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ORTHOUPDATE

Welcome to another issue of my newsletter. I have changed the layout and will appreciate any feedback on this, hopefully our final layout.

In April this year, I gave a one day course at the continuing education program at the University of Melbourne. The course centred on complex multidisciplinary treatments and I was delighted to give this course with Dr Eric Tan. We had a lot of fun preparing and presenting the course material. As always, some concepts become clearer when one has to explain them to others. I include a section on management of short clinical crowns in this newsletter, hopefully bringing a few concepts together to help you in treatment planning for patients with excessively worn anterior teeth.

Over the last few months, I have been approached by several radiology companies advertising and promoting the use of cone beam computed tomography. In this newsletter, I have included a section on this new technique.

Photo-tip

I am enjoying my photography more than ever. I am learning how to shoot in RAW format and then develop images using raw conversion software.

For ease of image adjustment and archiving, I recommend Adobe Lightroom. This software works on PC and Mac platforms, and opens up a very intuitive and robust image sorting/archiving/non-destructive editing possibilities. Its core engine is similar to Adobe Camera Raw (ACR), but unlike ACR, you do not have to be a professional photographer to use the interface. Also, Lightroom 2 is soon to be released, and it is promising to be something else indeed! Visit: www.adobe.com/products/photoshoplightroom/

I hope you enjoy this newsletter. My website is almost ready to go live and in the near future, these newsletters will be available for download in PDF format.

Happy reading!

Alex Yusupov



Balloon ride, August 2007, taken with Canon 5D, ISO 800, F8, 1/100 sec @ 35 mm

SHORT CLINICAL CROWNS

By Alex Yusupov

Often our adult patients present with short clinical crowns. There are many reasons why clinical crowns may be short and these include:

- worn teeth
- infra-erupted teeth (arrested eruption)
- gingival hyperplasia

The decision on how to manage worn teeth is not an easy one and many options are available which include:

- Restoratively lengthen the tooth crowns
- Crown lengthening through periodontal surgery with or without bone removal
- Periodontal surgery and restorative treatment

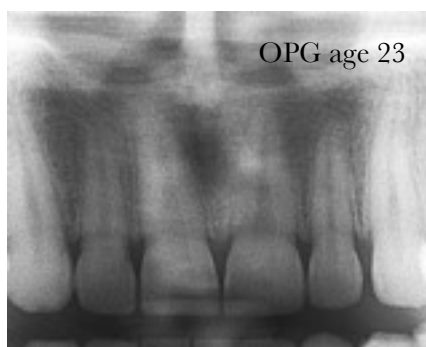
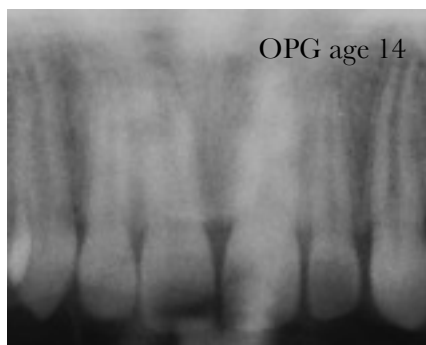
....and at this point, usually the clinician feels that they have exhausted the available modalities to handle short clinical crowns.

Case illustration



This is a 23 year old male, who is about to commence orthodontic treatment. He is concerned that he is showing a lot of gum and wants to correct his bite.

With the lips at rest, he is showing a good amount of upper incisors, and when he smiles, he has short clinical crowns of teeth 12, 11, 21 and 22, and excessive gingival display.



His OPG from previous orthodontic treatment is compared to the current OPG. We can see that his anteriors are short because of the wear and not because excessive gum or infra-eruption. The periodontal pockets are 1 mm.

Optimal crown dimensions

Crown dimensions - by how much do we need to lengthen the 12, 11, 21 and 22?

Well, working on the principle that the upper incisors Width:Length ratio should be 75-80%, we can calculate the ideal lengths of the incisors based on their current widths.

