

Australian Society
of Orthodontists



University of Sydney



Moving Teeth *Invisibly* with Sequential Plastic Aligners

PART 2

Creating Brighter Futures

Moving Teeth *Invisibly* with Sequential Plastic Aligners

Introduction

The 2009-1 issue of this newsletter described the development of 'Sequential Plastic Aligner' treatment and discussed its fundamentals. This issue will expand on the movements that can and cannot be readily achieved. Understanding the capabilities and limitations of sequential aligners is essential when planning treatment.

Which tooth movements are easy and which are difficult?

• Extrusion

Extrusive movements of groups of teeth are difficult to achieve with plastic aligners, eg, closing an anterior open bite. Other approaches may be required, such as intruding the posterior teeth with Temporary Anchorage Devices⁽¹⁾, which offer a more predictable and stable approach. Perhaps as the technique evolves, extrusive tooth movements will be possible.

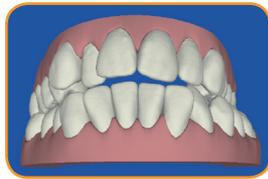


Figure 14 An example of an open bite case that would be difficult to treat using plastic aligners.

However extrusion of individual teeth that are infra-occluded relative to the arch is possible. Infra-occlusion is occasionally observed as an unexpected consequence of sequential aligner treatment. A tooth intrudes probably due to insufficient interproximal space, as evidenced by the gap between the incisal edge of the lateral incisor and the aligner (Figure 15).



Figure 15 The upper right lateral incisor is unexpectedly intruding, evident by the gap between the aligner and the incisal edge of the tooth.

After ensuring the proximal contacts are not too tight, the intruded tooth can be extruded using an elastic stretched over the aligner from a composite button bonded onto the labial surface of the tooth to a tag cut into the aligner's lingual border (Figure 16).



Figure 16 An elastic, drawn in yellow, used to extrude a tooth.

• Rotation

Rotational correction of conical teeth such as premolars can be difficult due to inadequate grip between the plastic aligner and the tooth. A buccal attachment is placed on the tooth to enhance the grip, or preferably, both buccal and lingual attachments are used forming a couple. The shape of incisors is more amenable to rotational movement. However, rotated teeth often require uprighting and torquing, which are more difficult movements. Figure 17 shows pretreatment records with a rotated upper right central incisor, mildly rotated lower incisors and a lower left canine that is in crossbite, rotated and infra-occluded. In figure 18 the post treatment records show that the lower incisors responded well but despite a long treatment, with over forty aligners including over rotation, the upper right central incisor remains slightly under corrected, as is the lower canine. Recently, using the mesial or distal surface of an incisor or canine as the axis for rotation has been recommended as being more effective than using the central or vertical long axis⁽²⁾. The tooth is rotated in a labial or buccal direction about the mesial or distal hinge axis, which creates space for the rotational correction prior to lingual movement into arch alignment.



Figure 17 Case SM pre-treatment



Figure 18 Case SM towards the end of active treatment. The upper right central incisor remains under corrected and is lagging behind the aligner prescription as represented in the digital model.

• Torque

Labial or lingual root movement using plastic aligners is achievable but difficult and time consuming. Forces required to tip teeth do not usually unseat the aligners, however force vectors and levels necessary for torquing movements and other bodily tooth movements can. Therefore, attachments to aid aligner retention are mandatory for successful root torquing. Correction of a

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Periodontal Disease as a risk factor for Pulmonary Diseases

Of all the systemic conditions that can be associated with periodontopathogens, diseases of the respiratory systems are shown most conclusively to have a causative relationship. This is through aspiration of the pathogenic cytokines into the lungs. Respiratory diseases predominantly include pneumonia and COPD (Chronic Obstructive Pulmonary Disease) and are seriously debilitating conditions, often occurring in the immunocompromised. Yoneyama (2002) showed that improving oral care in group care situations (e.g. nursing homes) significantly decreased a resident's likelihood of suffering from pneumonia. Chemical treatment of the periodontal bacteria has also shown to be effective at reducing pneumonia and other respiratory diseases in these patients (Azarpazhooh 2006). As clinicians, it is imperative that we initiate and continue periodontal treatment for patients who are at risk of systemic conditions such as pulmonary diseases.

Yoneyama T et al. J Am Geriatr Soc, 2002 Mar;50(3):430-3

Azarpazhooh A et al. J Periodontol 2006 Sep;77(9):1465-82



crossbite as in Figure 19 requires labial tipping of the tooth across the bite and labial root torque. Teeth cannot just be tipped forward over the bite, the root must be torqued labially as well. With fixed appliances, the crown is first moved into the arch prior to labial root torquing movement. With plastic aligner treatment, adopt a root first approach. The root should be torqued forward as space is made available within the arch prior to labial movement of the crown into the newly created space.



