

Australian Society  
of Orthodontists



University of Sydney



New approaches,  
new technology in  
modern Orthodontics

*Creating **Brighter** Futures*

# New approaches, new technology in modern Orthodontics

At the World Federation of Orthodontists' Congress, held at Darling Harbour, Sydney, in February 2010 the keynote address was delivered by one of the most distinguished orthodontic teachers and researchers of this generation, Professor William Proffit.

Professor Proffit provided insights into the future of orthodontics. This newsletter, and the next, will review his presentation to the Congress.

Broader and more complex orthodontic treatment goals have determined that more advanced clinical evaluation and 3-D imaging have gained prominence in diagnosis and treatment planning. Furthermore, genetic analysis is on the horizon and is likely to become increasingly important.

Clinical data documenting treatment outcomes utilising skeletal anchorage, while progressing beyond isolated case reports, is not yet adequate to determine long term outcomes. However, skeletal anchorage certainly will be widely used in the future. At present alveolar bone screws are receiving more attention while mini-plates receive less attention than perhaps they really deserve.

Data from clinical trials of new brackets and wires indicate that laboratory data often are not good predictors of their clinical performance. Most of the claimed advantages of the new products have not been verified by the clinical trials, which should be considered by clinicians when exposed to marketing campaigns.



Figure 1

## The Soft Tissue Paradigm

"The goals, and limitations of orthodontic/orthognathic treatment are determined by the soft tissues of the face and mouth, not by teeth and bones".<sup>(1,2)</sup>

Diagnostic emphasis has shifted to considerations of facial proportion and tooth display even though periodontal integrity, particularly relevant to lower incisor alignment and assessment of TMD remain significant diagnostic criteria.

## Facial proportions

Beautiful faces are just average in all dimensions. Symmetry and proportion are crucial, whereas introducing disproportion can have a highly detrimental effect. Interestingly, recent findings with altered photographs have shown that neither professionals nor lay people notice a chin deviation of up to 3mm, however most people will notice a 4mm deviation.

### 1. Symmetry

Proffit, when evaluating the position of the head in space, and the relative orientation of the dentition, discusses facial proportion in terms of Yaw, Pitch, and Roll (Figure 2). Pitch deformities are typically well diagnosed, but not Yaw and Roll deformities.

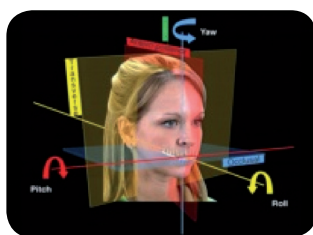


Figure 2

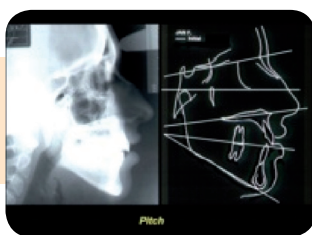


Figure 3

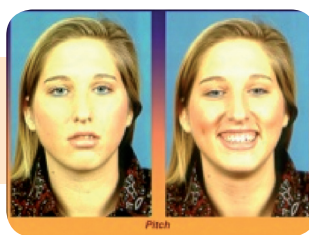


Figure 4

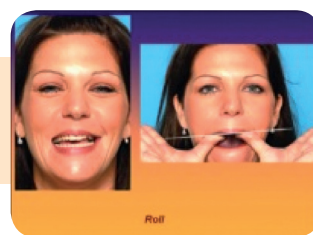


Figure 5

## Colgate CARE COLUMN

### Vision to improve oral health outcomes in the bush

Griffith University's School of Dentistry and Oral Health and global consumer products company Colgate-Palmolive have celebrated their collaboration to improve rural, remote and Indigenous oral health.

An agreement with Colgate, resulted in the appointment of Professor Ratilal Lalloo to the position of Colgate Chair for Rural, Remote and Indigenous Oral Health earlier this year. The position was created to drive innovative research, education and community service in rural, remote and indigenous oral health.

It supports Griffith University's longstanding commitment to equity and social justice and the vision of Foundation Dean of Dentistry and Oral Health Professor Newell Johnson for a strong public health focus in the School's agenda.

Since Professor Lalloo's appointment, Griffith has successfully launched a part-time dental clinic in the rural NSW town of Brewarrina. Residents of the small town previously had to travel about 100 km for oral health services. The clinic was developed in partnership with Brewarrina Shire Council, NSW Health and Ochre Health.

Groups of six to eight final year dentistry students have enjoyed three week rotations at the clinic during the year. About 1,300 appointments were managed during the 18 weeks the clinic was in operation. With this in mind Griffith is now planning a second rural clinic in collaboration with an Indigenous health service provider in Queensland.



