GEOFFREY WEXLER
BDSc MDSc LDS FRACDS DipOrth RCS MScORTH
REGISTERED SPECIALIST
ORTHODONTIST

AUTUMN 2008

# The Art & Science of the Smile

## 3 Dimensional X-Ray Imaging

### Will it change my Practice?

When considering the purchase of something new, one asks: "Will it improve my life?"

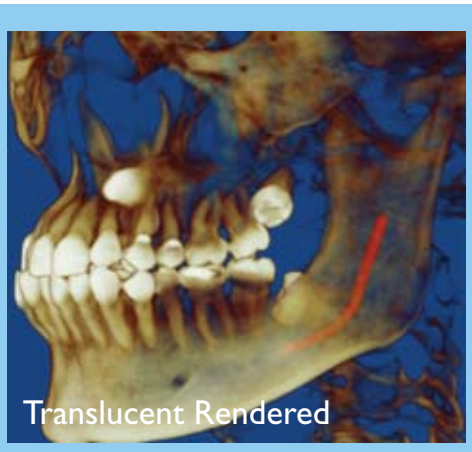
**C**one **B**eam **C**omputed (**V**olumetric) **T**omography (**CBC**(V)**T**) 3D dental x-rays arrived in Australian orthodontics and dentistry two years ago. CBCT is specialised tomography just for the head and teeth.

**Advantages over previous systems**

CBCT differs significantly from previously used medical CT systems for planning dental implant and maxillo-facial surgery. Medical CT has a high radiation dose, is expensive, involves a claustrophobic experience for supine patients and it lacks suitable software for the dentist. Medical CT was not used for orthodontics. CBCT data are produced from cone-shaped x-ray beams rather than slit or fan beams. Cone beam is more efficient in image production with much higher resolution.

Cone beam voxels are isotropic (x=y=z) and can easily be re-constructed into a single image of the whole 3D volume for surface

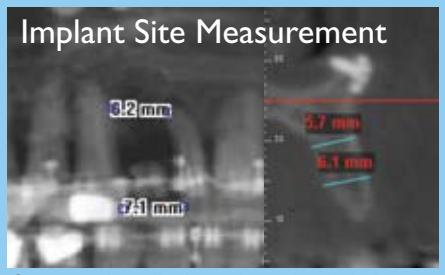

rendering, or for translucent rendering, displaying 3 dimensional relationships. Of course volumes can be sliced into planar films and curved re-formatted




images. CBCT is low dose providing a new a standard of service to implant dentistry and orthodontics. It is accessible in the suburbs. A forty second scan with a dose equivalent of 3 OPG's yields all desired views. These include panoramic, lateral ceph, P-A ceph, vertex occlusal, TM joint views and 0.1 mm transverse alveolar slices to measure implant recipient sites. CBCT also shows un-erupted teeth in three dimensional relationships to each other. It can demarcate the inferior alveolar canal with distances to third molar roots in tenths of a millimetre. CBCT aids in planning the most appropriate surgical approaches to un-erupted teeth. Much more detail is shown than ever before. Using PC-based viewing and rendering software, a whole skull can be viewed from front to back in "translucent" mode, showing all hard surfaces and internal structures. Within seconds the 3D volume image can be rotated 360° in all three planes of space to be measured, clipped and "snap-shotted" into an infinite number of arbitrarily practitioner-chosen views. Files can be e-mailed as movies for colleagues and patients. Images and movies are stored and retrieved in a PC database for later viewing & patient discussion and as part of the computerised patient record.

**Futher Benefits**

Better quality image information means more accurate diagnosis, treatment planning and informed consent with better risk management. CBCT reduces risks of iatrogenic accidents like surgical nerve damage by enabling more accurate surgical approaches to buried structures. CBCT enhances accuracy of implant placement so avoiding risk of collisions between tooth roots and implants. In orthodontics it helps avoid tooth-tooth collisions while retrieving un-erupted teeth in orthodontics.




Cost and radiation dose is slightly higher than with conventional imaging, but Medicare rebates dental CBCTs. Bulk billing applies and multiple billable reports can be generated from a scan.

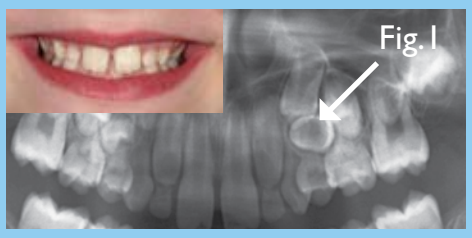
**CBCT Features**

1. Machines cost 30% to 10% of medical CT machines.
2. Scans are comfortable, sitting or standing; 10- 40 second exposure
3. Small footprint (like OPG machine)

4. Diagnostic yield up to 10 times the resolution of medical CT for 1/10th of radiation
5. Resolution possible - 0.1 – 0.2 mm
6. Dosage varies with resolution and field of view
7. Specialised providers for dentists
8. Specialised 3rd party PC viewing software constructs images from DICOM 3 data
9. Legal obligation exists to view all yielded data despite limited field of interest for a procedure
10. Machines differ in dosage & field of view. Compared to iCAT™, some have a high dose or smaller field of view making LatCeph not possible.

