can be adjusted to correspond to the anatomy of each individual patient.
 - The Lateral-PA TMJ program captures lateral and PA views on the same radiograph, while the multi-angle TMJ programs produce three different angles of radiographs from either the lateral or PA view.

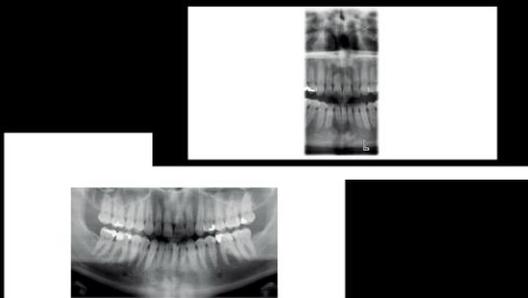
Standard Panoramic



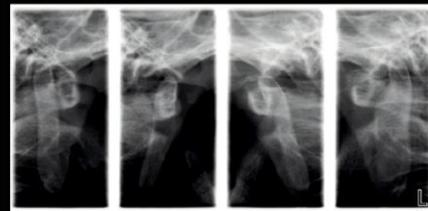
Bitewing



Horizontal and Vertical Segmenting



Lateral TMJ (closed & open)



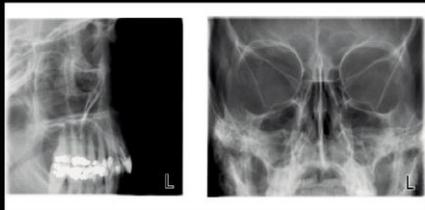
Lateral-PA TMJ



PA TMJ (closed & open)



Lateral and PA sinus



Plameca Promax 2D3S

- Child mode for reduced dose
 - Child mode reduces the patient dose remarkably for all programs by reducing the imaging area and exposure values
- Tomography

Lateral Jaw Radiography

- Lateral indicated when cooperation is substantially limited
- Bring head back and to side, place film (occlusal film/rigid cassette) against cheek, expose from opposite side below angle of mandible
- 5x7 inch film
- Obsolete
- Helpful in significantly medically compromised

Devices/Aids

- Positioning devices
 - Snap-a-Ray
 - XCP
- OR/GA films
 - Snap-a-ray
 - Hemostat
 - Velcro head strap
 - Tape
- Gagging
 - Topical lidocaine
 - Dyclone rinse
 - Distraction
 - Nitrous oxide



Clinical Indicators for Radiographic Exposure

- Dentoalveolar trauma
 - Multiple intraoral views as required to evaluate extent of injury or fracture/supporting structures
 - Trauma extending beyond dentoalveolar complex may require extraoral imaging
- Soft tissue trauma
 - Use 1/4 normal exposure time for foreign objects

Clinical Indicators for Radiographic Exposure

- Localization techniques
 - Buccal object rule
 - 2 projections with tube shift
 - Object is lingual if moves same direction as tube
 - Buccal if moves opposite direction relative to reference
 - True (cross sectional) occlusal



Clinical Indicators for Radiographic Exposure

- Pulp therapy
 - Post op evaluation requires periodic clinical and radiographic assessment of treated tooth and supporting structures
- Extraction- pre-op needed, post op if root remains
- Trauma
 - New film in 3-4 weeks for periapical lesion
 - 6-8 weeks for root resorption
- Orthodontics
 - Lateral/pa cephalometric, panoramic, intraoral films as required
- Periodontal conditions
 - Pas to assess level of alveolar bone, condition of interproximal bony crest, length and shape of roots, bone loss in furcations, calculus deposits
- TMJ
 - Definitive films indicated on selected basis for joint sounds in absence of signs and symptoms of dysfunction
- Swallowed restoration or appliance- obtain anteroposterior abdomen film to assure object is in GI tract and not aspirated

(LIP FOR ENLARGED VIEW)

TABLE 5. TYPE OF DENTAL RADIOGRAPHS INDICATED FOR SEVERAL TYPES OF PATHOLOGY OR ISSUES

Pathology / Issue	Type of radiograph (and/or)
Clinical detectable caries / gross decay (restoration may be needed) / periodontal disease	Bisewing radiographs Periapical radiographs Panoramic radiograph if large periapical lesions are suspected and tooth eruption anomalies are expected
Tooth eruption anomaly	Periapical radiograph Panoramic radiograph
Simple orthodontic treatment	Panoramic radiograph
Complex orthodontic treatment	Panoramic radiograph Cephalometric radiograph Cone beam CT
Large bony lesions	Panoramic radiography Occlusal radiograph Anteroposterior radiograph Cone beam CT
Dento-alveolar trauma	Periapical radiograph Occlusal radiograph Oblique lateral radiograph Cone beam CT
Temporomandibular joint	Cone Beam CT (for basic only) Medical CT (disc and bone) Magnetic Resonance Imaging - MRI (disc and bone)
Soft tissue lesions / swellings / abscesses	Ultrasonography Magnetic Resonance Imaging (MRI) Medical CT
Suspicion of inhaled/swallowed appliance or restoration	Chest X-ray (hospital)

Selection Criteria for Radiographs in a 3-6 Year Old (the selection of patients for x-ray examinations, dental radiographic examinations)

Projection	Criteria	Frequency
Posterior BW	Proximal surfaces of posterior teeth cannot be examined clinically Child is cooperative	At initial exam if contacts closed Semi annually if interproximal surfaces have been restored, until child achieves low risk status or is caries free; semi annually if high risk Annually to 24 month interval if child is caries free at initial by exam
Posterior Periapical	Suspected pathosis Confirmed pathosis Child is cooperative	As needed to diagnose and monitor treatment or patient condition
Anterior Occlusals	Suspected pathosis Confirmed pathosis Child is cooperative	Same as above or as caries-detecting radiograph if contacts preclude thorough exam

