Mastering Basic Skills Eases Conversion to Rectangular Collimation

Switching to Rectangular Collimation: First Know the Basics.

Johan K. Aps, DDS, MSc, MSc, PhD

Johan K. Aps, DDS, MSc, MSc, PhD -Special Presentation

Common reasons for not using a rectangular collimator are cone-cutting errors and ease of aiming with a circular collimator. However, rectangular collimators provide big benefits for both patients and image quality.

During my dental training, I was taught intraoral radiography using only rectangular collimation. Once out of the dental school in 1993, I realized that not many practices used rectangular collimators. Often-heard reasons for not using a rectangular collimator are cone-cutting errors and the fact that it is easier to aim with a circular collimator. Later, during my training as a dental and maxillofacial radiologist at King's College London in the United Kingdom, I was also using rectangular collimators for intraoral imaging. In every one of my lectures and classes, I have talked about the use of collimators in dental radiology, but I realize that not many practitioners are fond of them. However, we should be using rectangular collimators in dental radiography because they make a big difference for the patient and the quality of images. **Switching Over:** In the spring of 2013, one of the quality improvement initiatives in Dr Jonathon Lee's office was the adoption of long cone rectangular collimation for bitewing and traditional periapical x-rays. The process of switching to rectangular collimators went smoothly because of a quality improvement initiative undertaken in 2008 when the office went "hard sensor digital." The office uses the Carestream Dental (formerly Kodak™ Health) digital intraoral sensors, which have a true pedo size 0 sensor and sizes 1 and 2 sensors. Before going digital in 2008, Dr Lee reintroduced a "Radiology Back-to-Basics" workshop for the staff for a couple months in 2007. They used the Rinn® XCP kit holders to relearn proper technique with film. There was a no-bending film policy in place. This allowed the staff to master the technique before going digital. Eventually, staff members were able to visualize proper placement of the sensor and tube placement so that they needed only the Rinn XCP sensor holder and no longer needed the ring and the rod. From this experience, Dr Lee learned that his staff and patients had an easier time when digital sensors were used rather than film when taking x-rays. Patient comfort was his office's major concern. To patients, the sensors were like sucking on a xylitol lollipop because these sensors have rounded corners: there are no longer the sharp pokes that were common with film. In addition, compared to regular x-ray film, the images consistently were of higher quality, and fewer retakes were required with digital imaging. After mastering the basics, switching to the rectangular collimation was simple. (Reviewer-).

Keywords: Intraoral Radiography, Radiation Dose Reduction, Rectangular Collimation

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Rectangular Image Receptors Require Rectangular Collimation

Rectangular Collimators Restrict Beams to More Closely Match Image Receptor Shapes.

Johan K. Aps, DDS, MSc, MSc, PhD

Johan K. Aps, DDS, MSc, MSc, PhD -Special Presentation

A collimator restricts the area or shape of x-ray beams. Because the intraoral image receptors in dental radiography are rectangular, we should be using rectangular collimators, not circular ones.

In dental radiography, a collimator is a tool that restricts the area or shape the x-ray beams will cover. By the way, who of you uses circular intraoral image film or sensors? You may think this is a silly question, but I ask this question on purpose, because you should know that you do not have circular image receptors in your practice at all. Instead, image receptors are all rectangular. Nonetheless, dentists who use a circular collimator are using a circular x-ray beam to shoot at the rectangular-shaped image receptor. Consider a collimator as a diaphragm to size down the surface being covered by the x-ray beam. The goal is that the surface being covered by the x-ray beam should come as close to the size of the image receptor as possible. Collimation of the x-ray beam can occur at 1 of 2 places: at the base or at the end of the spacer cone, also called the beam-indicating device. Regardless of where collimation occurs, the results are the same. **Collimators:** The Margraf rectangular spacer cone is mounted on the x-ray machine and replaces the cylindrical spacer cone. Alternatively, the Rinn® Universal Collimator can be mounted on the end of the cylindrical spacer cone. The Tru-Align™ is a rectangular collimator device that can easily be fitted on the cylindrical collimator as well. Another possibility is use of the MASEL® Precision Rectangular Collimation Instrument, which is a metal image receptor holder equipped with a plate in which a rectangle is cut out, allowing for the x-ray beam to be rectangularly collimated. (Reviewer-).

Keywords: Intraoral Radiography, Radiation Dose Reduction, Rectangular Collimation

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Spacer Cones Ensure Safe X-Ray Tube-to-Patient Distance

Patient Protection: Spacer Cones Prevent High Skin-Dose Rates.

Johan K. Aps, DDS, MSc, MSc, PhD

Johan K. Aps, DDS, MSc, MSc, PhD -Special Presentation

The ideal distance between the patient’s skin and the focal spot (where x-rays are produced inside the machine) should be ≥200 mm (≥8 inches). The spacer cone secures this distance.

The spacer cone is designed to protect patients from extremely high local doses of radiation by keeping the patient a reasonable distance from the x-ray source. The spacer cone attaches to the tube housing of the x-ray machine and helps avoid the high skin-dose rates that can be encountered near the tube port. **Spacer Cones:** There are 3 spacer (source-to-skin) distances: 8 inches, 12 inches, and 16 inches. My machine has both an 8-inch "short cone" and a 12-inch "extension cone." The longer the cone, the less divergence, distortion, scatter, and radiation exposure. The literature has spread some confusion over the years regarding the terms "short cone" and "long cone." The ideal distance between the patient’s skin and the focal spot (where the x-rays are produced inside the machine) should be ≥200 mm (≥8 inches). The spacer cone secures this distance. If the manufacturer positions the focal spot near the base of the spacer cone, the spacer cone needs to be long (approximately 200 mm or 8 inches). If the manufacturer positions the focal spot at the back of the machine, the spacer cone can be relatively short. **Long-Cone Technique:** The long-cone technique refers to use of parallel x-ray beams, which can ideally be achieved when using a rectangular collimator with at least a 200-mm distance between the patient’s skin and the focal spot. **Short-Cone Technique:** The short-cone technique uses diverging x-rays, which result in severe distortion of the obtained image. This is something to be avoided, especially when assessing bitewing radiographs. **Misnomer:** Although we still use the term "cone," today’s spacer cones are actually cylinders or have a beam-like shape. The term's derivation goes back to the original cone-shaped spacers used in the beginning. Translation errors and interpretation errors have maintained the misconception of this terminology. This has caused some confusion among our colleagues. (Reviewer-).

Keywords: Intraoral Radiography, Radiation Dose Reduction, Spacer Cones

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Rectangular Collimation Reduces Radiation Dose, Improves Image Quality

The Pros of Rectangular Collimation and Tips for Image Receptor Positioning.

Johan K. Aps, DDS, MSc, MSc, PhD

Johan K. Aps, DDS, MSc, MSc, PhD -Special Presentation

Compared to circular collimation, rectangular collimation reduces the amount of radiation dose to the patient and improves the image quality by reducing scatter.

