

The Use of Cone Beam Computed Tomography in Endodontic Practice: Part I

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While three dimensional imaging has been an important component of medical diagnosis and treatment for many years, its use in dentistry was initially impractical for routine use, because of the expense and radiation involved. The advent of Cone Beam Computed Tomography (CBCT) has addressed these issues, with the ability to produce three dimensional images with a Focused Field of View (FFOV) at an affordable cost, with dramatically lower levels of radiation than medical grade scans (10-20 uSv, as compared to medical grade CAT scans at levels of 21,000uSv). In addition to its diagnostic applications, CBCT gives us a complete representation of the anatomical complexities within the root canal system, thereby complementing our ability to provide sophisticated microsurgical treatment. Accordingly, the CBCT is rapidly becoming an indispensable adjunct to the practice of endodontics, and is already considered by many to represent the standard of care.

The following are just some examples in which CBCT has proven to be advantageous:

- In cases of non-localized pain, (CBCT) may help identify areas of infection not evident on conventional 2D images.
- In cases of endodontic failure, the visualization of previously untreated canals may explain the etiology of the failure, while providing the anatomic information necessary to evaluate the various treatment options. In failures of multi-rooted teeth, treatment can be directed specifically to the involved root or roots. This information may be invaluable when considering the necessity of complete restorative disassembly, or when weighing the relative merits of surgical versus nonsurgical treatment.
- In cases of both internal and external resorption, visualization of the three dimensional extent of the lesions, especially as these relate to the size and location of perforations, will most definitely be critical to appropriate treatment planning.
- Regarding surgical endodontic treatment, the use of CBCT should be routine. There is information available in every scan, which can be used to plan flap design, especially in areas of possible dehiscence, and to help locate root apices in their relation to the cortical plate. It also allows us to as-

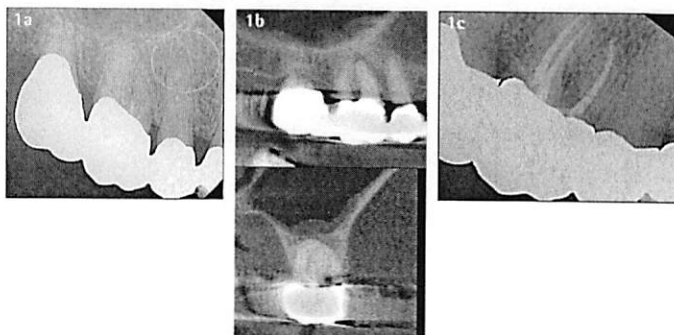
sess the proximity of anatomic structures to the operative site, and any associated risk involved. Furthermore, the surgical accessibility of a particular area can be accurately evaluated, sometimes enabling surgical management of mandibular second molars. In other cases, for example, the palatal root of a maxillary molar may be shown to be accessible from a buccal approach, enabling all of the roots to be treated during a single procedure.

- In cases of severe calcification, canal hunting in the apical half of a root can be risky business. Mid-treatment scans can often roadmap a direct path to the receded canal, enabling successful non-surgical treatment, with minimal risk of perforation.

CASE REPORTS:

CASE I

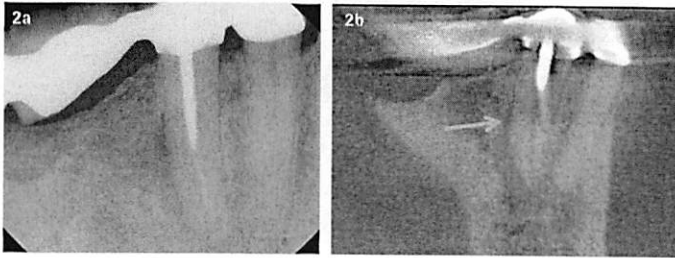
Patient reported with non-localized, but rather intense pain in the maxillary right quadrant. All teeth in this quadrant were equally tender to percussion, a common finding in splinted teeth, and there was no specific area of tenderness to palpation in the fold. Vitality tests were also inconclusive. The only radiographic finding was a slight apical radiolucency at the apex of tooth #4 (fig 1a). While suspicious of #4, but not convinced, a CBCT Scan was taken, clearly revealing a distinct periapical area associated with the mesio-buccal root of tooth #3 (fig 1b). Treatment of this tooth provided immediate relief of the pain. Treatment was completed at a subsequent visit (fig 1c).



Legend 1a - pre-op radiograph suggests #4 apical thickening as the only suspicious finding
1b - frontal and sagittal views of CBCT show pathology on mb root of #3
1c - post-treatment radiograph of #3