Recordkeeping

- Record films exposed, including remakes, diagnosis
- Do not alter images
- Never erase a digital film or throw away an image
- Mount and label films with name and date
- Consent should cover routine films
- Do not mark or write on films
- Infection control in place
- Waste management policy includes film processing solutions and lead foil
- Document when you cannot take x-rays, risks and benefits

Some Key Points

- May need to defer x-rays until behavior improves
- No radiographs indicated if all proximal surfaces visualized and examined clinically
- If posterior contacts-bw indicated
- X-rays indicated:
 - If history of pain
 - Swelling
 - Trauma
 - Mobility of teeth
 - Unexplained bleeding
 - Disrupted eruption pattern
 - Deep carious lesions

Key Points

- Pediatric (Size 0) used most often
- Size 2 for occlusal films
- Snap a Ray
- Lead apron and collar
- 16 inch or longer cone to reduce skin exposure
- Rectangular collimation ideal
- Assess behavior prior
- If parents assist they must be shielded, pregnancy ruled out and they must be able to stabilize the film
- Dental personnel should not hold film
- Parents concerns
- **AAPD advises use of radiographic exposures at a rate to maximize detection of abnormalities and minimize exposure to ionizing radiation**
- All radiographs AFTER a clinical exam and history completed
- Do not take routine bw on ortho patients with wire or with major ortho appliances in the mouth

Introducing a Child to X-rays

- Tell show do- do a dry run
 - "camera"
- Match film size to comfort
 - Bend corners
 - Vertical placement of bw
- Obtain least difficult x-rays first- anterior occlusals
- All settings are made prior
- Be patient
- Close eyes
 - Move head
 - "Freeze", not "don't move"

Guidelines for Encouraging Dental Radiographs

Type of Radiograph	Patient Age and Dental Developmental Stage				AAPD Education
	Child with Primary Dentition (Age 0-6)	Child with Mixed Dentition (Age 6-12)	Adolescent with Permanent Dentition (Age 12-18)	Adult (Age 18+)	
Anterior occlusal	Child with primary dentition: Indicated for caries, trauma, and eruption problems. Parental consent required.	Child with mixed dentition: Indicated for caries, trauma, and eruption problems. Parental consent required.	Adolescent with permanent dentition: Indicated for caries, trauma, and eruption problems. Parental consent required.	Adult: Indicated for caries, trauma, and eruption problems. Parental consent required.	Indicated for all ages with appropriate parental consent.
Periapical	Child with primary dentition: Indicated for caries, trauma, and eruption problems. Parental consent required.	Child with mixed dentition: Indicated for caries, trauma, and eruption problems. Parental consent required.	Adolescent with permanent dentition: Indicated for caries, trauma, and eruption problems. Parental consent required.	Adult: Indicated for caries, trauma, and eruption problems. Parental consent required.	Indicated for all ages with appropriate parental consent.
Orthodontic	Child with primary dentition: Indicated for caries, trauma, and eruption problems. Parental consent required.	Child with mixed dentition: Indicated for caries, trauma, and eruption problems. Parental consent required.	Adolescent with permanent dentition: Indicated for caries, trauma, and eruption problems. Parental consent required.	Adult: Indicated for caries, trauma, and eruption problems. Parental consent required.	Indicated for all ages with appropriate parental consent.
Other	Child with primary dentition: Indicated for caries, trauma, and eruption problems. Parental consent required.	Child with mixed dentition: Indicated for caries, trauma, and eruption problems. Parental consent required.	Adolescent with permanent dentition: Indicated for caries, trauma, and eruption problems. Parental consent required.	Adult: Indicated for caries, trauma, and eruption problems. Parental consent required.	Indicated for all ages with appropriate parental consent.

Guidelines

- These recommendations subject to clinical judgement and may not apply to every new patient
- Used by dentists only after completing health history and a clinical exam

Cone Beam

- Newest technique
- Type of CT
- CBVI- Cone Beam Volumetric Imaging
- CBCT- Cone Beam CT
- Allow 2 and 3 D gray scale and color reconstruction of the maxilla and mandible
- Some machines do Pan and CBVI
- Resulting imaging supplemented with written report placed in patient's records that includes full interpretation of findings
- Evidence based policies and guidelines currently under development
 - Produces vast amounts of data, must interpret all information obtained, even that which beyond immediate diagnostic needs

CBCT Indications

- Enhanced diagnosis for cases with impacted or supernumerary teeth
- Quantifying the magnitude of defect or deformity associated with craniofacial anomalies
- Improved differential diagnosis of asymmetric, open bite cases, and skeletal, dental or combined malocclusions requiring orthognathic surgery
- Helping to identify possible causes of malocclusions such as contribution of TMJ abnormalities to open bite or asymmetry

Nomad



- Handheld x-ray device
- Operator can stay with patient- no need to leave the room
- Can take a radiograph anytime during the procedure
- Valuable in dental surgery suites
- Perfect for sedated patients, children and special health care needs
- Backscatter shield and internal radiation shielding protects the operator
- No need for operator to wear lead apron unless pregnant
- "Buzz Lightyear gun"
- Check with local state regulations regarding use of this equipment

Parental Concerns

- Risks and benefits discussed
- Address the concerns
- Review radiation safety
- Ultimately parents have the final say
- X-ray refusal form



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