Mr Chris Pedersen GM Colgate; Griffith Uni's Pro Vice Chancellor Prof Allan Cripps, Colgate Chair in Rural Remote and Indigenous Oral Health Prof Ratilal Lalloo, and Acting Head of Dentistry and Oral Health Assoc Prof Jeroen Kroon



Figure 3 is a classic example of a pitch deformity involving the maxilla. Tracing the palatal plane reveals that the maxilla is tilted up anteriorly and down posteriorly.

Pitch discrepancies will affect the vertical positioning of the teeth and treatment planning. Not only evident radiographically, a pitch discrepancy can be demonstrated as in Figure 4 by excessive gingival display in the posterior region and across the anterior segment when smiling.

Roll deformities are not as easily identified, particularly using traditional cephalometrics, but are relatively easy to visualise (Figure 5). Diagnosing roll deformities involves assessment of orientation of the dentition with reference to the ocular plane and the inter-commissary line. Assessment relative to the inter-commissary line will identify orientation of the occlusal plane in relation to the lips.

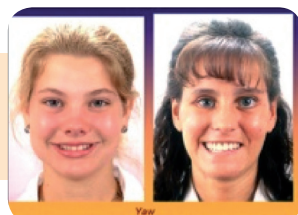


Figure 6

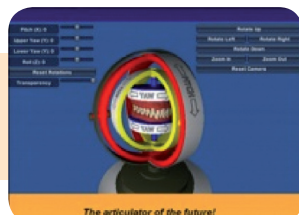


Figure 7

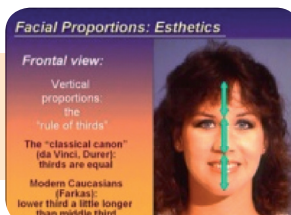


Figure 8

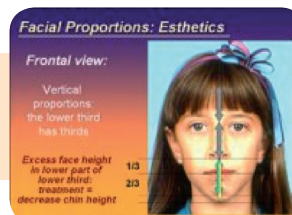


Figure 9

Yaw deformities have not been very well described at all in orthodontic evaluations. Figure 6 demonstrates how a yaw deformity of the mandible or maxilla can result in a patient's features appearing skewed to one side.

Another relatively new inclusion in the clinical examination is assessment of the Aesthetic Line of Occlusion, or Smile Arc, which is the contour of the occlusal plane ideally aligned with lip contour when smiling, essential for a pleasing smile and facial appearance. Virtual articulators (Figure 7) will allow us to set the Pitch, Roll, and Yaw of the dentition as needed including soft tissue considerations as determined in reference to the Aesthetic Line of Occlusion.

## 2. Vertical and Transverse Proportionality

Evaluation of the vertical facial thirds and the transverse facial fifths is the second step in facial evaluation.

**The "Rule of Thirds".** Classically, artists have used the "rule of thirds" (Figure 8) to judge vertical proportions. In modern Caucasians, the lower third is a little longer than the middle third.

The lower face can also be divided into thirds to assess the proportion of vertical elongation of the chin contributing to excessive lower face height. (Figure 9).

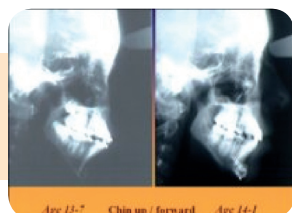


Figure 10

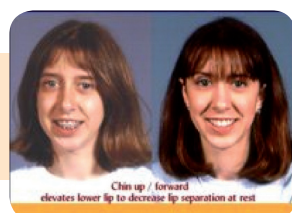


Figure 11

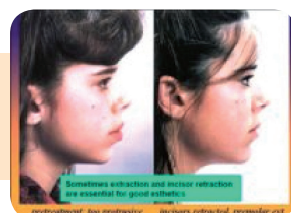


Figure 12

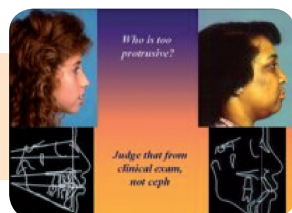


Figure 13

**The Facial Index.** The Facial Index is the ratio of face height to width and a significant criterion of facial harmony.

Assessment of vertical facial thirds will identify and quantify any facial disproportions, thereby indicating appropriate treatment options. Genioplasty to correct vertical disproportion can be an important enhancement to orthodontic treatment, and should not be overlooked as a treatment plan option. In Figures 10 and 11, elevating the chin has decreased the vertical disproportion as well as elevating the lower lip, resulting in less lower incisor display on smiling which is a sign of aging.

The nose and chin must be in proportion, which is also a significant consideration in orthodontic treatment planning. Retraction of incisors during treatment of a Class II Div 1 case will accentuate prominence of the nose, whereas mandibular advancement can restore aesthetic balance to nose and chin proportion.

## 3. Tooth/Lip Relationships at Rest

The third step in facial evaluation is assessment of tooth-lip relationships at rest. In the profile view, it must be remembered that excessive protrusion of the teeth has to be evaluated clinically, not from cephalometric measurements.

