issn 2161-7228

North America Edition · Vol. 1 · Issue 1/2012

ortho

the international C.E. magazine of orthodontics

1 2012

_earn c.e. credit

Clinical and diagnostic advantages of 3-D imaging systems in dental specialties

_practice matters

The business of private practice orthodontics in the United States

_techniques

Lingual you will love: Capturing the incremental patient with lingual orthodontics

Welcome to *ortho*

Torsten Oemus
Publisher
Dental Tribune International

The goal of this quarterly magazine is twofold. First, it seeks to share practical orthodontic knowledge that can be put to use in your day-to-day practice. Second, it is a vehicle to help you chip away at your continuing education (C.E.) requirements.

The amount of new information available in the orthodontic field about new products, techniques and research data is astounding. Running a practice and seeing patients leaves little time for catching up on the latest clinical news and product information. Thus, we hope *ortho* will not only be a welcome respite for those rare chunks of time you can devote to leisurely reading, but one that provides a practical return on your investment by providing information that you can actually put to immediate use.

In addition, we know that taking time away from the practice to pursue C.E. credits is costly in terms of lost revenue and time. As a quarterly magazine, *ortho* is here to help you chisel at least four C.E. credits per year out of your already busy life without the lost revenue and time away from your practice. To that end, every edition of *ortho* will include at least one hour of ADA CERP-certified C.E. credit where readers can answer questions about the materials at *www.dtstudyclub.com* to earn this credit. Annual subscribers to the magazine ($50) need only register at the Dental Tribune Study Club website to access these C.E. quizzes free of charge. In fact, even non-subscribers may take the C.E. quiz after registering on the DT Study Club website and paying a nominal fee.

If you are a practitioner with a penchant for words, it might also interest you to know that authors of the C.E.-accredited articles receive 15 percent of the fees collected from the non-subscribers who take the C.E. quiz online. The C.E. quiz for the articles in this edition will be available online on May 1.

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JSOP SCHEDULE

JSOP XVII

7/19-7/22, 2012 Session 2: Clinical Systems I
11/15-11/18, 2012 Session 3: Clinical Systems II
2/21-2/24, 2013 Session 4: Orthodontic Practice Marketing, Enrollment & Communication

JSOP XVIII

9/6-9/9, 2012 Session 1: The Business of Orthodontics

COURSE SUMMARY

SESSION 1: The Business of Orthodontics

- National Orthodontic Practice Statistics
- Integrated Systems Approach
- 17 Critical Factors
- Benchmarking
- Prioritizing System Corrections (Improvements)
- Strategic Planning
- Practice Monitors/Roncone Module

SESSION 2: Clinical Systems I

- Clinical Philosophy
- Brackets
- Wires
- Auxiliaries
- Bracket Placement
- Archform
- Stages of Treatment
- Finishing
- Orthodontic Results

SESSION 3: Clinical Systems II

- Diagnosis and Treatment Planning
- Phase I Treatment
- Treatment of the Adolescent and Adult Dentition
- Diseases of and Treatment of T.M.J.
- Hands-On

SESSION 4: Marketing, Enrollment & Communication

- Marketing Basics
- Who and Where is the Market You Want?
- Positioning
- Marketing Director, The Plan, Teams, Internal & External
- Enrolling New Patients

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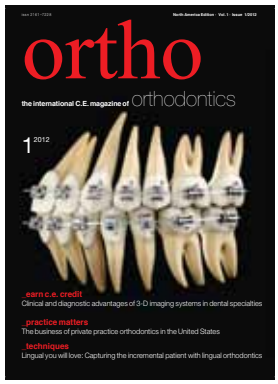

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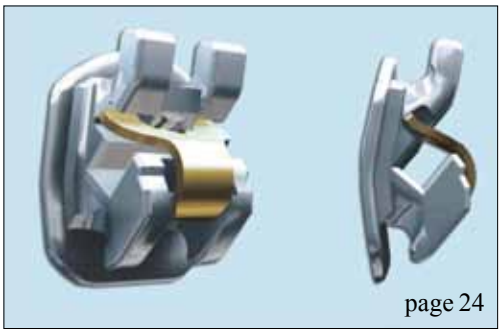
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Clinical and diagnostic advantages of 3-D imaging systems in dental specialties

Author_Dan McEowen, DDS

_c.e. credit article

This article qualifies for C.E. credit. To take the C.E. quiz, please log on to *www.dtstudyclub.com*. The quiz will be available on May 1.

