Getting to the Root of the Matter!!!

The Apex

Understanding the basics of using Cone Beam Computed Tomography (CBCT) in Endodontics.

As a result of superimposition, periapical radiographs reveal only limited aspects, a two-dimensional view, of the true three-dimensional anatomy. Additionally, there is often geometric distortion of the anatomical structures being imaged with conventional radiographic methods. These problems can be overcome by utilizing small or limited volume cone beam-computed tomography imaging techniques, which produce accurate 3-D images of the teeth and surrounding dentoalveolar structures. During the CBCT exposure sequence, multiple projection images are acquired of the field of view (FOV) in an arc of at least 180°. In this single rotation, CBCT provides precise, essentially immediate and accurate 3-D radiographic images. At the present time, CBCT is considered a complementary modality for specific applications rather than a replacement for 2-D imaging modalities. The Food and Drug Administration approved the first CBCT unit for dental use in the United States in March 2001. Since then, there have been several additional CBCT units approved by the FDA. This newsletter discusses the features, benefits and risks of using CBCT in endodontics.

Field of View (FOV)

In endodontics, a limited or focused FOV CBCT is preferred over large volume CBCT for the following reasons:

1. Increased resolution to improve the diagnostic accuracy of endodontic-specific tasks such as the visualization of small features including calcified/accessory canals, missed canals, etc.
2. Highest possible resolution.
3. Decreased radiation exposure to the patient.
4. Time savings due to smaller volume to be interpreted.
5. Smaller area of responsibility.
6. Focus on anatomical area of interest.

What is the Radiation Dose Considerations

For a meaningful comparison of radiation risk, radiation exposures are converted to effective dose, measured in Sieverts (Sv). The Sv is a large unit; so in maxillofacial imaging microSieverts [μSv] are typically reported. The radiation dose to specific tissues is measured, adjusted for the amount of that tissue in the FOV and weighted based on radiation sensitivity of the tissue. Comparisons can be performed with respect to natural background radiation. The International Commission on Radiological protection specifies the tissues/organs used to calculate the effective dose. A comparison of approximate Ionizing Radiation dosages for different radiographic images. (Table 1).

### Table 1

<table>
<thead>
<tr>
<th>Activity</th>
<th>Effective Dose in μSv</th>
<th>Days to 25 mSv</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 day background radiation, oral level</td>
<td>7.8</td>
<td>1</td>
</tr>
<tr>
<td>1 digital FO radiograph</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>4 dental bite-wing radiographs, F-speed film</td>
<td>38</td>
<td>5</td>
</tr>
<tr>
<td>FX, PSP or F-speed film</td>
<td>171</td>
<td>21</td>
</tr>
<tr>
<td>Kodak® CBCT focused field, anterior</td>
<td>4.7</td>
<td>0.71</td>
</tr>
<tr>
<td>Kodak® CBCT focused field, maxillary posterior</td>
<td>9.8</td>
<td>1.4</td>
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<tr>
<td>Kodak® CBCT focused field, mandibular posterior</td>
<td>38.3</td>
<td>5.47</td>
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<td>3D Acquisitions, J. Morris</td>
<td>20</td>
<td>3</td>
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<td>NewTom 3S, Imagingworks</td>
<td>68</td>
<td>8</td>
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<tr>
<td>Ortho x-ray</td>
<td>176</td>
<td>25</td>
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<tr>
<td>Mamogram</td>
<td>706</td>
<td>106</td>
</tr>
<tr>
<td>Medical CT, oral</td>
<td>2,000</td>
<td>243</td>
</tr>
<tr>
<td>Medical CT, spine</td>
<td>9,000</td>
<td>1,515</td>
</tr>
<tr>
<td>Medical CT, spine (oral and skull)</td>
<td>50,000</td>
<td>7,575</td>
</tr>
</tbody>
</table>


Dr. Maheeb Jaouni
Diplomate, American Board of Endodontics.

Case of the Month:

Interesting tooth #18. Do you notice any anatomical variation preoperatively?

Tooth #18 appears to have 3 roots and 4 canals with two of them joining at the apical 1/3rd.

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This Issue
Cone Beam Article P.1
Newest Addition P.2

- Dr. Maheeb Jaouni
What are the Advantages of CBCT in Endodontics

- **Assessment of Tooth Morphology and Complications**: Root morphology and bony topography can be visualized in 3-D, as can the number of root canals and whether they converge or diverge from each other. Unidentified and untreated root canals may be identified using axial slices, which may not be readily identifiable with periapical radiographs. In a study the CBCT images accurately identified the presence or absence of the MB2 canal in 78.95% of samples. Statistical analysis showed that there was no significant difference in the ability of CBCT scanning to detect the MB2 canal when compared with the gold standard of clinical sectioning. (Blattner et al 2010) CBCT’s are helpful in Intra- or postoperative assessment of endodontic treatment complications, such as overextended root canal obturation material, separated endodontic instruments, calcified canal identification and localization of perforations.