CASE II

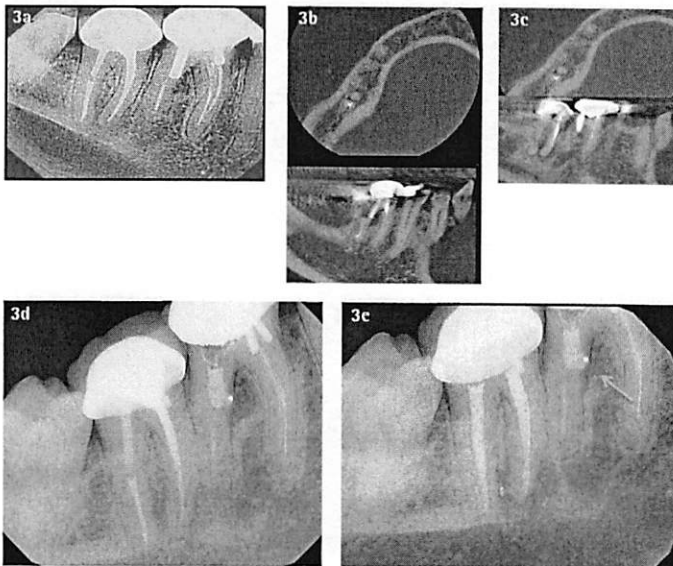
Patient presented with pain and buccal swelling in the area of tooth # 29. Radiographic examination revealed a radiolucent area along the distal root surface (fig 2a). The differential diagnosis included two realistic possibilities: this was either an endodontic lesion associated with a lateral canal or, more probably, a root fracture. A CBCT was taken, clearly demonstrating the existence of a root fracture (fig 2b) and extraction was indicated.



Legend 2a - pre-op radiograph # 29 showing large area on distal root surface
2b - fracture visible on frontal section of CBCT

CASE III

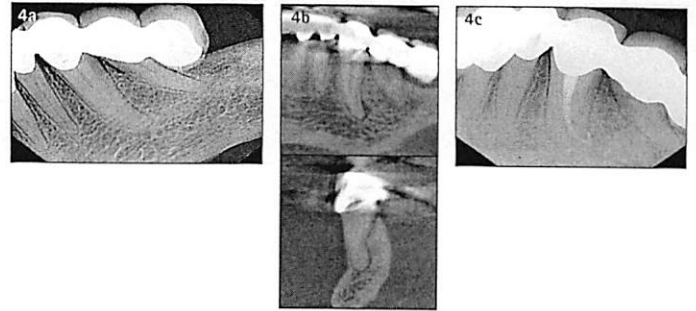
A patient presented with sinus tract, associated with a perforation in the distal root of # 30 caused by an oversized and misdirected post (fig 3a). A CBCT was taken to justify the merit of treating this perforation nonsurgically, by confirming the absence of periapical involvement (fig 3b). Surprisingly, the scan also revealed that #31, appearing to have received far more adequate endodontic treatment than # 30, was actually failing badly, (fig 3c). After treating the perforation of #30 with MTA (fig 3d), # 31 was retreated nonsurgically. Note the healing of the furcal lesion of # 30 at 6 month recall (fig 3e).



Legend 3a - pre-op radiograph showing furcal lesion on #30 associated with post perforation
3b- frontal section of CBCT showing extent of furcal lesion
3d - radiograph of #30 showing perforation treated with MTA
3e - 6 month recall radiograph showing furcal healing #30 and retreatment #31

CASE IV

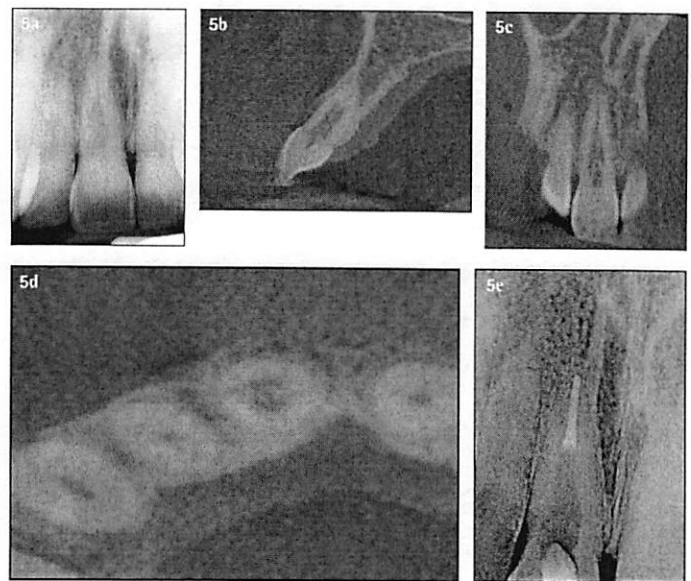
Patient reported in severe pain in her lower left jaw in the area of #21-22. The pain was non-localized, and all attempts at diagnosis were inconclusive. Radiographic examination was non-contributory, although #21 appeared to have a widened PDL (fig 4a). A CBCT Scan revealed a distinct periapical area around tooth #22, (fig 4b) which was treated (fig 4c).



Legend 4a- radiograph of lower left quadrant is non-contributory
4b- frontal and sagittal sections of CBCT showing periapical pathology # 22
4c - post-treatment radiograph of #22

CASE V

Patient presented without symptoms, but with radiographic evidence of a substantial resorptive defect in tooth #8 (fig 5a). A CBCT Scan was taken to evaluate the prognosis for retaining this tooth. There was no indication of any perforation in any of the sections (figs 5b, 5c, 5d) Conventional endodontic treatment was performed (fig 5e).



Legend 5a - pre-op radiograph #8 showing extensive resorption
5b,5c,5d - no evidence of perforation in any views on CBCT
5e - post-treatment radiograph #8

Editor's Note: Drs. Chalfin and Kellert will demonstrate the use of CBCT as an adjunct for endodontic treatment itself, as opposed to the purely diagnostic capabilities shown here, in part II of this article which will appear in the next edition of Dentists' Quarterly. ■