_For nearly 100 years, dentists have relied on 2-D radiographic imaging for diagnosis and treatment planning. With the 1999 introduction of cone-beam computed tomography (CBCT), all dentists now have tools available for more accurate diagnosis and treatment.[1] The ability to look at a tooth in any direction and orientation, as well as in 3-D, eliminates much of the guesswork commonly experienced with 2-D radiographs.

We have been limited in most cases to only a buccal-lingual view provided by periapicals, bitewings and panoramic radiographs with the occasional axial view of an occlusal film. Medical CT scans and images began in the early 1970s and were sometimes used by dentists, offering our first multiplaner views.[2]

The adoption of 3-D cone-beam imaging is appropriate and has important advantages for all modalities of dentistry. From every specialist to the general dentist, the increased amount of radiographic information as well as increased accuracy will aid in the most sound diagnosis possible.

_CBCT description

CBCT is a single or partial rotation of an X-ray source around the head, capturing X-rays on various flat panel arrays and sensors. The information is converted to a series of axial slices by computed tomography and stored as virtual anatomy in the computer.

With the use of sophisticated software, the dentist is able to view information in several different views, including: axial slices (head-to-toe orientation), coronal slices (front-to-back orientation), saggital slices (side-to-side orientation) all known as multiplaner reconstructions (MPR). The thickness of each slice can be varied to include more or less information.

Because the voxels (volumetric pixels 3-D) are isotropic, other MPR images can be generated by slices drawn at any angle, curve or thickness through the scan to view areas critical to the final diagnosis.[3,8]

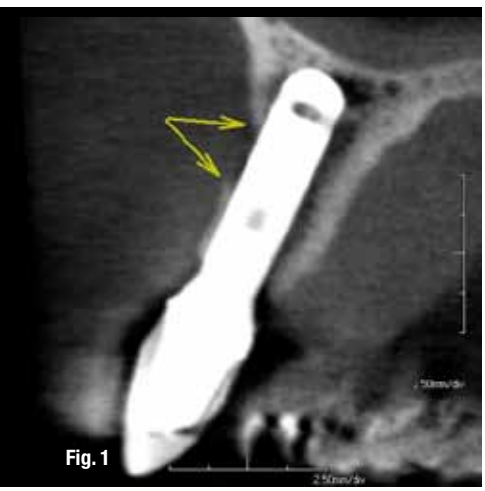
The final view offered by CBCT is a 3-D view that can be rotated and viewed in any direction.

Once again through software manipulation, 3-D

Fig. 1_Saggital CBCT MPR showing bone defect at point of dehiscence of the implant coating. (Photos/Provided by Dr. McEowen)

Fig. 2_Periapical does not show the sinus anatomy or the width of the bone.