Many dentists continue to use a circular collimator for dental radiography, but none of the image receptors are circular. Instead, a rectangular collimator should be used to more closely match the shape and area of the rectangular image receptors that are in common use. **So What's the Big Deal?** Visualize a 6- to 7-cm diameter (2.75-inch in diameter) circular collimator and a 3.5-cm x 4.5-cm (1.5-inch x 1.75-inch) rectangular collimator. A quick calculation shows that the difference in the surface area being irradiated is approximately 50% less with the rectangular collimator. This translates into the patient receiving about 50% less radiation with rectangular collimation than with circular collimation. This is extremely important for all patients, and especially for children whose tissues are more susceptible to the effects of ionizing radiation. Moreover, because the amount of radiation scatter is proportionate to the area exposed, the quality of the image will also improve with rectangular collimation, which is reason enough to start using a rectangular collimator right away. **Positioning the Image Receptor:** The ideal image receptor positioning requirements for either a periapical radiograph or a bitewing are as follows. (1) The image receptor should be as close as possible to the tooth, and it should be parallel to that tooth. (2) The image receptor’s long axis should be positioned vertically for incisors and canines and horizontally for premolars and molars. (3) The x-ray tube head should be positioned perpendicular to the image receptor and, hence, perpendicular to the teeth. (4) Above all, the positioning should be reproducible. All 4 of the above-mentioned requirements can be realized except the first condition. Anatomy of the maxilla and the mandible will not allow close contact between teeth and image receptor. Therefore, some distance between both is normal. To prevent magnification of the image due to this unmet ideal condition, the x-ray beam must consist of only parallel x-rays. (Reviewer-).

Keywords: Intraoral Radiography, Dose Reduction, Rectangular Collimation, Image Receptors

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Few Aiming Errors, Retakes Seen With Rectangular Collimation

Rectangular Collimation: Good Technique Leads to Few Errors.

Johan K. Aps, DDS, MSc, MSc, PhD

Johan K. Aps, DDS, MSc, MSc, PhD -Special Presentation

Will switching to rectangular collimation cause new problems with aiming errors and retakes? The truth is that few errors will occur if proper aiming devices or image receptor holders are used.

Many dentists are concerned that switching to rectangular collimation as part of their dental radiography program will be accompanied by new problems with aiming errors and retakes. The truth is that very few errors will be encountered if proper aiming devices or image receptor holders are used and if they are used correctly. I used to teach my students to work with the Rinn XCP® (Extension Cone Paralleling) instrument kits as well as with the Endoray® holding device, and I can assure you that retakes do not happen often if one obeys the rules. The latter is true for both periapical radiographs and bitewing radiographs. If the following rules are respected, the incidence of cone cuts will be exceptional. **Open the Contacts:** After being recruited by the University of Washington in 2012, I learned the expression “open up the contacts.” In Europe where I received my education, you will never hear that expression. Because I thought I missed something in my education, I searched through all my radiology textbooks, and I could find the phrase only in American textbooks. It is obvious that if one does not use proper image receptor holding devices with extraoral aids to aim correctly, it becomes a challenge to aim perpendicular at the image receptor and straight through the contacts of the teeth. To “open the contacts” without any extraoral guidance, one would have to guess. (Reviewer-).

Keywords: Intraoral Radiography, Radiation Dose Reduction, Rectangular Collimation

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Research Upholds Beneficial Aspects of Rectangular Collimation

Body of Evidence Grows for Benefits of Rectangular Collimation.

Johan K. Aps, DDS, MSc, MSc, PhD

Johan K. Aps, DDS, MSc, MSc, PhD -Special Presentation

Recently published studies and every handbook on dental and maxillofacial radiology contain recommendations and evidence regarding beneficial use of rectangular collimators.

To make optimal intraoral radiographs, the new 2012 dental x-ray guidelines from the American Dental Association (ADA) and the U.S. Food and Drug Administration (FDA) should be followed carefully. In addition, the American Academy of Oral and Maxillofacial Radiology (AAOMFR) strongly recommends use of the paralleling technique for intraoral radiography, too. Alternative techniques can be used only if the paralleling technique is not possible, such as for anatomical reasons. On page 14 of the revised 2012 ADA/FDA recommendations document entitled “Dental Radiographic Examinations: Recommendations for Patient Selection and Limiting Radiation Exposure,” it is clearly mentioned that collimation of the beam to the size of the receptor, whenever feasible, is an example of good radiologic practice. All these recommendations and guidelines are based on a growing body of evidence regarding benefits of rectangular collimation. **Radiation Dose:** A report by Ludlow and colleagues that was published in 2008 in the *Journal of the American Dental Association* mentioned that rectangular collimation is one possibility for decreasing the radiation dose to the patient. According to the authors' calculations, the radiation dose to the patient could be decreased 5 times just by using rectangular collimation and the fastest image receptor. **Errors:** In a study by Parrott and Ng published in 2011, cone cuts and projection errors were assessed among 1000 intraoral radiographs taken with a circular collimator without an image receptor holder, 1000 radiographs with a circular collimator and an image receptor holder, and 1000 radiographs with a rectangular collimator and an image receptor holder aiming device. The results revealed that the number of radiographs requiring a retake was equal among the 3 groups. The authors concluded that use of rectangular collimation, combined with image receptor holding aiming devices, should be used as a standard in intraoral radiography. **Other Studies:** In a study published in 2011, Goren and coworkers compared a rectangular collimator versus a circular one. The results showed that use of a rectangular collimator caused the radiation dose to decrease by a factor of 3.2. In a 2012 study published by Lorenzoni and coworkers, the authors concluded that use of rectangular collimation substantially reduced the radiation dose to the patient. Another study published in 2012 by White and Mallya also mentions the importance of using rectangular collimation. Every handbook on dental and maxillofacial radiology contains recommendations and evidence regarding beneficial use of rectangular collimators. (Reviewer-).

Keywords: Intraoral Radiography, Radiation Dose Reduction, Rectangular Collimation

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Receptor Instruments Improve X-Ray Cone Alignment

The Paralleling Technique: Aiming Devices.

Johan K. Aps, DDS, MSc, MSc, PhD

Johan K. Aps, DDS, MSc, MSc, PhD -Special Presentation

The most accurate technique for taking periapical and bitewing radiographs is the paralleling technique. Receptor instruments with x-ray beam ring guides improve the accuracy of the x-ray cone alignment.

