

Diagnostic Imaging – Hitchhiker’s Guide to the 3rd dimension

A Professional Development session presented by Dr Alex Yusupov, at DMDI (Dental & Medical Diagnostic Imaging, Camberwell, Victoria, ph 03 9889 1771) on 06 April 2011.



Dr Alex Yusupov

As orthodontists, we treat children and adults. We often see developing problems in young children long before all the permanent teeth erupt. Often permanent teeth are congenitally missing, malformed or have abnormal eruption paths that may result in impactions, adding risk, duration, and complexity to future orthodontic treatment.

If planned carefully, we often can use tooth substitution to negotiate the problems of missing or malformed teeth. In the maxilla, the second molar can be used as the first molar. The premolars are interchangeable with each other and canines, and often canines can be used as replacements for missing or peg shaped lateral incisors.

Examples of tooth substitutions:



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In this patient, the upper canines were substituted for congenitally absent lateral incisors.



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In this patient, several teeth were substituted for other teeth.

The canines and premolars are transposed, and the 12 is absent. The 14 is in place of 12, and 24 is in place of 23.



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Advantages of tooth substitution as opposed to opening space and replacing the missing teeth with implant supported crowns:

1. Natural root is more acceptable if there is gum recession as opposed to display of metal in the aesthetic zone
2. More control over gingival margins as can orthodontically intrude or extrude natural tooth to make the gum margins appear normal and harmonious (see example 1 above).
3. No need for space maintenance and delay to place implants
4. In cases where opening a space for implant requires removal of a premolar, this treatment is more conservative
5. No need for bone grafting, sinus lifts, gum grafting etc.

Until recently, the suitability of teeth to be used as substitutes could only be assessed once the candidate for substitution has erupted. This meant that early intervention to allow some “driftodontics” to occur could not be utilized. Now with 3D Cone Beam CT (CBCT) scanning, the crown form and dimensions of unerupted teeth can be accurately measured and assessed a long time before the teeth erupt. Thus decisions can be made much earlier and interceptive steps like removing a malformed tooth can be made at that time.

Let’s have a look at this example:



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The 12 appears to have a supernumerary. In the past,

there was no way of knowing whether this was indeed an extra tooth, or a germination of 12. A 3D CBCT revealed this to be a geminated 12 and it was removed. As this child has a Class II occlusion, the plan was to use the 13 as replacement for the 12, and on the left side remove 24.



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2 years later, this patient is ready to start orthodontic treatment and as an orthodontist I am happy that I do not have to close a 10 mm space in the 12 site!

Another very important role of 3D CBCT assessment is tooth impactions. Upper canines are the most commonly impacted teeth, with an incidence of 3% in the general population. Often the eruption paths of these teeth can be intercepted by timely removal of deciduous canines and space maintenance if required (I use an upper Nance button as a precaution). Failure to assess the eruption paths of upper canines at an age 9 or 10 can not only result in a preventable impaction, but in rare instances in damage to the roots of the lateral incisors.



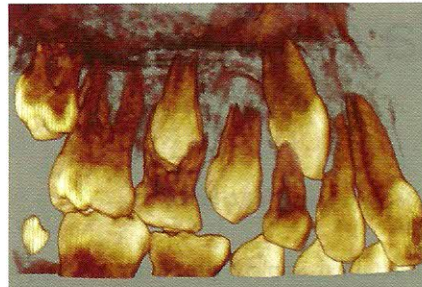
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This is a 12 year old girl who saw me recently. She has been monitored by another orthodontist for 2-3 years. There is spacing in the upper and lower arches and a Class I skeletal and dental pattern. One would assume that the canines have plenty of space to erupt, hence, no periodic radiographs (I recommend an OPG every 12 months) were taken.

The OPG revealed an abnormal eruption path of 13 and possibly resorption

of the 12 root. The 13 also has a large eruption cyst. The 23 on the other side is showing normal eruption.

The CBCT scan, taken by DMDI, clearly shows resorption of 12 root. The management is removal of 53 and hopefully the 13 will erupt in its normal position.



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3D CBCT technology provided by DMDI is amazing and often allows the only means of assessment.

Having said that, one must be mindful of the radiation hygiene, as children are up to 3 times more susceptible to the effects of ionising radiation. It is important to know the comparative doses of radiographic examinations, and these are listed below.

Indications for Cone Beam examination for children

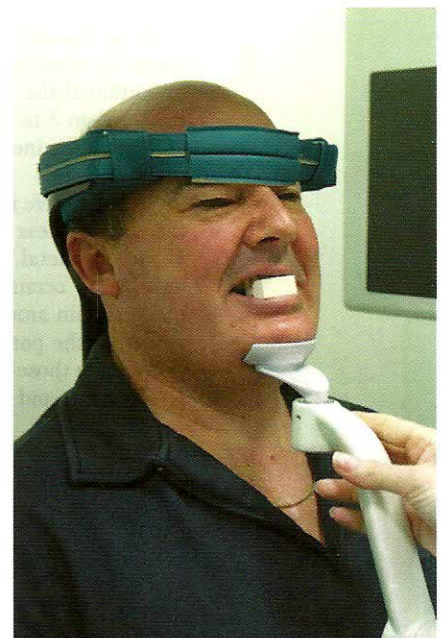
- ◆ When routine OPG shows an abnormality
- ◆ When the conventional, low dose radiographs can not answer the question
- ◆ When treatment plan will be altered based on the answer to the question
- ◆ When patient is old enough to sit very still for 5-10 seconds
- ◆ When further delay in treatment leads to greater risk

Indications for Cone Beam examination for adults

Exactly the same as for children, except in adults where implant space is being created or maintained, a CBCT scan will accurately reveal the sufficiency of the space, the need for bone grafting and any problems with root angulations. Often these factors are not possible to accurately assess from an OPG.

How to minimise the dose of Cone Beam CT

- ◆ Find out the doses of the Cone Beam provider – there is enormous variation between the different Cone beam machines and the doses. DMDI uses the lowest dose machine in Australia, with a full head CBCT dose of 50uSv to XuSv
- ◆ Use the smallest field of view – DMDI uses a Cone beam machine with selectable FOV In this instance, clinical history is extremely important so that the 3D cone beam study is limited to the area of interest. As DMDI is so computer savvy, emailing an OPG of the patient, sent to DMDI for a CBCT scan, will allow Susan (Dental Radiographer) to target the area of interest much more accurately.
- ◆ Use child exposure settings
- ◆ Use appropriate positioning restraints and supports – this is very important as movement during exposure will affect the whole image. ◆



Roy, with positional restraints in place

x-ray study*	dose in uSv (2007)*	DMDI average dose in uSv (2011)
OPG	14.3-24.3	12-20
Lateral Ceph	10.4	10
PA film	2-22	Not Applicable
Cone Beam CT	27-1073	40-80
Medical CT of jaws	180-2100	Not Applicable

From: *Koong B. Clin Implant Research 2010;21:1201-1208

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