Fig. 3_MPR showing post-op of sinus graft and implant placement.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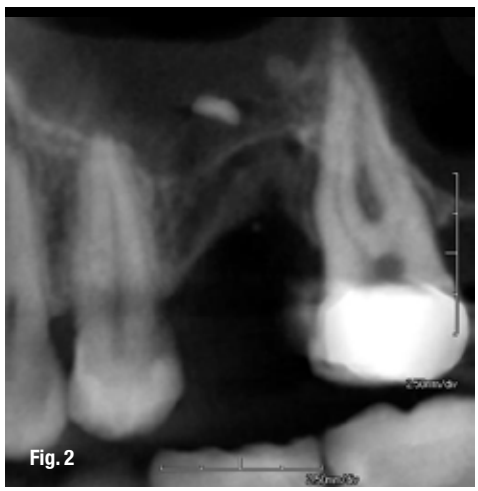
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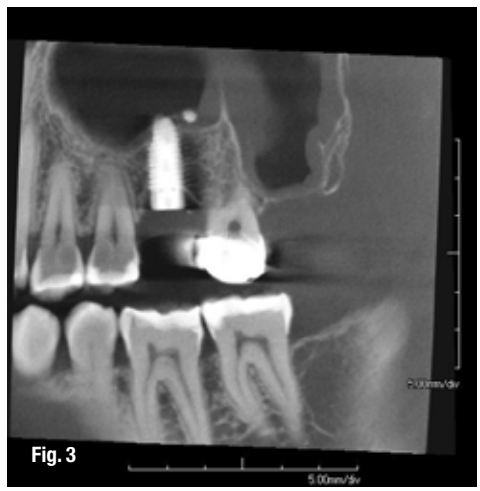
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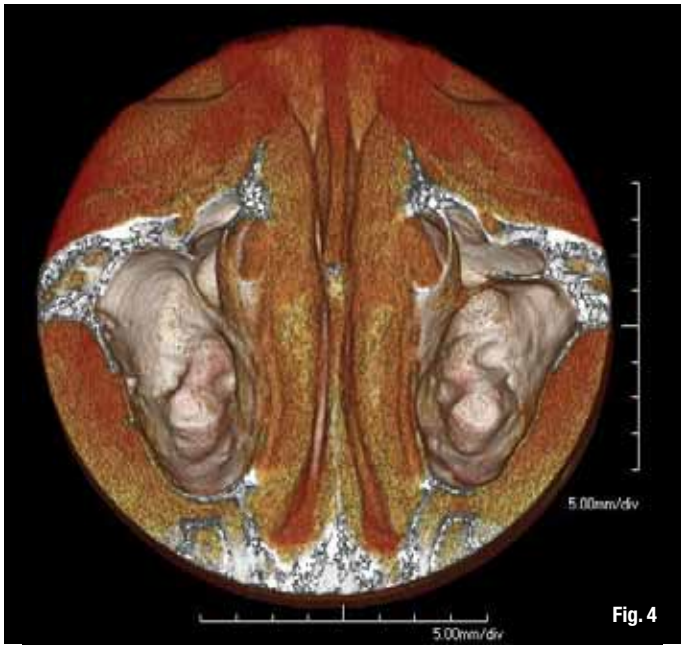

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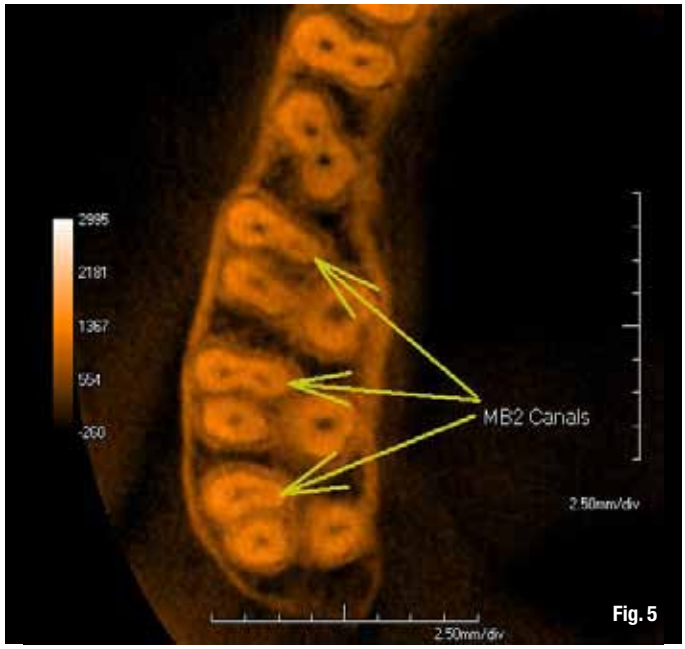

Fig. 5

images can be viewed as conventional radiographs, maximum intensity projections (MIP), soft-tissue projections and a variety other views.

This nearly endless ability to manipulate the data aids in the diagnosis and identification of disease, nerve canals, sinus morphology, dental caries, bone density, fractures, endodontic pathology, implant placement criteria, periodontal defects, bone pathology, fractured teeth, iatrogenic trauma, TMJ morphology and disease, third-molar position and many more healthy or diseased conditions.