The teeth are too protrusive only if prominent and everted lips are separated at rest and strained on closure over the teeth (Figure 12), noting that some racial types can tolerate varying degrees of protrusion (Figure 13). Frontal and three-quarter views demonstrate incisor display and the relationship of the dental midline to the skeletal midline.

## 4. Tooth/Lips and Cheeks on Smiling

The final step is to evaluate the relationship of the teeth to the lips and cheeks on smiling (Figure 14), with reference to;

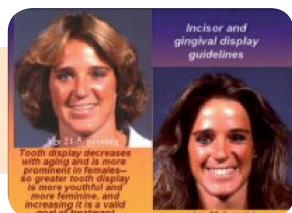


Figure 14

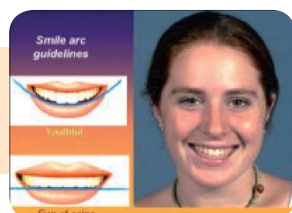


Figure 15

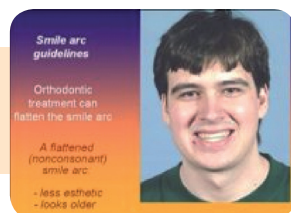


Figure 16

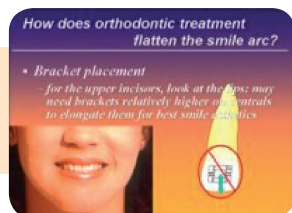


Figure 17



Brighter Futures is published by the Australian Society of Orthodontists (NSW Branch) Inc. in conjunction with the Orthodontic Discipline at the University of Sydney.

The newsletter is intended to help keep the dental profession updated about contemporary orthodontics, and also to help foster co-operation within the dental team.

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(a) **Arch Width.** Excessively wide buccal corridors (Negative Space) are un-aesthetic. However, maxillary expansion only improves smile aesthetics if the cheek drape is wider than the dental arch and there must also be a balance between the width of the zygomatic arches and the dentition. Excessively wide dental arches produce unnatural "denture aesthetics". Dental arch width should match the drape of the cheeks as they descend from the zygomatic arches. The broader the face, the broader the dental arch should be, and vice versa. It is a misconception that buccal corridor width (separation of the teeth from the cheeks) should be eliminated.

(b) **Incisor/Gingiva Display.** Display of the maxillary teeth and gingiva on smiling should be age and gender appropriate. Maxillary incisor display decreases with advancing age<sup>(3)</sup>, while displaying some gingiva produces a more youthful and more feminine appearance. Intrusion of maxillary incisors, resulting in reduced gingival display, is therefore not always indicated for overbite reduction. On smiling, the upper lip should elevate to the incisor gingival margin, although acceptable range varies from 4mm tooth coverage to 4mm gingival display. Incisor display of 75% is the minimum for good aesthetics<sup>(4)</sup> and in general, it is considered more aesthetically pleasing to show more gingiva than not enough crown.

(c) **The Smile Arc.** For optimum aesthetics, the contour of the maxillary dentition on smile should match the contour of the lower lip on smile<sup>(4)</sup>. Flattening of the smile arc can easily occur during treatment if the orthodontist is not aware. Often overlooked, smile arc contour is perhaps the best example of "If you don't look for it, you won't see it." (Figures 15 and 16)

## How does orthodontic treatment flatten the smile arc?

### Bracket Placement/Position:

Bracket positioning is a primary cause of flat smile arc. Traditionally, orthodontists have measured from the incisal edge to place brackets, however the modern guideline is bracket placement with reference to the upper lip to facilitate the smile arc relationship.

### Inadvertent tooth movement

A flat smile arc can emerge as a consequence of tooth movement to establish a canine protected occlusion or following incisor intrusion to decrease gingival display when smiling.

### Inherent growth pattern

Flattening of the smile arc isn't always a result of orthodontic treatment. Some patients naturally grow in such a way as to flatten the smile arc, particularly in brachyfacial patients.

### Tooth movement versus restorative treatment

Positioning upper incisors to compensate for incisal attrition, particularly in conjunction with incisal levelling, can result in shortened clinical crown heights and flattening of the smile arc. Alternatively, positioning the incisors with gingival contour and smile arc as priorities will complement restorative treatment to re-establish ideal crown length and optimum aesthetics.

## Summary

Orthodontics continues to evolve, driven by ever greater computing power and enhanced audio-visual technology. All facets of facial aesthetics must be considered and it is no longer satisfactory to merely align the teeth. We are now aiming to "design the smile".

The next Newsletter will review the changes in technology including 3D imaging and genetic testing. Improvements in skeletal anchorage and wire and bracket design will also be discussed.

## References available on request

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