The paralleling technique is the most accurate technique for taking periapical and bitewing radiographs. Receptor instruments with x-ray beam ring guides improve the accuracy of the x-ray cone alignment and ensure correct beam angulation and centering. Devices used to accomplish this include receptor instruments with ring guides, standard biteblocks, and bitewing tabs. Image receptor holders should hold the image receptor stable during handling. The biteblock should allow proper seating on the occlusal surfaces of the teeth, and the rod outside the patient's mouth should support a ring that can be shifted as close to the skin as possible. The spacer cone should be positioned parallel to the extraoral rod, and the rectangular collimator should be rotated exactly to cover the entire image receptor, avoiding any cone cuts. The extraoral ring allows you to aim the rectangular collimator perpendicular at the teeth, avoiding overlapping projections of the interproximal surfaces of the crowns. While assembling the aiming device, you should be able to see the entire surface of the image receptor while peeking through the ring. The rod actually visualizes the line that goes through the interproximal contacts and helps determine the horizontal and vertical angulation of the x-rays. For a periapical radiograph, the use of a cotton roll on the antagonist side of the biteblock may provide more stability for the aiming device and more comfort for the patient. Never ask the patient to "bite" on the biteblock, especially children. They will interpret this wrong and will either bite hard and fast and open immediately or they start chewing. It is best to ask the patient to close their teeth slowly on the biteblock and then ask them to keep a "grin" so you can check the position of the biteblock and the image receptor. If they hold the image receptor holding device in place with their lips while the teeth are not in contact with the biteblock, a retake will be necessary. (Reviewer-).

Keywords: Intraoral Radiography, Rectangular Collimation, Paralleling Technique, Aiming Devices

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Image Receptor Holding Device Helps Make Distortion-Free Image

The Paralleling Technique: Image Receptors and Image Receptor Holding Devices.

Johan K. Aps, DDS, MSc, MSc, PhD

Johan K. Aps, DDS, MSc, MSc, PhD -Special Presentation

For the paralleling technique, the image receptor holding device aims the x-ray beam perpendicular to the teeth and the image receptor to obtain a distortion-free image.

The paralleling technique is the most accurate technique for taking periapical and bitewing radiographs. Devices used to accomplish this include receptor instruments with ring guides, standard biteblocks, bitewing tabs, and image receptor holders that hold the image receptor stable during handling. **Image Receptor Holding Device:** The purpose of the image receptor holding device is to aim the x-ray beam perpendicular to the teeth and the image receptor (positioned parallel to the teeth) to obtain a distortion-free image. Especially with bitewings, even slight overlapping of the interproximal surfaces on the image may lead to misdiagnosis. If the holding device was properly aligned and yet overlapping still occurs in the image, it is because of anatomical reasons or teeth being ectopically positioned. There is no solution for this. As always, clinical and radiographic examination together will provide you of the right diagnosis. **Image Holders:** Disposable Styrofoam image holders do not provide an extraoral guide and are not suited for this technique because the chances of obtaining geometrical projection errors are substantial. The Ezee Grip® and the Snap-A-Ray® also have the same problem, although these image holders allow you to assess the occlusal plane better due to the part of the holder sticking out of the patient's mouth. Nonetheless, cone-cutting errors are abundant, especially if a rectangular collimator is used. However, this should not be a reason to discard the rectangular collimator and switch to the circular one. There is also a Snap-A-Ray® DS that is equipped with a metal rod and a plastic ring to enable you to make parallel technique images. (Reviewer-).

Keywords: Intraoral Radiography, Rectangular Collimation, Paralleling Technique, Aiming Devices

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Avoid Unnecessary Retakes When Using Digital Imaging

Digital Imaging: Retakes, Goals, and Patient Radiation Burden.

Johan K. Aps, DDS, MSc, MSc, PhD

Johan K. Aps, DDS, MSc, MSc, PhD -Special Presentation

In dental practices, use of digital imaging for intraoral radiographs has increased the number of radiographs that are taken, which has resulted in a higher radiation burden to patients.

For intraoral radiography, digital sensors offer an increased efficiency of image acquisition, which facilitates the retaking of images. Because the number of film exposures does not limit us, we tend to take more images than needed. Therefore, some dental offices have a "1 retake policy," meaning that, if the image is not satisfactory after 1 retake, you must get help from another assistant or doctor. **When Are Retakes Necessary?** If an image in not excellent but is diagnostically acceptable, a retake is not necessary. If an image is not of diagnostic quality, the dentist must decide whether to go for another attempt. In pediatric dentistry, perfect images are not always easy to obtain. If you are uncertain whether there will be an improvement with a retake, then refrain from taking another radiograph. **Other Thoughts:** Digital imaging cannot correct for any geometric projection errors. Also, the radiation necessary to make 1 digital intraoral radiograph, whether it is a solid-state sensor or a phosphor storage plate, is equal to the radiation needed for the fastest analog-direct intraoral film. The introduction of digital imaging has increased the number of radiographs that are taken, subsequently resulting in a higher radiation burden to patients. Especially with the solid-state sensors (the digital receptors that provide an instantaneous image on the monitor), it is tempting to make additional images. Plus, an inadequate image surface of these sensors can be experienced, thus necessitating an additional exposure. **Summarizing the Paralleling Technique:** Using rectangular collimation makes a huge difference and contributes to a lower radiation dose and a better image quality. The purpose of the paralleling technique should be to obtain an image (1) in which all intended anatomical details (teeth and bones) can be distinguished, (2) that extends 3 to 4 mm beyond the apex in a periapical radiograph, (3) in which the approximal surfaces do not overlap in their projection (no foreshortening), especially not on bitewing radiographs, and (4) in which no cone cuts appear. **Advantages of Paralleling Technique:** The aiming device used in the paralleling technique ensures geometrically accurate images. Thanks to the aiming device, relative positions of the image receptor, the teeth, and the x-ray beam are always maintained, regardless of the position of the patient’s head. Finally, using this technique, images can be reproduced at different follow-up visits. **Disadvantages:** The paralleling technique has several disadvantages. Some patients are very uncomfortable with the image receptor aiming device placed in the mouth, especially when a large bulky solid-state sensor is used. Some patients have a severe gag reflex when the aiming device is placed in their mouth. Anatomy may be a reason for failure of correct placement of the aiming device intraorally, such as a torus mandibularis or torus palatinus. (Reviewer-).

Keywords: Intraoral Radiography, Radiation Dose Reduction, Digital Intraoral Radiography

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Bisecting Angle Technique Alternative to Paralleling Technique

Bisecting Angle Technique Available When Paralleling Technique Not Feasible.

Johan K. Aps, DDS, MSc, MSc, PhD

Johan K. Aps, DDS, MSc, MSc, PhD -Special Presentation

In dental radiography, using the paralleling technique is not always possible. The bisecting angle technique is an alternative, but it should not be used as the preferred technique.

