Australian Society of Orthodontists

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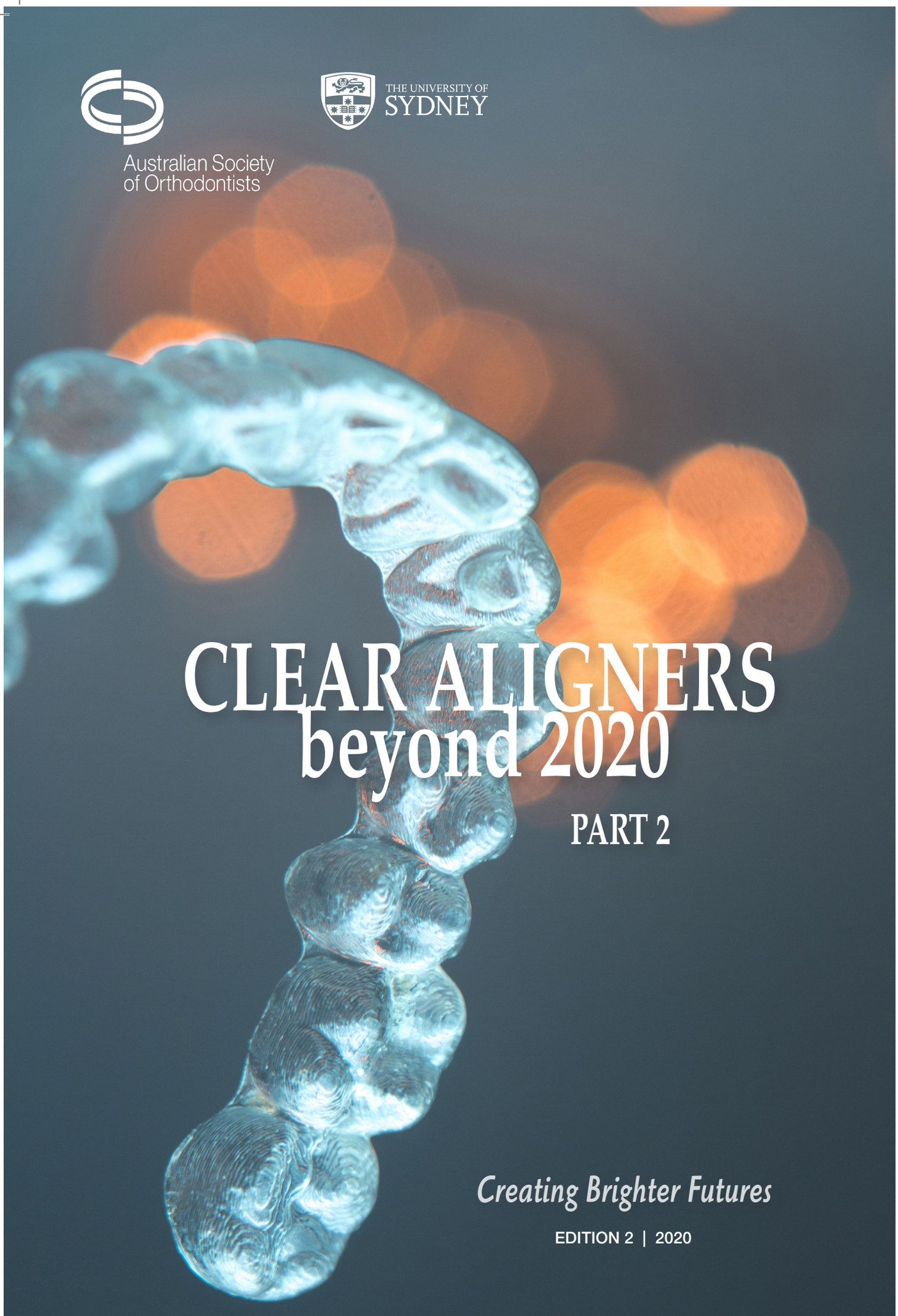

CLEAR ALIGNERS beyond 2020

PART 2

Creating Brighter Futures

EDITION 2 | 2020

Clear Aligners Beyond 2020 PART 2

In the previous newsletter we began the discussion about the issues that need to be considered when planning clear aligner treatment and noted that there are some factors that clinicians cannot control. Bone physiology will be affected by such things as metabolism, cellular turnover and bone and dento-alveolar density and will differ with age, gender and racial diversity (Roberts et al., 1987). The dimension and anatomical form of the dentition, both crowns and roots, will also affect the way teeth move. Hence, case selection is important and it begins at the consultation appointment. The appropriate selection of attachments, logical sequencing and staging of dental movement are essential parts of the digital treatment planning process. The use of auxiliaries such as elastics, TADs and/or sectional brackets may also be required.