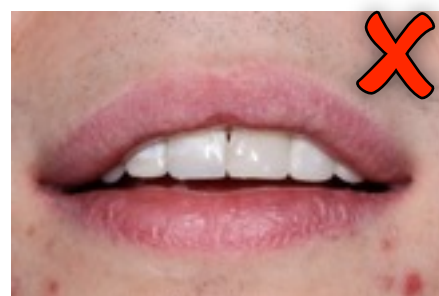
Tooth	Width	Length	Ideal length	extra length
12	7	6.2	8.75	2.5
11	9.2	8	11.3	3
21	9.1	8.1	11.3	3
22	6.5	6.2	8.6	2.5

Thus, based on the current tooth widths and a Width/Length ratio of 80%, the lateral incisors need to be 2.5 mm longer and the central incisors 3 mm longer.

Treatment options

1. Restorative option alone.

Add the length to the incisal edges with restorative material (composite/porcelain, veneer or crown).



This option will do little to the existing gingival display and create a traumatic overbite. It will also increase the incisor display at rest, which is really good at present.

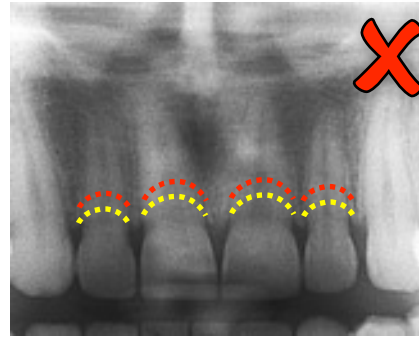
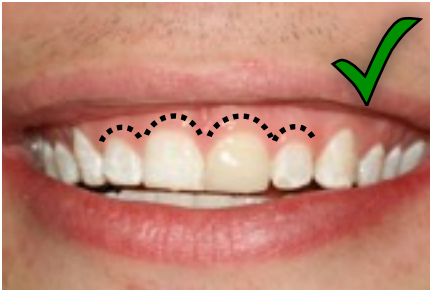
2. Periodontal surgery and restorative option

Crown lengthening the upper front teeth (and possibly the 14 and 24). This will be followed by full coverage restorations of the 12, 11, 21 and 22.

In this option, we maintain incisor display at rest, lengthen the clinical crowns and reduce the amount of gingival display - sounds like a winner option! Let's examine it in detail.



Well, it means that for us to successfully achieve 2.5 to 3.0mm of crown lengthening, we have to remove 3.5 to 5.00mm of bone in this case.



This can be easily demonstrated to the patient with quick composite additions, where no enamel etchant is used so that the additions can be quickly removed.

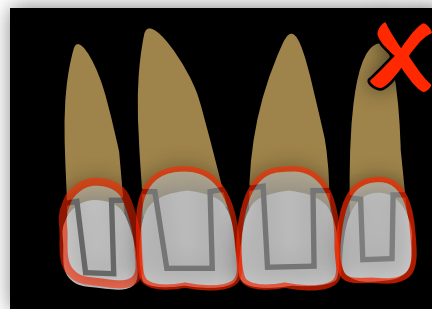
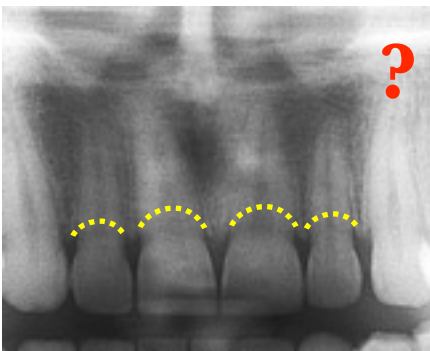
- This also has a number of restorative implications:
- restorative margins on root surfaces of the teeth.
 - poor emergence profiles
 - we have to remove a lot of tooth substance for crown preps
 - root:crown ratio is increased
 - unpredictable tissue response with several surgical revisions likely.