In dental radiography, using the paralleling technique is not always possible. The bisecting angle technique is an alternative, although it is not the most ideal technique. There are 2 modifications of this technique. **Modification 1:** For the first modification, the image receptor is placed against the tooth that needs to be imaged. The x-ray beam must be aimed perpendicular to the imaginary bisecting angle between the long axis of the tooth and the long axis through the image receptor. This can be performed with the rectangular collimator, too, to keep the radiation dose as low as possible. However, this technique is prone to geometric exposure errors because there are no extraoral aiming aids. The Rinn® Bisecting Angle Instrument (BAI) holder can be used to help obtain good images with this technique. **Modification 2:** For the second modification, the image receptor is placed on the occlusal surface of the teeth. The x-ray beam is aimed perpendicular to the imaginary bisecting angle line between the long axis of the image receptor (the occlusal surface) and the long axis of the tooth. Again, this technique is prone to geometric exposure errors. The wire on the solid-state sensor must be protected because the patient can bite down on it. If using phosphor storage plates, protect them with some cardboard inside the plastic barrier because bite marks will damage them irreversibly. I like to use 2 wooden tongue depressors between which I tape the phosphor storage plate or the analog film. This protects the phosphor storage plate and allows you to estimate the occlusal plane a little better, making aiming a little easier. The latter technique works for all quadrants and is especially easy in upper and lower incisors. In that case, the phosphor storage plate is taped in the middle of the 2 tongue depressors. For small children, this eventually allows for a mother or father to hold the spatulas in place, if necessary. **Patient Position:** For these radiographs, the patient needs to sit upright in the dental chair so the occlusal plane is parallel to the floor. **Advantages of Bisecting Angle Technique:** Positioning the image receptor in the patient's mouth is relatively easy. Overall, patients tolerate this technique well. If all geometric angulations are correct, an image similar to the one obtained through the paralleling technique can be produced. Nonetheless, the bisecting angle technique should not be used as the preferred technique. **Disadvantages:** If one of the geometrical angles is not met, the image will be distorted. The technique demands considerable skills from the radiographer. The patient must be positioned in a correct upright position to aim the x-ray beam correctly. Cone cuts are abundant with this technique. (Reviewer-).

Keywords: Intraoral Radiography, Radiation Dose Reduction, Bisecting Angle Technique

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Special Tips Allow Imaging of Lower Third Molars, Endodontics

Radiographic Techniques for Imaging Lower Third Molars and Endodontic Work.

Johan K. Aps, DDS, MSc, MSc, PhD

Johan K. Aps, DDS, MSc, MSc, PhD -Special Presentation

Special "tips of the trade" allow the dentist to take good radiographic images of the lower third molar in adolescents and to perform the paralleling technique using rectangular collimators for endodontic work.

In dental radiography, adolescents with third molar issues pose problems when a periapical image of the lower third molars is needed. However, there is a simple trick to deal with the problems encountered in periapical radiographs of the lower third molars if you are using analog film or phosphor storage plates. For phosphor storage plates, place a piece of cardboard inside the plastic wrapping to protect the plate. Clip a hemostat, Snap-A-Ray®, or Ezee-Grip® along the long edge of the image receptor so it looks like a flag. Ask your patient to open their mouth as wide as possible and slide the image receptor on the lingual side of the molar teeth as far back as possible. Then ask your patient to close their mouth slowly. This will relax the soft tissues on the floor of the mouth. Now, you should be able to slide the image receptor a bit further distally. The anterior edge of the film or phosphor storage plate should be at the first molar position. The hemostat, Snap-A-Ray, or Ezee-Grip (whatever you use) can now be held by your patient, who is closing down the teeth on the holder while sitting upright in the dental chair with the back of the head well supported. Aim the x-ray beam perpendicular to the patient's cheek, 1 cm higher than the lower border of the mandible, with the central x-ray beam on a vertical line dropped from the outer corner of the eye. In most cases, you will have a complete image of the third molar. You could try to obtain the same with a solid-state sensor, but the bulky physical characteristics of the sensor will probably make it a difficult job. **Endodontics:** For endodontic treatments in which endodontic instruments are positioned in the root canals, special image holders have been developed. The Rinn EndoRay® can be used for both film and phosphor storage plates. Modified solid-state sensors are also available. Using these allows you to use rectangular collimation with adequate parallel technique imaging. **Oblique Lateral Technique:** If this is still not possible and you really need radiographic information, you can turn to the oblique lateral radiographic technique. However, a circular collimator is preferred, and a cassette with a phosphor storage plate or an indirect analog film is necessary. This can be a very helpful technique if mastered. (Reviewer-).

Keywords: Intraoral Radiography, Special Radiographic Techniques, Third Molars, Endodontics

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Imaging for Children Requires Clear Terms, Careful Planning

Odds and Ends: Tips for Imaging Children and Good Resources for Dental Radiography.

Johan K. Aps, DDS, MSc, MSc, PhD

Johan K. Aps, DDS, MSc, MSc, PhD -Special Presentation

In pediatric dentistry, children are not just small adults. Although they present unique challenges for dental radiography, it is still possible to achieve good quality radiographic images.

For those of us who work in pediatric dentistry, we can tell you that children are not just small adults. Instead, children are a special audience, but it is still possible to achieve good quality radiographic images in a child. If a child is reluctant to have the image receptor holding device placed in the mouth, you can put a holder in your own mouth to show them how to do this simple and painless task. Remember, never place the image receptor holder in immediate contact to the teeth because this is where the most sensitive area of the soft tissues is located. Try to hold the image receptor as long as possible parallel to the occlusal surface when inserting it in the patient's mouth before rotating the holder into the correct position. The x-ray machine should have been placed close to the patient already so as not to waste any time and to get maximum cooperation from the patient. Use the correct words to make sure the patient understands what is expected. To a child, "biting" means "chewing," and "put together" means only that -- "put together." **Resource Recommendations:** As an academic, I am not easily persuaded to use a specific company's name. However, I must make an exception when discussing collimation and the paralleling technique. One company that has made special efforts to help in this arena is the Rinn® company. For those of you who wish to explore what they have to offer, see their Web site at www.rinncorp.com. For those who are interested in some good handbooks, here are a few of my favorite examples. (1) Iannucci J, Jansen Howerton L. *Dental Radiography: Principles and Techniques.* 4th ed. Elsevier Saunders; 2011. (2) Langland OE, Langlais RP, Preece J. *Principles of Dental Imaging.* 2nd ed. Lippincott Williams & Wilkins; 2002, (3) White SC, Pharoah MJ. *Oral Radiology: Principles and Interpretation.* 6th ed. Mosby; 2008. (4) Miles DA, Van Dis ML, et al. *Radiographic Imaging for the Dental Team.* 4th ed. Saunders; 2008. (5) Whaites E. *Radiography and Radiology for Dental Care Professionals.* 2nd ed. Churchill Livingstone; 2008. (6) Whaites E. *Essentials of Dental Radiography and Radiology.* 5th ed. Churchill Livingstone; 2013. (Reviewer-).

Keywords: Intraoral Radiography, Pediatric Radiology, Resources, Reference Books

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CBCT Provides 3D Volumetric Images With High Accuracy

Cone-Beam CT Imaging in Dentistry.

Shaza Mardini, DDS, MS

Shaza Mardini, DDS, MS -Special Presentation

The cone-beam scenario of cone-beam CT images the entire head as 1 volume. Software can then reconstruct highly beneficial cross sections at any angle.