With the increased use and availability of clear aligners, orthodontic treatment has been made more available and acceptable within the community and is being delivered by a wider range of practitioners and providers. As aligner treatment evolves within the cosmetic dental environment, the understanding of the science behind dental movement is slowly being eroded or not clearly understood by some providers. Using pre-set defaults within the digital software and allowing digital technicians to dictate clinical treatment may sometimes allow the clinician/provider to get away with treating simple Class I cases. However, when faced with more complex situations, the question arises: how much orthodontics should you know before using aligners, especially when tackling more complex cases such as extraction cases?

Extraction Cases

A classic extraction case would be a routine bimaxillary protrusive, lip incompetent and dental crowding patient requiring premolar extractions where interproximal reduction (IPR) is not feasible. The space that remains after the extractions would be utilised for dental retraction, relief of dental crowding and addressing soft tissue pattern including lip competence.

Digital technicians may not be aware of some clinical limitations including: (i) difficulty in obtaining the correct amount of dental expansion, (ii) inability to achieve sufficient anterior torque in premolar extraction cases, (iii) inability to fully correct deep overbite malocclusions, and (iv) inability to resolve severe dental crowding (including premolar rotations) without multiple refinements or additional aligners. In addition, technicians are usually not aware of recovery techniques needed to overcome situations where treatment is not tracking as planned. Sectional or full arch fixed appliances, fixed bonded power arms incorporated with power chains and/or pull coils, buttons and elastics etc.– are some of the `get out of trouble` techniques necessary. Clinicians need to spend more time preparing, planning and undertaking such recovery techniques when required. Patients who are not pre-warned of such situations will not be impressed with the prolonged treatment duration, extra costs involved and the placement of a more visible appliance to complete treatment.

Extraction treatment therapies using the aligner system are challenging and potentially the least predictable. The decision to involve an extraction programme is based on several factors including anchorage requirements, prognosis of teeth, past trauma and periodontal support. Other considerations include (i) the final position of the upper incisors in relation to the upper lip position, (ii) the degree of dental crowding, (iii) the amount of retraction required, (iv) midline correction and/or preservation, and (v) the amount of overjet and overbite present. As with all facets of dentistry, a correct diagnosis and appropriate treatment plan is essential.

Understanding the side effects and the inadequacies of the aligner system is extremely important when treating complex cases such as extraction cases. The degree of `play` between the removable aligners and the dentition, even with attachments in place, affects the true tracking of the appliance. During dental space closure with aligners the anterior teeth are extruded and retroclined contributing to an increase in dental overbite, deepening of the Curve of Spee often leading to an anterior interference and posterior open bite. The axial control of the dental translation during space closure is also difficult to manage even with compensatory tipping movements. See Figures 1 and 2. There is no formula to calculate the amount of compensation required in such extraction cases as every individual case is different. The degree of compensation relies on various factors including bone density, basal metabolic rates, dental anatomy, age, gender, ethnicity, crown height vs root dimensions, and other factors such as pregnancy and prescription drugs which may affect cellular turnover and other metabolic changes. The anchorage control in the maxilla and mandible often differs and arch asymmetries must be monitored.

Fig 1. A four 1st premolar extraction case treated with aligner therapy showing the potential inadequacies of the appliance. Bite deepening produces anterior interference with a posterior open bite and the loss of control of the axial inclination of the posterior teeth.

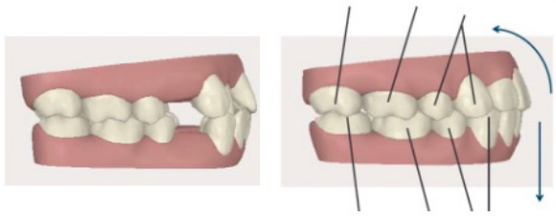

Fig 2. To avoid bite deepening and poor axial inclinations, compensatory movements in the digital plans are required when handling these extraction cases. Common compensatory movements include (i) increased upper anterior lingual root torque, and further intrusion of the lower incisors. (ii) Teeth mesial to the extraction sites need increased distal root tip movements while teeth distal to the sites require increased mesial root tip movements. Due to the dampening effect of the aligner system, the further away from the extraction space the less compensatory tipping movement is required (Chan et al., 2017).

Extraction case example

A typical Class I extraction case has either severe upper and lower dental crowding or has a bimaxillary protrusive dento-facial profile. The case demonstrated in Figure 3 is an Asian adult male patient who presented with a bimaxillary protrusive Class I dental malocclusion on a skeletal 1 base with a normal direction of growth. He had a protrusive dental profile, incompetent lips, an anterior crossbite with minimal overjet and overbite.

The treatment plan was to extract four first premolars with simultaneous staging. For aesthetic reasons a vertical rectangular attachment was placed on the lingual surface of the upper right instanding lateral incisor. The compensatory movements in this case included an increased upper incisor lingual root torque of 4 degrees, further intrusion of the lower incisors of 0.6mm, increased mesial and distal root tip of the abutment teeth distal and mesial to the extraction sites respectively of between 4-8 degrees.