_Early CBCT adoption with implants

The first and primary use of CBCT for early adopters was implant placement. As the scope and the value of the information became better known, dentists of all branches began to see the value of MPRs and 3-D renderings including periodontics, endodontics, oral surgery, treatment of TMJ, orthodontics, implantology and general dentistry.[1,7,8]

Clinical periapical and panoramic radiographs for the placement of implants can be misleading with elongation, foreshortening, superimposition and geometrically incorrect data.[7,8] A look at the implant in the periapical shows no obvious disease to an existing integrated implant. Clinically, a buccal fistula was present with exudate and slight pain. The CBCT scan (Fig. 1) reveals a more accurate view showing a buccal defect on a saggital MPR. A surgical flap revealed a dehiscence of the coating of the implant. Removal of the foreign body resulted in an asymptomatic and healthy patient

The evaluation of the available bone for the initial implant placement can be crucial for the long-term success of the case. If there is inadequate bone available, grafting may be a necessity. CBCT studies render the most accurate information available at a low radiation dose. The periapical shows an obvious lack of bone height, but does not show the buccal-lingual dimensions or an accurate view of the sinus morphology (Fig. 2).

The MPR view of the CBCT shows all necessary measurements to perform the sinus lift and grafting with the immediate placement of the implant fixture (Fig. 3). Three-dimensional views show the floor of the sinus and any soft-tissue pathology (Fig. 4). Having accurate measurements in all dimensions is an advantage of CBCT scanning.

_CBCT and endodontics

Endodontics is a field that is rapidly adopting the use of CBCT and for good reason. The inherent geometric deficiencies of 2-D radiographs make the CBCT scan a valuable adjunct to investigate the root morphology in both 3-D and MPR. The typical periapical will show superimposed canals in the anteriors, bicuspids and molars as well as unwanted bone densities both buccal and lingual to the affected tooth, making the image quality poor.

The ability to view MPR slices in cross-section, long axis and oblique directions gives the ability to follow all canals in any direction and show their relationship and measurements from other known structures. This virtual tour of the root morphology is a great benefit to the final treatment outcome (Fig. 5).[3,4]

Fig. 4_The 3-D CBCT showing anatomy of the maxillary sinuses.

Fig. 5_Axial MPR showing mesial buccal roots in first, second and third molars.

Fig. 6

Fig. 7

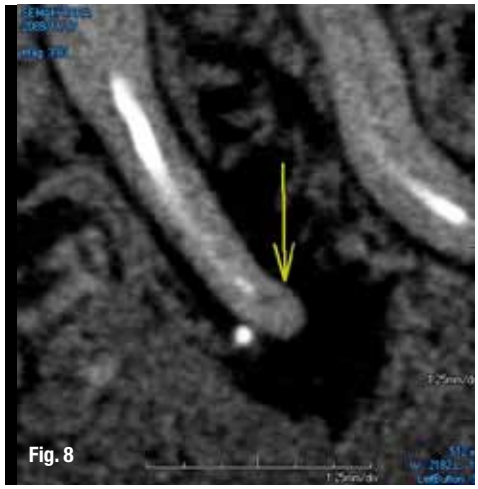
Fig. 8

Fig. 9

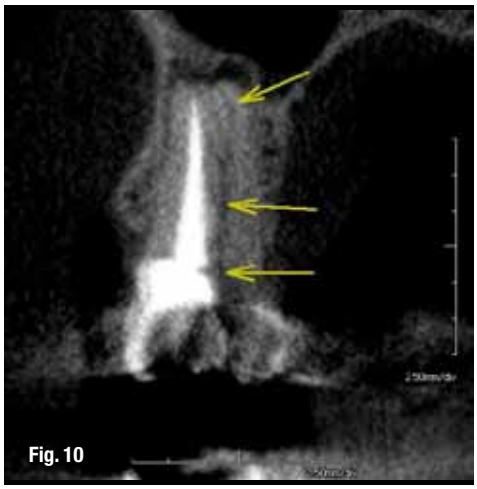
Fig. 10

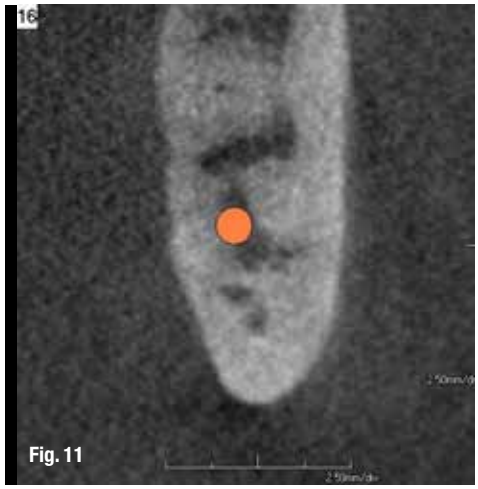
Fig. 11

Fig. 6_Periapical showing minimal pathology with no radiolucency.