Cone-beam computed tomography (CBCT) images are high-resolution images of maxillofacial structures used in dentistry to aid in diagnosis and treatment planning. As a term, CBCT is interchangeable with the term "cone-beam volume tomography." The public is generally familiar with CT in medicine (medical CT), which is a diagnostic radiographic tool that is sometimes called a CAT scan. In general, CT works by producing an x-ray beam that goes through the area of interest and "hits" a sensor on the other side of the patient. The sensor converts the x-rays to light, which the computer then reads and converts into a digital image viewed on a monitor. **How CBCT and Medical CT Differ:** CBCT uses a cone-shaped x-ray beam, while traditional medical CT uses a fan-shaped x-ray beam. The cone-shaped beam of CBCT allows us to image the patient as an entire volume rather than imaging them slice by slice, which is what the fan-shaped beam of medical CT does. My analogy is that of a loaf of bread. In the medical CT scenario, the fan-shaped beam images the loaf of bread slice-by-slice and is traditionally viewed as a series of axial slices. If we want to see a different dimension, such as a sagittal view, we then must have the computer merge those slices together and reconstruct the view of the other slice or the other side of the bread. In the cone-beam scenario of CBCT, the whole loaf of bread is imaged at once, and then the computer software slices it up for us to view in the different dimensions. **Advantages of CBCT:** The cone-beam scenario of CBCT allows us to image the entire head as 1 volume, and we lose very little information when reconstructing images in different views. In the medical CT version, putting the slices together allows for more error and less resolution in the reconstructed view. In CBCT, we can view the images in all 3 dimensions (sagittal, axial, and coronal dimensions) with no distortion and no loss of resolution. Software then allows us to also reconstruct transaxial images or so-called “cross sections” at any angle, including perpendicular to the mandible or maxilla, to get a perfect 90° cross section. These views are extremely beneficial when viewing pathology, evaluating bone for implant placement, or viewing something such as the temporomandibular joints. (Reviewer-).

Keywords: Dental Radiography, Cone-Beam CT, General Description, Advantages

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Cone-Beam CT Radiation Dose Low for Most Non-Occupational Limits

CBCT: Appropriate Indications for Use and Radiation Burden to the Patient.

Shaza Mardini, DDS, MS

Shaza Mardini, DDS, MS -Special Presentation

It is appropriate to use cone-beam CT when traditional imaging modalities do not allow us to view structures that are important for diagnosing the patient.

No diagnostic image should be considered "routine": radiographs are prescribed and should be taken very seriously when ordered. Radiation should be used only when necessary for diagnosis. Cone-beam computed tomography (CBCT) images have great value in aiding diagnoses in the dental field because they allow us to see the patient and the area of interest in 3 dimensions. **Indications:** I believe it is appropriate to use CBCT when our traditional imaging modalities do not allow us to view structures that are important for diagnosing the patient. For example, if orthodontic treatment is required for a patient and the stability of the temporomandibular joints (TMJs) is in question, CBCT would be an appropriate imaging modality for the area. With CBCT, we could gain information about the TMJs that we would not be able to see with traditional panoramic images, which would include sagittal and coronal views. For the TMJ, we can also draw a line through the long axis of the joint and ask the computer to give us 90° cross sections. This can be done with no distortion or magnification only when we use CBCT. **Radiation Exposure:** The radiation dose from most CBCT units is a small amount with respect to the non-occupational limits for radiation exposure. This does not mean that we should be careless with our prescriptions, but we should always adhere to the principles of ALARA, which states that all radiation doses for diagnostic imaging should be “as low as reasonably achievable.” (Reviewer-).

Keywords: Dental Radiography, Cone-Beam CT, Indications

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Imaging Goals Dictate What FOV Is Ordered

CBCT: Determining Appropriate Field of View.

Shaza Mardini, DDS, MS

Shaza Mardini, DDS, MS -Special Presentation

When ordering a cone-beam CT image, the dentist must first determine his/her imaging goal and then determine whether a large or small field of view is needed.

When ordering a cone-beam computed tomography (CBCT) image, the most important question to ask is “What is my imaging goal?” This will dictate whether a large or small field of view (FOV) is needed. For example, if my goal is to evaluate the bone in an area for a single implant, then a small FOV would be appropriate because we are imaging only that 1 tooth and/or surrounding structures. If my imaging goal is to evaluate the relationship of the maxilla, mandible, and temporomandibular joints (TMJs) prior to a surgical procedure or orthodontic treatment plan, then a larger FOV would be appropriate. **ALARA:** Radiographs are prescribed and, therefore, the appropriate image should be selected only after each case is evaluated. This is what we call "selection criteria." If a small FOV is enough to gain the information necessary, it would be irresponsible to image the entire head. If we did so, we would not be following the ALARA (as low as reasonably achievable) principle. **Full-Head Volume:** In addition, if the entire head is imaged, then the practitioner is responsible for reading the entire image for pathology. If the practitioner is not comfortable with this, then an oral and maxillofacial radiologist who is trained to read these images can provide a report for the referring doctor. There are many incidental findings when reading a full-head volume. I believe that most general practitioners and other non-radiology specialists are capable of reading incidental findings on smaller volumes, which are often limited to dental structures. However, larger volumes may pose more difficulty due to the increased number of structures within that volume, such as sinuses, airway, and TMJs. (Reviewer-).

Keywords: Dental Radiography, Cone-Beam CT, Selection Criteria, ALARA, Full-Head Volume

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ADA Guidelines Emphasize Safety, Prudent Use of CBCT

Summary of ADA Guidelines for CBCT Use in Dentistry.

Shaza Mardini, DDS, MS

Shaza Mardini, DDS, MS -Special Presentation

Practitioners should be familiar with the American Dental Association's practice guidelines regarding cone-beam CT.

The American Dental Association has issued practice guidelines regarding safe and appropriate use of cone-beam CT (CBCT) in dentistry. **History & Exam First:** CBCT imaging should be used only after a review of the patient's health and imaging history and after a complete examination of the patient. **Costs vs Benefits:** The benefits of using CBCT should outweigh the risks. CBCT images should not be used for screening purposes. Additional considerations should also be made for children, who are more sensitive to ionizing radiation. **Diagnostic Yield:** CBCT should be used only when the practitioner believes that the diagnostic yield will benefit patient care, enhance safety, and improve clinical outcomes. CBCT should also be used as an adjunct to standard modalities. However, it may replace conventional 2D imaging (cephalometric and panoramic images) when appropriate and when structures of interest may not be captured in those conventional images. **Radiation Exposure:** The ALARA (as low as reasonably achievable) principle of radiation exposure should be used, and radiation doses should be optimized to the lowest practical level, using the smallest field of view, the lowest scan time, and the most optimal settings to produce the best image. Operators should take precautions to reduce the radiation dose and ensure patient safety during imaging. Collars and aprons are recommended if they do not interfere with the area being imaged. **Qualifications & Regulations:** CBCT exams should be prescribed by a dentist who has appropriate training and education in CBCT imaging. Images should be evaluated by a dentist with appropriate training. The entire image set should be interpreted regardless of the area of interest, and findings should be reported and documented. Practitioners who use CBCT must have appropriate training. Dentists must abide by federal and state regulations regarding the operating of a CBCT unit. Dentists should use professional judgment when prescribing and performing CBCT exams. **Installations & Maintenance:** A health physicist should be consulted when CBCT units are being installed to ensure safety. A quality control protocol should be established where the units are being operated. (Reviewer-).

