

Summary of appliances for orthodontic/orthopaedic expansion and development

By Terence Whitty

ith common general orthodontic treatment, there are three main ways to gain space: extraction; Inter Proximal Reduction (IPR); and expansion. Of course, moving groups of teeth such as distalisation can gain space as well.

Expansion is often associated with the upper jaw as the mandible tends to respond differently to orthopaedic forces.



Figure 1a. HYRAX expander. This one is made on two bands; 4 bands are sometimes used but the path of insertion can be difficult.



Figure 1b. Variety screw from Dentaurum - small form factor expansion screw.

Three maxillary expansion modalities exist today: rapid maxillary expansion; slow maxillary expansion; and surgically assisted expansion. Dr John Mew, an English dentist and an advocate of "orthotrophics" argues "semi rapid expansion" is also a valid treatment as well, so this would sit in between rapid and slow. All of these modalities have their advantages and disadvantages and also their fair share of controversy, however the practitioner commonly will select the treatment based on their own experience, the patient's age and the type of malocclusion.



Figure 1c. The Dentaurm HYRAX Click mechanism and Variety mechanism.



Figure 2. Superscrew appliance. This appliance mechanism has been plagued with manufacturing defects.



Figure 4a and 4b. Bonded acrylic HYRAX.



Figure 3. HAAS Appliance.





Figure 5. TAD HYRAX appliance.

Rapid maxillary expansion

F irst described by Emerson Angell in 1860 and later made popular by Haas, rapid maxillary expansion was originally was used to reduce the narrowness of the maxilla. In reality, it has an affect on 10 bones of the face and head. Users of this technique believe that minimum dental movement, or tipping, is involved and most of the movement is skeletal.



Figure 6. Note the position of the incisors due to the separation of the mid palatal suture.

When heavy, rapid forces are transferred to the posterior teeth, in the correct way, the forces are transferred to the sutures. When this force is beyond that needed for tooth movement and sutural separation, the sites will open up and the teeth will only move minimally within the supporting bone. There is compression of the periodontal ligament, slight bending of the alveolar bone, tipping of anchor teeth then separation of the mid-palatal sutures and separation of the other maxillary sutures.



Figure 7. Quad Helix Appliance.



Figure 8. W Arch Appliance.



Figure 9. Removable transverse expander, sometimes called a Schwartz appliance.



Figure 10. The i-expander, claspless design and very effective for pre-aligner therapy



Figure 11. Laser welded HYRAX.



Figure 12. The metal-only T-REX appliance uses distalising springs in TMA wire.



Figure 13. T-REX appliance with acrylic button incorporating expansion screw.



Figure 14. Transverse and sagittal development in one appliance.



Figure 15. Simple sagittal appliance.



Figure 16. 3-way appliance with extra posterior transverse screw.

How fast this should occur again is in debate with some cautioning that 1mm per week is the maximum, whereas others will take the more aggressive approach.

Appliances for rapid expansion are generally threefold: the HYRAX appliance; the Bonded RME; and the HAAS appliance.

The HYRAX is actually a trademark of the Dentaurum company of Germany and an anagram for HYgenic RApid eXpanderMcompanies have copied the device over the years and the word is used generically for any fixed skeletonised appliance connected to two or 4 bands (See Figure xxx).

More recently, the "Superscrew" device was used generally because of its ease of adjustment by the patient and a low profile design. Unfortunately, the company was plagued with manufacturing issues and this product is now no longer available. Copies of the superscrew have appeared with generally the same design but one has to be skeptical about their reliability as they basically use the same mechanism and the author has had many issues with these types of mechanisms.

The bonded RME can use the HYRAX mechanism but instead of bands, uses an occlusal covering of acrylic that is boded to the posterior teeth. A framework of wire connects the HYRAX mechanism and also assists with removal.

The HAAS appliance has somewhat fallen out of favour but is basically a framework connected to bands with an expansion screw embedded into palatal acrylic. It was often thought this appliance gave a move parallel expansion but the use of acrylic made it somewhat unhygienic and can traumatise the palatal tissue.

Implant-assisted maxillary expansion is becoming a trend where TAD (Temporary Anchorage Devices) are incorporated into the fixed expansion device. See Fig 5 for an example. The TADs give the appliance greater anchorage and can be very successful.

Surgically assisted expansion

Sosteotomy of the mid palatal suture is performed. The relative inelasticity of the palatal muco-periosteum limits the degree of expansion that may be achieved.



Figure 17. 3-screw 3-way appliance.



Figure 19. Twin screw sagittal appliance perfect for distalisation. The screws are adjusted one side each week and utilises alternative cross arch anchorage.

Slow maxillary expansion

Slow maxillary expansion appliances generally fall into two Scategories - fixed and removable. Examples of fixed appliances include the quad helix, the W arch and the NiTi expander. These appliances are attached to bands, adjusted prior to insertion and work over a long period of time, applying gentle forces to the teeth and alveolus. There is limited, if any, skeletal changes with these appliances.

Removable appliances use various spring and screw mechanisms embedded into an acrylic baseplate to separate the appliance slowly. This intern places forces on the teeth palate and alveolus. Usually this sort of expansion is done with adjustments of 0.25 mm per week, trying to attain approximately 1mm per month. Traditionally, these appliances use metal clasps to hold the appliance in place and can incorporate additional springs, labial bows, hooks for elastics, etc making them truly multifunctional appliances. Sometimes these are referred to as a Schwartz appliance. Removable appliances can incorporate screws for transverse or sagittal development or a combination of both. Also single tooth screws are available. It's always wise to choose good quality screws such as Dentaurum as they are precision-manufactured and will always be reliable.



Figure 18. Twin Block using 2 Transverse screws. Will not wind back!

Winding back issues with maxillary expansion appliances

It is unlikely quality expansion screw mechanisms spontaneously wind back in response to the compression in the oral cavity. However, it is important to note that screw mechanisms are for "one use only" and if this is not adhered to, they can become loose.

This is most likely to occur if the patient is not compliant and winds the mechanism back to fit the appliance after a period of non-wear. If this becomes habitual, the constant winding forward, winding back will usually end up damaging the screw and making it loose. It is then unlikely any expansion will occur. Usually you find this situation at a checkup and of course, instantly the appliance is blamed, even though it's unlikely the appliance is at fault.

To be sure removable acrylic appliances don't wind back, you can use two screws and these are adjusted alternate weeks, if this is done, the screws create an alternate locking mechanism and it's almost impossible to spontaneously wind back in the mouth.

For rapid maxillary appliances, use of the patented Dentaurum HYRAX Click mechanism will negate any winding back as it has a special mechanism that will not allow the winding back unless the adjustment tool is used. This is an ingenious mechanism and has a 100% success rate, definitely making it the only choice these days.

About the author

Terence Whitty is a well-known dental technology key opinion leader and lectures nationally and internationally on a variety of dental technology and material science subjects. He is the founder and owner of Fabdent, a busy dental laboratory in Sydney specialising in high tech manufacturing. Using the latest advances in intra- and extra-oral scanning, CAD/CAM, milling, grinding and 3D printing, most specialties are covered including ortho, fixed and removable prosthetics, computerised implant planning and guidance, TMD, sleep appliances and paediatrics. Terence can be contacted on 1300-878-336 or visit www.fabdent.com.au.