Figure 19 Crossbite correction of the upper right lateral incisor initially involves labial root torque as space is created for movement across the bite. Note the attachment needed to keep the tooth seated within the aligner as torque is applied to the lateral incisor.

Correction of the upper right canine labial displacement in Figure 20 requires lingual root torque with the assistance of labial attachments (Figure 21). These facilitate tooth movements and prevent the canine from intruding and lifting out of the aligner during treatment.



Figure 20 The crowded upper right canine will require lingual root torque.



Figure 21 Horizontal beveled attachments to help retain the aligner while torquing the teeth.

• **Bodily movement**

Moving teeth bodily with aligners is difficult. Thus, severe crowding, Class II and Class III cases needing extractions, or space closure cases, often require combination treatments involving sectional fixed appliances to achieve the desired bodily tooth movements. Figures 22, 23 and 24 show a Class II Division I crowding case where the upper first premolars were removed and sectional fixed appliances were placed to initiate upper canine retraction with mesial movement of upper first molars to close residual posterior space. Six months into treatment, Figure 23 illustrates the upper canines retracted to Class I leaving space available to align and retract the upper incisors using sequential aligners. In Figure 24, nearing completion of treatment, note mesial tipping of the upper first molars following additional residual space closure using aligners.



Figure 22 Case CW pre-treatment.



Figure 23 Case CW after six months of sectional fixed appliances.



Figure 24 Case CW near the end of treatment.

Figures 25 to 28 illustrate a Class II Division I case that was treated with upper second premolar extractions and sectional upper fixed appliances prior to alignment and detailing using sequential aligners. A lower incisor was also extracted just before the aligners were issued. Most of the upper arch space closure involved bodily movement of the premolars, canines and incisors distally using the sectional fixed appliances and plastic aligners rather than the mesial movement of the upper molars. This resulted in less molar tipping compared to the previous case (CW).



Figure 25 Case EW pre-treatment



Figure 26 Case EW after both maxillary second premolars were extracted and sectional upper left and right fixed appliances were placed for 6 months to retract canines and close most of the maxillary extraction space resulting in reduction of the dental protrusion.



Figure 27 Case EW with aligners, Class II elastics and lower incisor extraction space closed.

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Correspondence is welcome and should be sent to:

Department of
Orthodontics
University of Sydney
Sydney Dental Hospital
2 Chalmers Street,
Surry Hills NSW 2010

AUTHOR & EDITORS

Dr Morris Rapaport
PRINCIPAL AUTHOR

Prof M Ali Darendeliler
Dr Dan Vickers
Dr Michael Dineen
Dr Ross Adams
Ms Felicity Dougherty

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Figure 28 Case EW post-treatment

It is important to note that both of these cases are very difficult and only the most experienced clinicians should attempt such complex combination treatment. They are included to show the boundaries that are being stretched and where this exciting mode of treatment may be headed.

Costs

The laboratory fee for comprehensive treatment using sequential aligners is quite high and must be considered when establishing a fee for the patient. While laboratory costs vary between companies and with complexity of the case, it is usually around \$3000. Most of the laboratory costs are incurred at the beginning of treatment and cover case planning and aligner production.

Considerable time is spent by the clinician during the treatment planning process involving case diagnosis and dictating tooth movements that are achievable and predictable. Therefore, an appropriate initial fee, often half the total fee, is charged at commencement of treatment. The fee charged for sequential aligner treatment is generally at least \$1000 more than fixed appliance treatment.

Patients are seen regularly to monitor progress, place attachments, provide interproximal reduction and issue subsequent aligners. Additional PVS impressions may be necessary if the case is not "tracking" as anticipated. Treatment duration, number of appointments and retention may be similar to fixed appliance treatment.

Conclusion

Sequential Plastic Aligners add a new and exciting option to our treatment armamentarium. However, achieving good outcomes can often be more difficult than first expected. As Dugoni⁽³⁾ wrote, "... the use of aligners is far more complicated than most people believe. It takes a knowledgeable clinician with considerable experience to use the appliance..."

Close examination of each malocclusion often reveals the need for complex tooth movements involving torque, mesio-distal uprighting, extrusion and space closure that are all difficult to achieve with sequential plastic aligners. Although progress is inevitable, at present the results achievable with sequential plastic aligners are not as precise and predictable as those using traditional fixed appliance therapies.

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