- the roots are not exposed
- the gum margin placement is precise
- no surgery is required
- conservative restorative preps

What about from periodontal surgery point of view? We have 1 mm healthy pockets, so we will need to remove 1mm of gum and 1.5 - 2mm of bone to get our 2.5 to 3mm of crown lengthening, right?

The stroke of elegance

The upper anteriors can be temporarily restored **before** orthodontic appliances are fitted. This will allow precise placement of incisal edges, gum margins, connector areas, correct smile arc all the while ensuring correct tooth volume is preserved for final restorations.



Braces fitted the same day as the

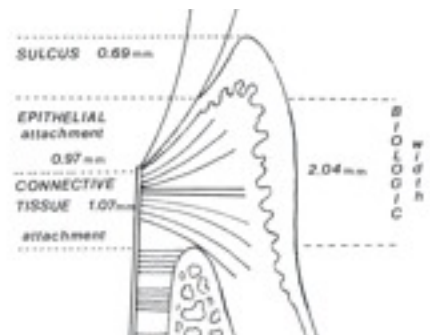
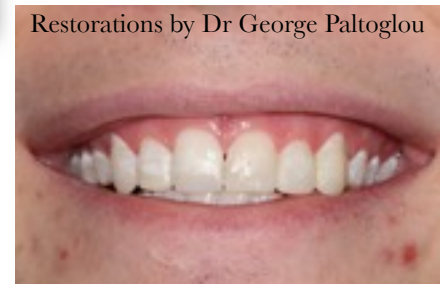
Well, that's not quite correct. Remember the **biologic width?**

Any other options?

3. Orthodontics and restorative option

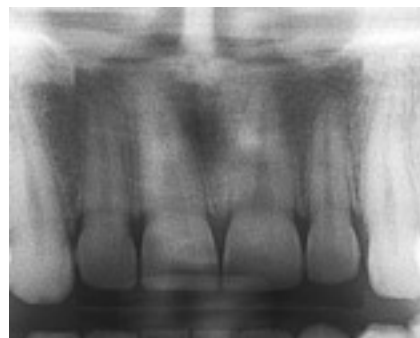
This means that between the bone and the floor of the sulcus, we have to have a 2.04mm of combined connective tissue and epithelial attachment.

In this option we intrude the upper 4 incisors 2.5 - 3mm and then have these teeth restored with porcelain veneers/ crowns.



From Rufenacht 1992.

So what does that mean for our periodontal surgery?



Photoshop simulated intrusion

restorations completed on the upper teeth.

References:

Rufenacht, C.R (1992). "Fundamentals of Esthetics", Quintessence Pub. Co.Inc. p. 225

ALARA

Cone beam computed tomography - the complete picture.

Cone beam computed tomography (CBCT) has allowed dentists to visualise dental structures in 3 dimensions. While representing an amazing technological leap, routine 3D tomography application to every orthodontic patient requires careful consideration. I have been approached by radiology clinics who have CBCT machines and they tell me that some orthodontists use 3D tomography to generate lateral cef and OPG images for every patient. They claim that radiation exposure is only slightly more than the conventional x-rays and that for the exposure equivalent of 3 OPGs we get a 3D image of the jaws and we can then reformat the image to provide an OPG and a lateral cef. I also know of orthodontists boasting that routine 3D tomography makes their orthodontic practice state of the art.

We are allowed to refer patients for radiographic examination using the ALARA dose principle - where ALARA stands for "as low as reasonably achievable". So what are the criteria for a radiographic examination? For me, the following questions need to be considered:

Can the radiographic examination influence my treatment planning? In other words, what is the biologic cost of doing this examination versus not doing this examination?

What is the radiation dose and which examination technique will provide the necessary information with the least amount of radiation?

What is the material cost of doing this examination?

To x-ray or not to x-ray?