Fig. 7_Coronal MPR showing a short fill on the mesial lingual and radiolucency.

Fig. 8_Saggital MPR showing unfilled canal and radiolucency.

Fig. 9_Periapical showing a normal fill with a radiolucency.

Fig. 10_Coronal MPR showing the superimposed lingual root unfilled.

Fig. 11_Coronal MPR showing nerve between roots of the third molar.

Post root-canal infection can be difficult to diagnose with the standard periapical. The endodontic fills may appear to be normal even though other clinical findings and symptoms are abnormal. The patient presents several months post root-canal treatment with pain on palpation and pressure and avoids this side of the mouth.

A periapical radiogragh shows minimal pathology (Fig. 6). The roots appear to be filled and a small puff of sealer extends through the apex of the mesial roots. The distal root structure and fill appear normal. There is little indication of periapical radiolucency only a widening of the periodontal ligaments of the mesial roots.

A CBCT scan reveals a completely different picture. The coronal MPR reveals a short fill near the apex of the mesial lingual root and a large radiolucency (Figs. 7, 8) not visible on the periapical radiograph (Fig. 6).

Missed canals are difficult to see in a buccal-lingual projection of the periapical radiograph as one canal is superimposed on the other (Fig. 9). Often, as viewed in this radiograph, we see periapical pathology with an apparent normally filled canal. CBCT scans allow dentists to look for pathology in MPR planes to identify the actual problem before invasive procedures are performed on the patient. The axial view shows a lingual canal exists and is untreated. The coronal view confirms the diagnosis and treatment can be completed (Fig. 10).

Today's endodontists, as well as general dentists, are benefiting from the diagnostic capabilities of the high-resolution CBCT scanners available over conventional 2-D periapical.[5,6]

_Oral surgery

Oral surgery, with its inherent invasive nature, can be better served using CBCT with MPR as well as 3-D images. The ability to perform virtual surgery is a benefit to both the doctor and the patient. Doctors have the advantage of seeing morphology and landmarks in real time and space with accurate measurements, and patients will gain a better understanding of the problems and the solutions their doctors are offering them.

Third-molar extractions can be risky based on 2-D and panoramic radiographs. These radiographs can often superimpose nerves and sinuses over root structures. Dentists using 2-D radiographs must often rely on experience to assess the risks of iatrogenic