Class II elastics were used initially to allow anchorage control and to maintain a Class I, canine relationship. During the refinement stages as seen in Figure 4, posterior box elastics were used in conjunction with the upper anterior precision bite ramps in order to control the vertical settling of the occlusion.

The total treatment duration was 26 months with 83 aligners including 3 lots of refinements/additional aligners. The 53 refinement/additional aligners were changed weekly.

Fig 3. Class I bimaxillary protrusion case

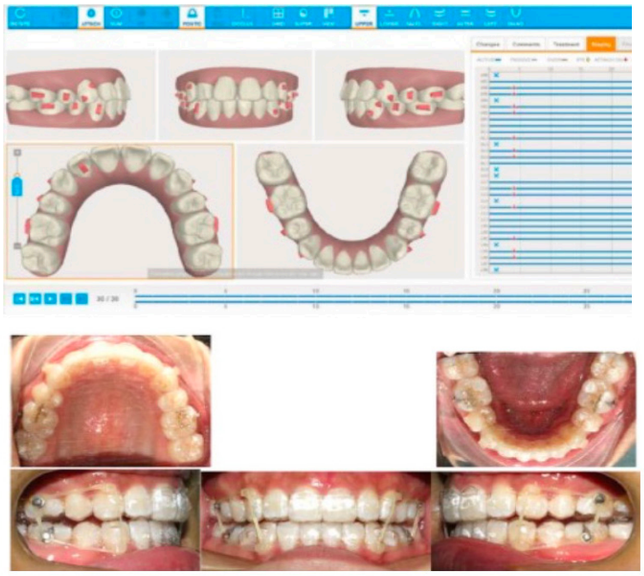

Fig 4. Refinement and Finishing

Attachment designs

Attachments are made of composite resin that are adhered to the surface of the dentition in order to increase the contact surface area between the aligners and the dentition. This allows a better 3-D control of the desired dental movements. Attachments are generally indicated for (i) intrusion, (ii) retention (iii) rotation, (iv) tooth uprighting, and (v) significant space closure.

Attachments can be classified as either passive or active. Passive attachments are indicated for indirect anchorage (e.g. on posterior teeth for anterior intrusion), or for aligner retentiveness (e.g. to resist displacement when elastics are worn directly to the aligners via precision hooks). Active attachments are placed on the teeth that move during treatment (e.g. the rotation of cylindrical teeth, root control in tipping, and/or translation, and dental extrusion).

Although computer aided designs have helped greatly with the selection of the type of attachments required for the desired dental movements, it is still essential to check for clinical variations prior to the approval of the digital treatment plan. Considerations include the crown and root dimensions, worn incisor edges, root dilacerations, bifurcations, as well as the degree of dental crowding/ spacing present. The timing of attachment placement must be considered.

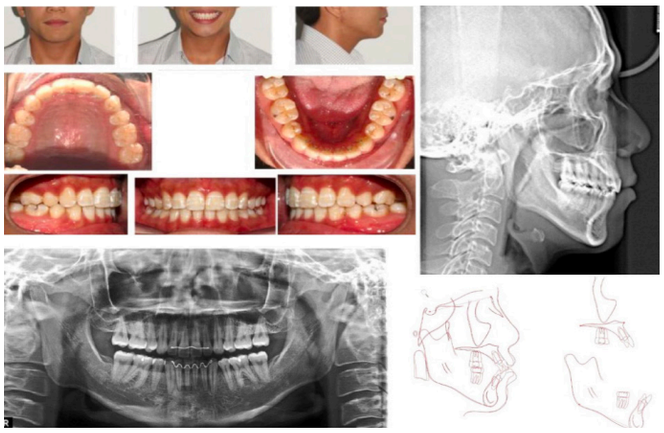

Fig 5. Completed case

Conclusion

The scope for predictable orthodontic treatment outcomes using clear aligners has increased over the years as a result of improved appliance design, clinical experience and the clinician's confidence in the appliance.

These two newsletters have touched on treatment considerations for non-extraction and extraction cases. Understanding the biological variations and treating the right patient using the right technique all point toward a rewarding experience for both clinician and patient. However, no two patients are alike; therefore no two treatment plans can be identical. With a sound understanding of orthodontic principles and tooth movement, a thorough examination and good planning, the clinician can avoid most of the pit falls those early clear aligner therapy users faced.

References

Adkins MD, Nanda RS, Currier GF 1990 Arch perimeter changes on rapid palatal expansion. Orthod Dentofac Orthop 1990; 97:194-9.

Roberts WE, Turley PE, Brezniak N et. al., 1987. Bone physiology and metabolism. Calif Dent Assoc J. 15:54-61.

Chan E, Darendliler MA. 2017. The Invisalign appliance today: A thinking person's orthodontic appliance. Seminars in Orthodontics.23:12-64

M. Ali Darendeliler A. Darendeliler M. Mandurino. Clinical application of magnets in orthodontics and biological implications: a review. Eur J Orthod, 1997:19(4);431–442.

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