Well, there is no doubt that a simple OPG and a lateral cef are a minimum requirement for orthodontic treatment planning. These two radiographs

coupled with patient's clinical examination, models and photographs provide more than adequate information for routine treatment planning. With the introduction of digital OPG and cef machines the radiation doses are minimal. In fact, a routine OPG is a must for every patient from 7 years age or older.

Sometimes, we need extra radiographs to check the anatomical position of structures and to assess if any pathological changes have taken place: the most notable is root resorption of teeth adjacent to an impacted canine.

Radiation dose

Silva *et.al.* (2008) have published the results of their study comparing radiation doses for conventional OPG/ CEF, 2 CBCT machines and a multi-slice CT. The authors used an anthropomorphic phantom loaded with dosimeters at 16 sites representing sensitive organs. From these dosimeters, effective and absorbed organ doses were measured.

Their results are summarised in the tables below:

Mean absorbed doses (μGy) to various tissues for each unit

	NewTom 9000	i-CAT	Panoramic/ lateral cephalometric	Multi-slice CT
Bone marrow				
Third cervical vertebrae	648.9	731.3	62.8	7525.6
Mandibular ramus	1244.7	1282.9	360.4	9930.4
Brain				
Hypophysis	316.1	745.0	30.2	1488.9
Eye				
Lens	472.8	1229.2	45.8	892.8
Thyroid gland				
Thyroid	232.4	134.3	13.1	1417.7
Salivary glands				
Submandibular	1425.7	1364.1	566.8	11815.0
Parotid	1678.7	1502.2	324.4	14204.4
Skin				
Thyroid	663.8	157.5	25.9	1889.0
Neck (back)	3257.1	651.1	270.8	15837.2
Philtrum	3273.6	1434.9	25.3	12791.8
Parotid	1489.4	1510.9	608.7	14734.4
Nasion	451.2	1060.9	19.9	1008.2

Mean equivalent dose (μSv) and effective dose (μSv) for each unit

	NewTom 9000	i-CAT	Panoramic/ lateral cephalometric	Multi-slice CT
Bone marrow*	946.8	1007.1	211.6	872.8
Brain	316.1	745.0	30.2	1488.9
Eye	472.8	1229.2	45.8	892.8
Thyroid gland	232.4	134.3	13.1	1417.7
Salivary glands [†]	3552.7	1433.15	445.5	13009.7
Skin [‡]	1427.0	963.0	190.1	9252.1
Effective dose	56.2	61.1	10.4	429.7

*Mean of mandibular ramus and cervical spine.

[†]Mean of submandibular and parotid glands.

[‡]Mean of thyroid skin, neck, philtrum, parotid, and nasion skin.

From Silva *et.al.* 2008.

As can be seen, the mean absorbed doses and mean equivalent doses are 3 to 40 times higher for some organs using CBCT examinations as compared to routine OPG and lateral cef alone. The Multi-slice CT is the most dose intensive examination. These findings are similar to those of Ludlow *et.al.* (2006).

Let us also remember that a large proportion of orthodontic patients are children. Would you like your child to be exposed to unnecessary x-radiation?

Clinical excellence is doing more with less, rather than doing less with more!
Alex Yusupov

Material cost

While most radiology practices bulk bill Medicare, the cost to Medicare must be considered. An OPG and lat cef costs approximately \$110-\$140. The cost of a CBCT scan is \$500-\$700.

Final word

CBCT is a useful tool, and in some instances must be used to determine the anatomical or pathological conditions. But it is our obligation and responsibility not to carry out unnecessary and potentially harmful procedures. If a simple low dose radiograph will provide the required information, then this must be the radiograph of choice.

References

Silva, M, *et.al.* (2008). "Cone-beam tomography for routine orthodontic treatment planning: A radiation dose evaluation". Am J Orthod Dentofac Orthop:133 (5) 640.e1-640.e5.

Ludlow J.B., *et.al.* (2006). "Dosimetry of 3 CBCT devices for oral and maxillofacial radiology: CB Mercuray, NewTom 3G and i-CAT". Dentomaxillofacial Radiol:35(4): 219-226.