## Will they Change Our Practice?

### Example 1.




The anomaly in Fig. 1 was found in a seven-year-old in routine examination. Is that an odontome or a transversely oriented tooth? Will it block eruption of UL3? Should it be surgically removed?

### What does 3D add to the picture?

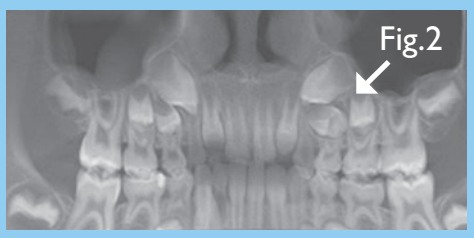
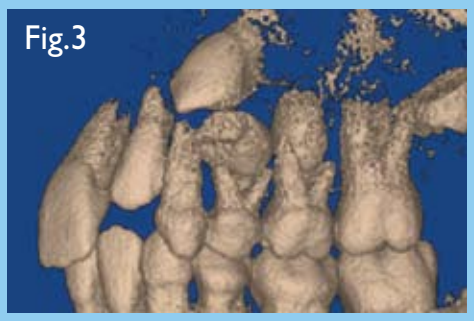
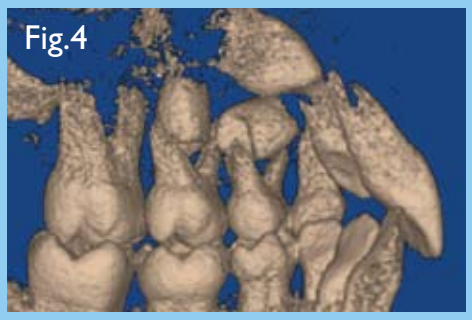



Fig. 2 is an iCAT planar reconstruction showing the object is a tooth. But will it block eruption of UR3?

Figs. 3 & 4 are surface-rendered 3D views from the buccal & lingual sides of the region of interest.



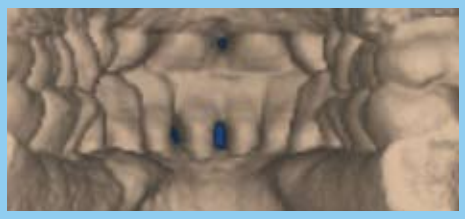




Rotating the viewed surfaces clearly reveals normal anatomy of a tooth, not obstructing eruption of UL3, despite its poor orientation. The child is saved from the surgeon. Mum hugged me when I showed her this! The surgeon was also surprised.

### Example 2

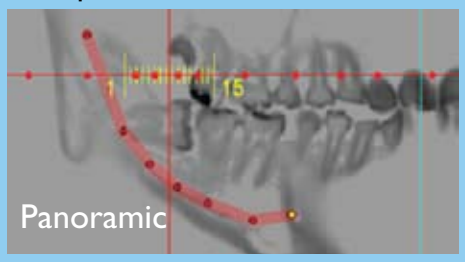

This patient has obstructive sleep apnoea. The airway volumes can be seen qualitatively and measured. The lumens can be navigated pseudo-endoscopically.

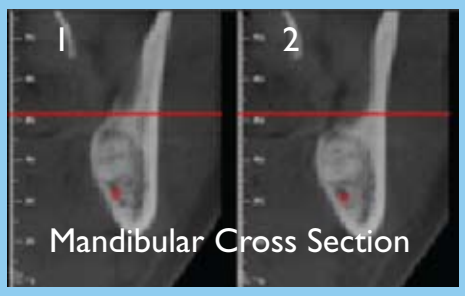
### Example 3.

This patient has periodontal bone loss around the lower incisors. The extent of the vertical defect is deeper on the labial on than the lingual & can be easily visualized to plan debridement.

### Example 4.




The IDN in Figure 4 can be mapped for better surgical risk management.

Red demarcates the inferior alveolar nerve. Cuts 1& 2 transect LR8 root apices, showing IDN nerve proximity.

## Next Issue will cover photography

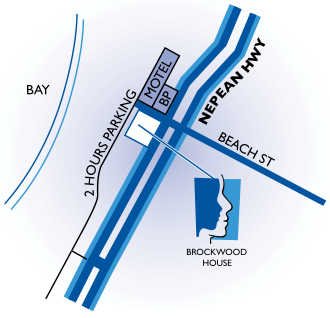
Patient images in this newsletter were provided with patient consent. All patients were orthodontic patients.


**TOORAK**
Level 4, Trak Centre
445 Toorak Road Toorak VIC 3142

GEOFFREY WEXLER
BDSc MDSc LDS FRACDS DipOrth RCS MSc ORTH
REGISTERED SPECIALIST
ORTHODONTIST
ADA Specialist Member

**ALL APPOINTMENTS**
**(03) 9827 0188**
**www.drgeoffreywexler.com.au**

Light blue indicates parking, but read restrictions before leaving your car




**FRANKSTON**
Suite 1, Brockwood House
424-426 Nepean Highway Frankston VIC 3199