How to avoid extractions when treating malocclusions using MRC’s Bent Wire System and Trainer System for arch development

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Re German O. Ramirez-Yañez, DDS, PhD, and Chris Farrell, DDS

Abstract

Maxillary and mandibular expansion has been proposed since Edward Angle to avoid extractions, which may produce improved stability because of simultaneous habitual correction in selected cases. Two cases treated with the Trainer Bent Wire System® (BWS®) are described and the advantage of this method of treatment is discussed.

Introduction

Expansion of the jaws has been increasingly performed in orthodontics to achieve better occlusal and maxillary relationship and, in doing so, improving orofunctions. Maxillary and mandibular expansion has been proposed since Edward Angle to avoid extractions (Dewel, 1964). This paper presents a novel method to produce dental arch development in the maxilla and the arch form improves because of the lingual arch, which produces better results when it is performed in the early permanent dentition (Sari, 2005). Although this statement appears to be supported by other studies (Chung, Hounes, 2005; Sulpian, 1995), maxillary expansion may also be successfully done in older adolescents and adults (Stuart, 2005; Iseri, 2004; Lima, 2000). In the maxilla, rapid and semi-rapid expansion produce an increase of the lower nasal and maxillary base widths, with the maxilla moving forward and downward (Chung, 2004; Sari, 2005; Iseri, 2004). These changes in the maxilla produced by the expansion are accompanied by a spontaneous mandibular response, which increases the dental arch perimeter (Lima, 2004; McNamara, 2005) and rotates the mandible posteriorly (Sari, 2005; Chung, 2004). Mandibular displacement is associated with an increase in facial height (Sari, 2005; Chung, 2004).

Net gain in the arch perimeter may be calculated accordingly with the expansion performed. Motoyoshi and co-workers reported that 1 mm increase in arch width results in an increase in arch perimeter of 0.57 mm (Motoyoshi, 2002). Akkaya and collaborators determined that arch perimeter gain through expansion could be predicted as 0.4 mm per 1 mm of the posterior expansion when treatment with normal arch form produced higher amounts of expansion, and 0.003 times the amount of posterior expansion when treatment is performed with semi-rapid maxillary expansion (Akkaya, 1998). This is also supported by Adkins and co-workers, who determined that arch perimeter may increase 0.7 times the expansion produced at the premolars.

An expected relapse in the amount of expansion has been reported by some authors (Hune, 1990; Hounes, 2005), which appears to be the result of that pressure delivered by the cheeks on the maxillary arch and the resistance to deformation of maxillary sutures and surrounding tissues to maxillary expansion. Nevertheless, maxillary and mandibular expansion rises up as one of the important phases of orthodontic treatment, producing arch perimeter increase, and thus, avoiding extraction of teeth. Increasing numbers of clinicians are using passive self-ligating brackets. As they have become popular, few additional forces are needed to maintain arch expansion when treatment tends to use only upper and lower multi-banded techniques using passive self-ligating brackets have been reported that 1 mm increase in arch perimeter of 0.37 mm (Motoyoshi, 2002). Akkaya and co-workers, who determined that arch perimeter gain through expansion could be predicted as 0.4 mm per 1 mm of the posterior expansion when treatment with normal arch form produced higher amounts of expansion, and 0.003 times the amount of posterior expansion when treatment is performed with semi-rapid maxillary expansion (Akkaya, 1998). This is also supported by Adkins and co-workers, who determined that arch perimeter may increase 0.7 times the expansion produced at the premolars.

The BWS Orthodontic System

The BWS Orthodontic System discussed in this article is composed of two different appliances: the Trainer® and the BWS®. These two appliances combined may simultaneously produce arch development and treat poor myofunctional habits. The Trainer, a pre-fabricated functional appliance, has amply demonstrated an ability to re-locate the mandible (Esmore, 2004) to correct improper forces produced by the muscles of the cheeks and lips (Quattrelli, Ramirez-Yañez, 2005a) and to change the dimensions of the dental arches (Ramirez-Yañez, 2005b). Further research (Iagiari 2011) showed that treatment using the Trainer produced a positive influence on the maxillary and peri-oral musculature. However, in those cases where more maxillary and mandibular expansion is required to avoid teeth extractions, the Trainer combined with the BWS produces higher amounts of expansion and, therefore, a higher increase in arch form. It is also proposed that by utilizing the Trainer in conjunction with the arch expansion, the force of the tongue activates further alveolar change in the maxilla, which may not achieve because of the fluke of the appliance being located in the palate where the tongue should naturally position itself (Fig. 1). Additionally, the BWS is not made of acrylic, nor does it occupy the palate. It allows the tongue to position correctly and the patient to speak normally.