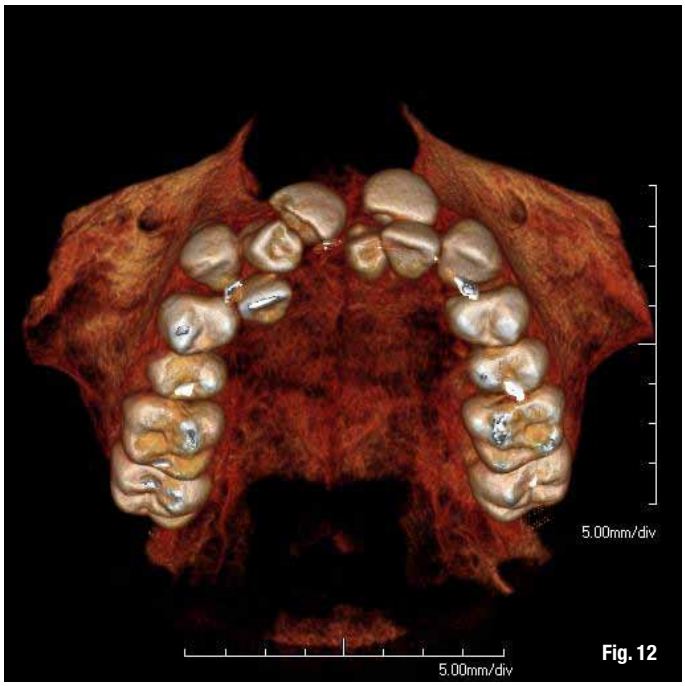

Fig. 12

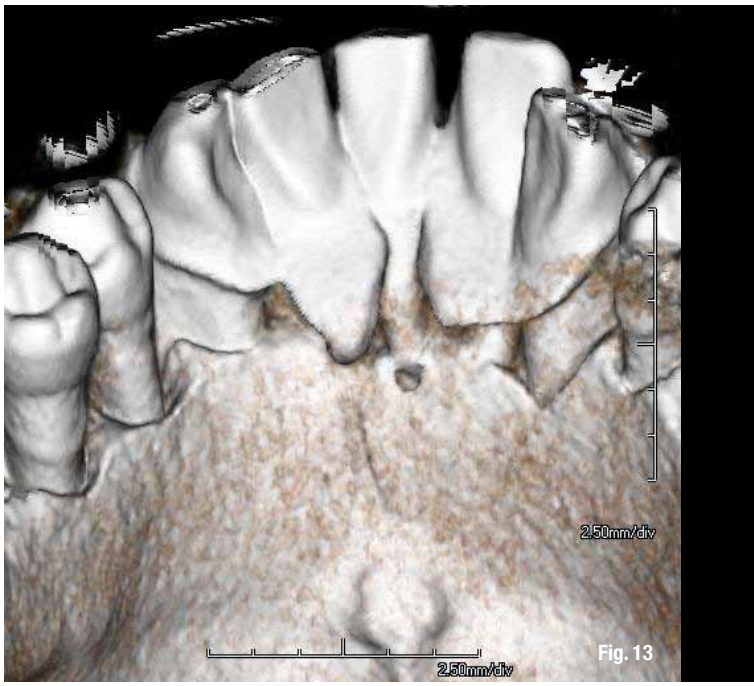

Fig. 13

trauma. The use of CBCT with MPRs and 3-D images reduces any guessing as well as the chance for any permanent damage to the patient. With the adoption of CBCT, the judgment is based on solid evidence and the risk will decrease.

A panorex of the superimosed third molars gave no solid evidence the canal lies between the roots. It is only with the use of CBCT and the MPRs that the nerve can accurately be seen traversing between the mesial buccal and mesial lingual root (Fig. 11).[4,5]

Other surgical advantages include the identification and the position of supernumerary or impacted teeth. The images show accurate positions and show definitive morphology that will aid in removal of the proper teeth (Fig. 12). Knowing the exact position of many of these teeth is a benefit to both the doctor and patient. It will lead to the most precise surgical path and the least invasive procedure.

_Periodontics

The explanation of periodontal problems are often misunderstood by the patient. As doctors, we talk about pockets, point to X-rays and propose treatment only to have patients refuse treatment because they do not understand what we are clinically describing. Using the 3-D portion of the CBCT scan can improve the understanding and acceptance of treatment plans.

The images are a picture of the problem that is owned by that patient and much easier to understand by the layperson. Illustrating periodontal defects and pockets allows the patient to better participate in the process (Fig. 13).

The MPRs and the 3-D projections aid in surgical planning for periodontists, allowing for accurate measurements and bone analysis prior to osseous surgery that doctors cannot get using the periapicals or panoramics.

Studies have shown that CBCT images are more accurate than panoramic radiographs. For the periodontist placing implants, the ability to measure bone density and avoid important anatomy is important.[4,5]

_Orthodontics

Orthodontists are beginning to adopt large field-of-view CBCT. Recent studies show that linear measurements of bony structures are more accurate using CBCT and have less distortion than current methods of measurement: lateral cephalometric, posteroanterior (PA) and submentovertex (SMVT).[5] Accurate measurements of tooth volume and tooth position can aid in accelerated treatment times and more precise treatment.

Along with tooth position, density of bone and size of arches, the orthodontist also has an accurate evaluation of the temporomandibular joint and position of the condyles. Impacted teeth are easily identified and position, either buccal or lingual can be confirmed prior to movement or removal.

Both MPRs and 3-D projections give the clinician a complete picture of the problems and the treatment course.

With a single CBCT scan, orthodontists can produce all of the information they need: panoramic, cephalometric, PA, SMVT, tooth size and volume, crowding evaluation in any plane, TMJ evaluation

Fig. 12_The 3-D rendering showing supernumersary teeth and positions.

Fig. 13_The 3-D rendering with periodontal defects and calculus bridge.