Cone-beam computed tomography in endodontics—Overcoming limitations

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Introduction

Irreversible pulpitis can often be challenging to diagnose and therefore frustrating to manage. Often patients will complain of poorly localised pain on one side of their face; they may be unable to localise even the quadrant from which the symptoms originate. Clinical examination may be unremarkable, no obvious signs may be elicited, and the results of vitality testing may be inconclusive.

In these situations, it is not uncommon for conventional radiographs (film or digital sensors), taken at several different views of the area of interest, not to reveal anything untoward. This is because conventional radiographs have several limitations. The image is the result of the complex (3-D) anatomy being radiographed being compressed into a 2-D “shadowgraph”; this inevitably results in loss of potentially useful information (for example, the axial plane that is not usually seen with radiographs). The images produced with radiographs, even when taken with a beam-aiming device, have a certain degree of geometric distortion, as it is often impossible to place the image receptor parallel to the long axis of the tooth. Finally, the anatomy overlying the area of interest (for example, zygomatic buttress, cortical bone) often masks the area of interest—this phenomenon is known as anatomical noise.

CBCT may be used to overcome the limitations of conventional radiographs. CBCT is an imaging system that has been specifically designed to produce 3-D images of the maxillo-facial skeleton (Fig. 1). These images are produced quickly and effortlessly, and assessed using relatively simple software on standard PCs.

Having access to CBCT imaging is a tremendous benefit in specialist endodontic practice. Most importantly, using a small field of view, the effective dose to the patient can be kept to a minimum.

The case described in this article demonstrates how CBCT may be used to manage a common diagnostic problem more effectively.

Case report

A 45-year-old fit and healthy female patient was referred by her GDP for management of her pain, localised to the left side of her face. On presentation,
the patient complained of poorly localised pain over
the left side of her maxilla. The pain was spontaneous,
woke her up at night, and was dull and throbbing in
character. These symptoms had been present for five
days and were steadily deteriorating.

She had seen her dentist when the symptoms first
developed. He examined her and diagnosed tooth #25
as the cause of her symptoms and with her consent
root treated this tooth. Unfortunately, the symptoms
did not improve after this treatment.

Clinical examination revealed that the upper
and lower left quadrants were heavily restored; how-
ever, none of these teeth was tender to percussion
or palpation. None of the teeth was mobile and all
responded positively to vitality testing.

Conventional radiographs did not reveal anything
untoward; tooth #25 had undergone a well-executed
root-canal treatment, and no periapical radiolucen-
cies could be detected (Fig. 2). A small-volume CBCT
scan was taken of the upper left quadrant. Recon-
structed sagittal images clearly showed a periapical
radiolucency associated with the distobuccal root of
tooth #26, and the axial slices revealed the presence
of three canals (mesiobuccal, distobuccal and palatal;
Figs. 3a & b).

A diagnosis of chronic periapical periodontitis was
made for this tooth, and with the patient’s consent
this tooth was root treated in a single visit under local
anaesthetic (Fig. 4). The patient was contacted the
following day and reported that she was completely
asymptomatic.

_Discussion_

The key to effective management is accurate diag-
nosis. Invasive (and irreversible) treatment should not
be carried out until a definitive diagnosis has been
made. In this case, a periapical radiolucency was
readily detected with CBCT.

Perhaps not surprisingly, this same apical pathol-
ogy could not be detected with conventional radiog-
raphy, as the cortical plate and zygomatic buttress
masked the pathological changes occurring in the
cancellous bone. This case highlights the difficulties
that even experienced endodontists commonly face
in everyday practice, and demonstrates how CBCT
may be used to help make an accurate diagnosis.

The reconstructed axial slices were also useful
during examination. They confirmed the number and
exact position of the root-canal entrances before
treatment was commenced. This resulted in a con-
servative access-cavity preparation and swift iden-
tification of the root-canal entrances, thus allowing
treatment to be carried out effectively and efficiently._