The BWS is also suitable for use in the lower arch. Typical treatment tends to use only upper expansion for three to four months, after which time the wire component of the BWS is removed (the bands are kept for later use of the BWS). The i-2 Trainer (with the inner cage that produces arch expansion) is then used to maintain the initial arch expansion gained using the BWS. Lower alignment is re-evaluated throughout this stage of i-2 Trainer (Fig. 2).

The BWS Orthodontic System on arch development.

Case No. 1

This 18-year-old female patient...
consulted because of a crowded dentition involving unusually minimally spaced central incisors with a midline shift of 50 mm and a lost "c" space on the lower left side. The parents requested that the treatment be non-extraction, although they had previously been advised that future orthodontic treatment might require this option (Fig. 6). This diagnosis was classified as Class I with normal overjet and overbite. No noticeable skeletal variation was found on cephalometric measurements and analysis of cast models reported a lack of arch development. This case was diagnosed as a Class I malocclusion with underdevelopment of both dental arches. Midline shift was primarily as a result of the lost lower "c" space. Soft-tissue analysis showed a mouth open posture and hyperactive peri-oral musculature. It was considered the myofunctional habits were a contributing factor to the malocclusion and, thus, a suitable case for the BWS and Trainer combination prior to fixed appliances once the permanent dentition was fully erupted.

The plan of treatment involved a first phase with a BWS for the upper arch combined with an i-2 Trainer. This would be followed by an expansion on care for increased flexibility and use with the BWS. The i-2 Trainer was used one hour daily overnight plus while sleeping. Monthly adjustment to the ac- tivation loops of the BWS were made in increments of 1-2 mm per month.

This treatment was continued for four months, after which time the upper BWS was removed and i-2 Trainer was used to maintain the expansion achieved by the BWS. The i-2 Trainer also encouraged the tongue thrusting to maintain the maxillary expansion without retainers. At this stage, the lower arch form and dental alignment was assessed and considered improvement. It was noted the space for the lower left permanent canine had increased — an effect thought to be not new to orthodontics. Maxill- ary expansion tends to also improve the lower arch length and assists the orthodontist in achieving the desired extraction outcome with more stable results because of simultaneous correction of arch form and space. No relapse was noted for the lower anterior dentition, which was expected to have a better prognosis since the permanent canine was erupted.

This case was treated in a 2-year period, required minimal chair side time and a difficult ex- traction case was converted to a simple, non-extraction case.

Case No. 2

This 12-year-old female patient consulted because of very un- derdeveloped maxillary arch form and ectopic erupting canines (Fig. 8). This is far from an ideal age for attempting non-extraction treatment. However, the parent insisted that the case was attempted non-extraction. The lower anterior teeth were also considerably crowded, and it would regularly be justified in extracting the first four premolars and going into upper and lower straight wire fixed appliances.

It could be argued that treating non-extraction will prolong the treatment and certainly incur greater expense on the parent. However, there is a growing de- mands placed on patients who have had orthodontics in the past to avoid this approach for their children. Therefore, the BWS Orthodontic System can be a beneficial technique that the orthodontist can use in these ex- ceptional cases.

Treatment was similar to case 1. An upper BWS was fitted and combined with the use of the i-2 Trainer for the first four months, after which time the BWS was removed, leaving the nodal bands in place. The i-2 Trainer was introduced at this stage for a further three months to maintain the expansion prior to a second phase of treatment using the BWS and i-2 Trainer for three months (as mentioned earlier this was non-extraction treatment). This allows the dentition to "catch up" and prevents excessive tooth mobility. It is thought that much of the expansion achieved by this system is dento- alveolar rather than sutureal, as with a rapid maxillary expander and other acrylic expanders. Also, there is more development of the lower arch form and arch length, which is an effect previously found in the research on the Trainer, a pre-fabricated functional appliance, and the myobrace regular™ from MRC, an exceptional cases.