- **Detection of Apical Periodontitis**: The CBCT image can help in diagnosis of dental periapical pathosis in patients who present with contradictory or nonspecific clinical signs and symptoms, who have poorly localized symptoms associated with an untreated or previously endodontically treated tooth with no evidence of pathosis identified by conventional imaging, and in cases where anatomic superimposition of roots or areas of the maxillofacial skeleton is required to perform task-specific procedures. CBCT enables the detection of radiolucent findings before they are visualized on conventional radiographs. One study showed that 34% of the radioluencies detected with CBCT were missed with periapical radiography in maxillary premolars and molars. (Low et al 2008) CBCTs can also help in the diagnosis of pathosis of nonendodontic origin in order to determine the extent of the lesion and its effect on surrounding structures.

**Assessment of Traumatic Injuries and Sequelae**: The CBCT aids in the diagnosis and management of dentoalveolar trauma, especially root fractures, luxation and/or displacement of teeth, and alveolar fractures. CBCTs also provide valuable information that assists in the determination of the type and severity of dental injuries.

**Assessment of Vertical Root Fractures**: Studies have shown that CBCTs are significantly better than conventional radiographs in the diagnosis of vertical root fractures. However, fine vertical cracks appear to not be revealed on CBCT images at current CBCT resolutions. What may be observed, however, is the resultant vertical bone loss in one or more of the CBCT slices. (Khayat & Michonneau 2009)

**Assessment of Dental anomalies**: CBCTs are used in localization and differentiation of external from internal root resorption or invasive cervical resorption from other conditions. CBCTs aid in the determination of appropriate treatment and prognosis.

**Presurgical Assessment**: Three-dimensional imaging allows assessment of the anatomical relationship of the root apices to important anatomical structures, such as the inferior dental canal, mental foramen and maxillary sinus. Presurgical case planning is essential to determine the exact location of root apex/apices and to evaluate the proximity of adjacent anatomical structures in order to reduce the risk of post operative complications.

**Mandibular nerve in proximity to a lesion on tooth #28 and curves next to the lesion.**

This had to be taken into consideration when the root-end resection was planned.
We are extremely pleased to announce that Dr. Tariq Alsmadi has joined our practice. Dr. Alsmadi, or “Dr. Smadi”, as his patients like to call him, is an Ivy League graduate from the University of Pennsylvania, he received his Doctor of Dental Medicine (DMD) degree with honors in 2003. Soon after graduating, he established Safe Dental Group, a dental practice that offered a comprehensive approach to dentistry with various specialists available in the same office.

In 2008 he decided to focus on Endodontics and enrolled in the residency program at University of Nebraska Medical Center. During his residency, Dr. Smadi became interested in regenerative dentistry and conducted research investigating the role of Bone Morphogenetic Protein 2 (BMP2) on the dental pulp cells. He graduated in 2011 and was hired as an Assistant Professor in the same program.

Dr. Smadi is an active member of the American Dental Association and the American Association of Endodontics, He is board eligible with the American board of Endodontics. While a resident he was awarded the UNMC Golden U for excellence and in 2011 he was awarded the UNMC Golden U for excellence as an educator.

He is an active supporter of Boy Scouts of America and enjoys community services. Dr. Smadi is married to Desiree and blessed with two wonderful children who enjoy swimming and Tae Kwon Do. The Smadi family enjoys spending time together enjoying outdoor activities and traveling.

Dr. Smadi is a welcomed valuable asset to our team and shares our practice philosophy of providing your patients with high quality endodontic care in a gentle and efficient manner. We

Do you have a patient who may benefit from a CBCT image? Other than the benefits of using CBCTs in endodontics, CBCTs are also used to evaluate sites for implant placement.

We are now fully equipped with a state of the art Kodak 9000 Cone Beam Digital Tomography Unit. The capturing takes less than 30 minutes and your office will receive the images via a handy flash drive or compact disk.

A radiologist can read the image and complete a report, if requested. An endodontic consultation is also always available. If you have any questions about our new unit, please do not hesitate to give our office a call.

Your first patient sent for a CBCT can receive a complimentary 50% discount if you provide them with this cutout.