Keywords: Dental Radiography, Cone-Beam CT, ADA Guidelines

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Image Gently, Image Wisely Trying to Minimize Radiation Risks

Image Gently and Image Wisely Campaigns Advocate for Patient Safety in Dental Radiography.

Shaza Mardini, DDS, MS

Shaza Mardini, DDS, MS -Special Presentation

The Image Gently® and Image Wisely® campaign advocate that dentists be conservative when prescribing radiographs so as to maximize the diagnostic yield while minimizing the radiation dose to patients.

The Image Gently® and Image Wisely® campaigns are important movements that advocate for the safety of children and adults, respectively, with respect to radiation exposure. The goals of these 2 campaigns are to develop protocols to maximize the diagnostic yield while minimizing radiation dose. It is important to look at cone-beam CT (CBCT) with respect to radiation safety, The exposure from a single CBCT, both small and large volumes, is within the normal imaging practices of dentistry. However, these create more exposure to the patient than a routine periapical or bitewing radiograph. The radiation exposure associated with a CBCT image is probably more comparable to that of panoramic images. CBCT exposures are often reported as fractions or multiples of panoramic exposure because, in dentistry, this is something with which we are familiar. For example, a small-volume CBCT may be associated with less radiation exposure than is a single panoramic image. However, the radiation dose of a full-head volume may be equivalent to that of 5 to 8 panoramic images. The onus is on the practitioner to understand what the imaging goal is and to advocate the least amount of exposure possible for the patient. The movement does not say “never image.” Rather, it is advocating that we be conservative with our prescribing of radiographs. Many of our decisions in dentistry are guided by risk-to-benefit ratio. What is the risk, and what are the benefits? Gaining information from a CBCT that increases the level of care for the patient is a huge benefit. In contrast, the radiation exposure risk of a single CBCT is small, particularly when compared to that of medical CT and daily background radiation. In the end, the risks and benefits should be evaluated, and conservative guidelines for selection would be consistent with the Image Wisely and Image Gently movements. (Reviewer-).

Keywords: Dental Radiography, Cone-Beam CT, Radiation Exposure, Image Wisely, Image Gently

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Research in Progress, but 3D Imaging Appears Highly Beneficial

Evidence for the Benefits, Accuracy of 3D Imaging With CBCT.

Shaza Mardini, DDS, MS

Shaza Mardini, DDS, MS -Special Presentation

Only a few studies have compared the clinical outcomes of using cone-beam CT versus not using it. Anecdotally, we see that practitioners are most comfortable with treatment planning when using 3D imaging.

Have any studies to date demonstrated that cone-beam CT (CBCT) has improved the quality in orthodontic, oral surgery, and dental care treatment when compared to conventional 2D films? Research is an ongoing process. Only a few studies have compared the clinical outcomes of using CBCT versus not using it. For example, Nickenig and colleagues evaluated the accuracy of implant placement after virtually planning the implant positions using CBCT data and a surgical guide template versus conventional free-hand methods (*J Craniomaxillofac Surg* 2010; 38 [October]: 488-493). Twenty-three implants were placed in 10 patients using 3D CBCT data and surgical guides generated from that data. Manual implantation of the same implants was performed on anatomical casts of the same patients. The study's conclusion was that there was a significantly smaller variation between the planned and actual implant positions using the CBCT 3D-based guide versus free-hand implantation. We also know of several studies that confirm that measurements made using CBCT are more accurate than those done with 2D imaging. An example is a study by Chien and colleagues that compared the reliability of anatomical landmark identification using 2D cephalometrics and 3D CBCT (*Dentomaxillofac Radiol* 2009; 38 [July]: 262-273). The conclusion was that 3D imaging, as in CBCT, allows for improved reliability in identifying landmarks. Another study done by Stratemann and colleagues made linear measurements comparing 2 different CBCT systems, and they found that there was <1% error when comparing the measurements (*Dentomaxillofac Radiol* 2008; 37 [February]; 37: 80-93). In addition to these studies, we see anecdotally that practitioners are more comfortable with treatment planning all aspects of dental treatment (including orthodontics, surgery, and implants) when using 3D imaging than when using conventional 2D imaging. For example, localizing third molars and the relationship to the mandibular nerve is commonly seen in CBCT and helps the practitioner plan the surgical removal with some confidence. We will not know for sure what the outcomes are until the current research comes in, but we see that 3D imaging is truly benefitting us. (Reviewer-).

Keywords: Dental Radiography, Cone-Beam CT, Outcomes

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Be Alert -- Incidental Findings on CBCT May Need Referral

What to Do With Incidental Findings on CBCT.

Shaza Mardini, DDS, MS

Shaza Mardini, DDS, MS -Special Presentation

Incidental findings on cone-beam CT images fall into 1 of 3 categories. Those images that contain serious incidental findings should be referred to a specialist for interpretation.

As with any diagnostic tool, it is important that all dentists have some understanding of how to use and interpret the results of cone-beam CT (CBCT). **Small-Volume Images:** With CBCT, I believe that the smaller volumes (essentially, those that cover dental structures) can be easily read and interpreted by a dentist and other dental specialists. These small volumes usually cover the tooth or region of interest and surrounding bone, which are familiar structures for dentists. However, I would encourage anyone interpreting CBCT images to attend training courses and continuing education seminars to improve their interpretation skills. **Large-Volume Images:** Larger volumes may be more difficult to interpret due to nondental structures often included in the volume, such as the airway, soft tissues of the neck, cranial structures, vasculature within the head and neck, etc. In addition, structures such as the paranasal sinuses and temporomandibular joints (TMJs) often have minor pathology or incidental findings that, without training, can be difficult to interpret. **Incidental Findings:** I would divide incidental findings into 3 categories: (1) serious findings that should be referred to a specialist for interpretation; (2) important findings that may not be urgent; and (3) incidental findings of lesser importance. Examples of serious incidental findings include carotid calcifications and possible stenosis, severe cervical spine degeneration, possible malignancies or severe infections, and trauma. Common findings that are important but may not be as urgent include benign neoplasms, acute sinusitis, TMJ degenerative joint disease, and sialoliths. Other common incidental findings that are not as critical are deviated nasal septum, concha bullosa (air pockets in the turbinates), tonsilloliths, antral pseudocysts (mucous extravasation phenomenon), enostoses, and developmental anomalies, for example with the number or size and shape of teeth. In all cases, the findings need to be reported. However, I recommend that any findings in the first category and many in the second category be referred for interpretation by an oral and maxillofacial radiologist. The third category may not need referral if the dentist is familiar with the finding and comfortable with the diagnosis. There are continuing education courses to help train dentists to deal with these incidental findings. (Reviewer-).