The occlusion was classified as a class I malocclusion with a crowded, and it would regularly be justified in extracting the first four premolars and going into upper and lower straight wire fixed appliances. The difficulty in cases like this, requiring large amounts of ex- pansion to achieve a non-ex- traction result, is a tendency to create an open bite. Although this occurs to some extent, the BWS Orthodontic System does not open the bite as much as more conventional techniques because the tongue position is favorably altered by use of the Trainer. This conjecture may require further investigation to fully determine.

Once again, spontaneous align- ment of the lower anterior de- ntion has occurred without the need for extractions. The lower arch. This ef- fect is not just restricted to these two cases but is a routine obser- vation of the BWS Orthodontic System. This case also illustrates the stability achieved in the lower en- der dentition as no retainers were used apart from night use of the Trainer.

Although this patient is not at the ideal age, the pictures show that it was possible to obtain space for all permanent canines, without extractions and with good stability.

The bite opening is minimal and tends to decrease with further dental development. Although this case was finalized with the Myobrace Regular™ from MRC, the authors think the BWS would have possibly delivered quicker results following the BWS Orthodontic System. The assistance of correcting the forces delivered by the muscles of the cheek (masseter) and lips (oralis lateralis) is a key point to be noted in the treatment of expansion systems. After two years of treatment and observation, along with the use of the i-2 Trainer for 12 months after treatment, the BWS produced enough upper arch develop- ment to not only accommodate the erupting canines, but also achieve lower anterior align- ment with minimal intervention and minimal retention.

Conclusions

Maxillary and mandibular ex- pansion has been shown to be an excellent alternative to increase the arch perimeter and, thus, to prevent the need for extractions to properly align teeth. This paper has presented two cases treated using the BWS Orthodontic Sys- tem, which involves the combi- nation of two appliance systems: the Trainer, a pre-fabricated functional appliance, and the BWS. Both appliances, Trainer and BWS, have to be used in order to get the results reported in this paper. The BWS Orthodontic System showed in these two cases and in many cases treated by the authors is an excellent means to produce arch development in both upper and lower dental arches in a short time.

The effect of the BWS Orthodontic System on arch development does not change the inter-maxil- lary relationship when a Class I occlusion exists at the beginning of treatment. However, when a Class II maloc- clusion associated to a crowded dentition is present the BWS Orthodontic System produces arch development and, at the same time, the mandibular relocation.
effect is produced by the Trainer (Usaman, 2004; Ramirez-Yaizis, 2005a; Quadrelli, 2002), which treats the distal position of the mandible. Additionally, the BWS Orthodontic System has shown to improve the overjet and overbite but to maintain them when they are correct at the beginning of treatment. This system treats muscular dysfunctions that may be the cause of crowding and malocclusion and may cause relapse after treatment is finished. Thus, the BWS Orthodontic System may be proposed as an excellent alternative form of treatment in those cases where arch development is required to align teeth, patients want to minimize or even avoid brackets and extractions, the mandible needs to be relocated, soft tissue dysfunction is present and treatment needs to be performed in a reasonable period of time.

References

About the Authors

Chris Farrell, BDS, graduated from Sydney University in 1971 with a comprehensive knowledge of traditional orthodontics using the Begg technique. Through clinical experience, he took an interest in TMJ/TMD disorder and, after further research, Farrell discovered that the etiology of malocclusion and TMD was myofunctional, contradicting the current views of his profession. Farrell founded Myofunctional Research Co. (MRC) in 1989 and has become the leading designer of intra-oral appliances for orthodontics, TMD and sports mouthguards.

German O. Ramirez-Tafera, DDS, PhD, is a dentist from Colombia (South America) with more than 20 years of experience in guiding craniofacial growth and development. He is a specialist in pediatric dentistry (Mexico) and functional maxillofacial orthopedics (Mexico and Brazil), and is trained in orthodontics (Mexico). Ramirez has a master’s in oral biology and a PhD in dental sciences (Australia). He has published more than 20 articles about early orthodontic treatment and craniofacial biology in peer-reviewed international journals.