Keywords: Dental Radiography, Cone-Beam CT, Interpreting Images, Incidental Findings

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Teleradiology Expands Boundaries for Image Interpretation

Teleradiology May Be Answer to Limited Numbers of Oral and Maxillofacial Radiologists.

Shaza Mardini, DDS, MS

Shaza Mardini, DDS, MS -Special Presentation

Teleradiology allows images to be interpreted by an oral and maxillofacial radiologist residing in another state. However, not all state dental regulations allow for images to be interpreted by someone outside that state.

Teleradiology is the act by which an image is interpreted by a practitioner who is not located in the same facility in which the image was taken. This may occur in a facility in the same town but a different place, a different state, or in some cases a different country. Teleradiology is practiced by both medical radiologists and oral and maxillofacial radiologists. Because images are digital, they can be accessed or delivered via the Web, which allows the practitioner who is interpreting the images to be located just about anywhere. For example, I am located in Knoxville, Tennessee, and can interpret images submitted from various states around the United States. Currently in the U.S., each state has its own regulations regarding how dentistry is practiced, which includes the interpretation of images. No generic rules and regulations apply to every state. The American Academy of Oral and Maxillofacial Radiology is working toward educating the state dental boards to allow flexibility for interpretation across state lines to provide better care for our dental patients. There are a limited number of oral and maxillofacial radiologists in the country, which means that some states do not have a specialist living in their state. Teleradiology solves this problem by allowing images to be interpreted by a radiologist residing in another state. Of course, all state dental rules and regulations must be taken into consideration. Radiologists practicing in the U.S. must abide by the state regulations: this includes both the acquisition of images and their interpretation. In addition, the Health Insurance Portability and Accountability Act (HIPAA) must be followed to protect the privacy of patient information. (Reviewer-).

Keywords: Dental Radiography, Cone-Beam CT, Image Interpretation, Teleradiology

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Determine Your Needs Before Selecting an Imaging Modality

Making the Decision Between Pan/Ceph and CBCT Images.

Shaza Mardini, DDS, MS

Shaza Mardini, DDS, MS -Special Presentation

The choice between prescribing a traditional digital panoramic/cephalometric image or a cone-beam CT image depends on the imaging goals of the practice.

Based on the new guidelines from the American Dental Association, the Image Wisely® and Image Gently® campaigns and ALARA (as low as reasonably achievable) principle of radiation exposure, if a dentist had a choice between only a traditional digital panoramic/cephalometric (pan/ceph) image and a cone-beam CT (CBCT) image, which would you recommend? This is a tough question because I do not believe we can just make a choice between the traditional 2D pan/ceph units and a CBCT. They are 2 completely different imaging modalities that serve different purposes. My answer is that the choice would depend on the imaging goals of the practice. For example, a general dentist and an orthodontist would likely have different imaging goals. A general dentist may be satisfied with 2D imaging for pathology screening and viewing of general dental structures. However, an orthodontist may benefit more from a CBCT to evaluate landmarks, temporomandibular joints (TMJ), jaw relations, and dental structures all in 1 volume. There is a great argument that CBCT allows you to reconstruct a panoramic, lateral, and frontal cephalometric view and a TMJ view all using 1 scan. With traditional imaging, this could potentially be 4 to 5 different images. When adding the dose of the traditional images, you come very close to the dose of 1 CBCT scan. With the 3D scan, you can gain much more information about the patient. This includes being able to make measurements that are 1:1, viewing structures such as the airway, and the ability to use third-party software to create virtual models and other aids for treatment planning. 2D images do not allow accurate measuring in the way that 3D images do. Just because a practitioner owns a particular unit, it does not mean they have to use it on every patient. If you own a pan/ceph unit but your patient would benefit from a 3D CBCT scan, then it would be best to refer the patient to a center that provides this service. On the flip side, if you own a CBCT, it does not mean that every patient in your practice needs a scan. Once again, I believe the imaging goals of the practice are what should guide the choice of the type of unit, and each individual case must be evaluated before prescribing radiographs. (Reviewer-).

Keywords: Dental Radiography, Cone-Beam CT, Pan/Ceph Units, Selection Criteria

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GIs Need Panoramic X-Rays for Diagnostic, Forensic Purposes

Military Requirements for Panoramic Radiographs During Vietnam Era.

William M. Carpenter, DDS, MS

William M. Carpenter, DDS, MS -Special Presentation

During the Vietnam War era, all new GIs were required to have a panoramic dental x-ray in their record that could be used for personal identification if the need ever arose.

In dental imaging, the panoramic radiograph is commonly prescribed because it contains a lot of information and can reveal many interesting conditions. I had a 21-year career with the United States Army Dental Corps, and I now serve as professor and chair for the Department of Pathology and Medicine at the University of the Pacific Dental School. During my time in the military, all entering military GIs were required to have a panoramic radiograph in their record. This was done for expediency purposes as well as for forensic purposes, should the need arise. **Vietnam Era & Panoramic X-Rays:** I served in the military during the Vietnam era when large numbers of individuals were being inducted into the military. At that time, it was required that each GI must have this type of radiograph in their record. The panoramic radiograph was quick and easy to perform at induction centers and was also necessary for personal identification in case that would ever be needed. As inductees would get into their individual stations where they would be located for a few years, then that initial panoramic radiograph was supplemented with bitewings and other dental radiographs as necessary. However, during that era, all GIs would have a panoramic radiograph in their records. I have been retired from the military for >25 years and, as a result, I am not aware whether or not this is part of the current protocol. (Reviewer-).

Keywords: Dental Radiography, Panoramic Radiographs, Military Requirements

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Panoramic X-Rays Help Visualize the Mandibulofacial Complex

Panoramic Radiographs for Evaluating Growth/Development and Occult Disease.

William M. Carpenter, DDS, MS

William M. Carpenter, DDS, MS -Special Presentation

Panoramic radiographs allow us to visualize the mandibulofacial complex, including the maxillary sinuses, temporomandibular joints, mandibular rami, and some areas of the neck or upper cervical region.

The public sometimes gets the impression that dentists take radiographs only to diagnose for cavities. However, in the updated 2012 guidelines on oral radiography published jointly by the American Dental Association and the U.S. Food and Drug Administration, it was noted that care should be taken to examine all radiographs for evidence of caries, periodontal bone loss, developmental anomalies, and occult disease. The panoramic radiograph can be very helpful in terms of assessing growth and development and occult disease. **Growth & Development:** In the dentition of children, a number of developmental events can go awry, and the panoramic radiograph is an excellent tool for evaluating these kinds of problems. At age 8 years, we can use panoramic examinations to evaluate the development and eruption of the permanent dentition. At this point, decisions can be made as to whether any intervention needs to occur at an early age, including orthodontic evaluation. In adolescents between the ages of 16 and 18 years, we are most concerned about the eruption of third molars. For this age group, the panoramic radiograph is a wonderful tool to determine whether there is enough room for third molars to erupt, whether the teeth will erupt, and whether recommendations need to be made for surgical removal. **Occult Disease:** The normal full-mouth radiographs consist of periapical radiographs and bitewing radiographs, which mainly concentrate on the dentition. However, a number of developmental, inflammatory, and neoplastic diseases can also occur that are outside the field of normal dental radiographs. The panoramic radiograph allows a better visualization of the mandibulofacial complex and will allow us to evaluate a number of areas not seen on routine radiographs. These areas include the maxillary sinuses, temporomandibular joints, mandibular rami, and some areas of the neck or upper cervical area. (Reviewer-).

Keywords: Dental Radiography, Panoramic Radiographs, Growth & Development, Occult Disease

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Panoramic X-Rays Superior for Visualizing Many Pathologies

Pathologies Identified on Panoramic X-Rays Not Seen on Standard Radiographs.

William M. Carpenter, DDS, MS

William M. Carpenter, DDS, MS -Special Presentation

A number of pathological conditions can be viewed on the panoramic radiograph that may not show up on the standard full-mouth radiograph.

A number of pathological conditions can be viewed on the panographic radiograph that may not show up on the standard full-mouth radiograph. I like to categorize pathologic conditions into 1 of 4 major categories according to the etiopathogenesis of each condition. Using this classification system, we have come up with an acronym of "MIND," which stands for metabolic, inflammatory, neoplastic, and developmental conditions. **Metabolic Conditions:** Metabolic or systemic conditions can occur that affect the jaws along with a number of other bones of the body. This group of metabolic conditions is fairly rare. They are considered to be systemic problems or hormonal problems. These conditions can be thought of as problems with the bone metabolism of the jaws. The basal bones of the jaws usually cannot be visualized well with periapical radiographs. However, with panoramic radiographs, we can see the normal bony or osseous trabeculation, and we can evaluate for any metabolic conditions, such as osteoporosis, osteopetrosis, or other conditions. **Inflammatory Conditions:** A large number of inflammatory conditions arise from odontogenic processes of the teeth and the periodontium. These are usually visualized well enough on the periapical radiograph, but other inflammatory conditions of jaws may arise outside of the normal visualization area, such as osteomyelitis or bisphosphonate-related osteonecrosis of the jaws. These often involve large areas of the jaws. **Neoplastic Conditions:** Neoplastic conditions can be categorized as odontogenic neoplastic conditions, which include odontogenic tumors, and are often seen in the posterior portion of the mandible outside the viewing area of the standard periapical radiograph. Ameloblastoma and other odontogenic tumors are often seen in this posterior location. **Developmental Conditions:** Developmental conditions include the developmental cyst that can be due to both an odontogenic event and developmental processes that occur during embryogenesis. Various other developmental conditions can occur, such as the Stafne defect during development of the jaws. (Reviewer-).

Keywords: Dental Radiography, Panoramic Radiographs, Visualization of Certain Pathologies

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Inspect Panoramic X-Rays for Carotid, TMJ Disorders

Panoramic Radiographs Can Reveal Carotid Stenosis, TMJ Problems, and Other Conditions.

William M. Carpenter, DDS, MS

William M. Carpenter, DDS, MS -Special Presentation

The panoramic radiograph allows the dentist to evaluate the carotid arteries for possible stenosis, the temporomandibular joint for various disorders, and the maxilla for other conditions.

On most panoramic radiographs, we can view the area of the upper neck or the cervical spine, which is just inferior to the lower border of the mandible. This area contains a number of structures that need to be evaluated. In the area of the upper cervix, one carotid artery can be seen on the right side of the neck, and another can be seen on the left side. The carotid artery can undergo atherogenesis, which is the buildup of plaque that leads to the obliteration of the lumen of these vessels. This can be part of the aging process, it occurs in large numbers of people, and it is responsible for atherosclerotic heart disease and the blockage of other vessels. When the coronary arteries are blocked, this leads to a myocardial infarction. This same process of atherogenesis can show up in the carotid arteries, and it can lead to a brain attack or calcification of major arteries going to the brain. If the blockage does not allow the blood to flow to the brain, an ischemic cerebral stroke can result. This blockage of the carotid artery can be detected if the dentist evaluates the area of the carotid arteries in the panoramic radiograph. If a radiopaque linear blockage occurs in these areas, then the dentist should consider referral to a physician for evaluation, which is generally done sonographically. Various procedures, including certain medications or surgery, can be prescribed that may help improve this condition and prevent the cerebral stroke. **Other Conditions:** Other conditions can be identified by inspecting this area of the neck on panoramic radiographs. For example, a rare malady called Eagle syndrome (calcification of the stylohyoid ligament) may result in a pain in the patient's neck. There are also a number of conditions that can occur in other areas of the maxilla, and the maxillary antrum can be visualized very nicely on the panoramic radiograph. A number of pathologic conditions can also be seen in the panograph, including inflammatory sinusitis and areas of a pseudocystic nature. **TMJ:** The panoramic radiograph will also allow the dentist to evaluate the temporomandibular joint. A number of conditions can be evaluated to include those of the MIND classification (metabolic, inflammatory, neoplastic, and developmental conditions). (Reviewer-).

Keywords: Dental Radiography, Panoramic Radiographs

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Oral Pathologists Sometime Need to View Panoramic X-Ray

Oral Pathologists May Need Radiographs to Make Diagnosis.

William M. Carpenter, DDS, MS

William M. Carpenter, DDS, MS -Special Presentation

For a number of conditions, oral pathologists cannot make the diagnosis based on tissue evaluation alone. Therefore, submission of the panoramic radiograph along with the tissue sample can be very helpful.

From a pathologist's point of view, what type of information would you like the dentist or oral surgeon to submit in addition to the actual biopsy? In the northern California area, oral pathologists receive about 5000 specimens/year from various dentists and dental specialists. These small pieces of tissue can be of mucosal origin, or they may have their origin from the maxilla or the mandible. When we get lesions of the jaws that have been detected or evaluated from a radiograph, we always like to be able to evaluate radiographic findings as well. This is very helpful to us. In fact, there are a number of conditions for which we cannot make the diagnosis based on the tissue evaluation alone, so it is necessary for us to evaluate the radiograph. Many of these conditions occur in areas that do not show well in the full-mouth x-rays and bitewing x-rays. Therefore, the panoramic evaluation can be a very important one. Now that we are in the digital age, we are able to receive these images very quickly over the Internet, and that added to the description of any other clinical findings is very helpful to us in our histopathologic evaluation. (Reviewer-).

Keywords: Dental Radiography, Panoramic Radiographs, Oral Pathology Diagnosis

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