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Clinical Section

Rapid Palatal Expansion in Treatment of Class II Malocclusions

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Abstract. *A technique which combines the use of rapid maxillary expansion and fixed appliance in growing patients, is presented. The treatment in three patients with Class II division 1 malocclusion and different skeletal patterns is described, and relative advantages highlighted.*

Index words: Rapid Palatal Expansion, Class II Malocclusion, Transverse Discrepancy.

Introduction

In clinical observations of patients with Class II division 1 malocclusions there is often a transverse discrepancy between the dental arches, generally due to a reduction in maxillary width. Staley *et al.* (1985) has emphasized the importance of evaluating the transverse discrepancy in Class II subjects. He also emphasized the transverse maxillary inadequacy and posterior crossbite tendency in an adult Class II sample when compared with an adult Class I sample. Therefore, according to the results of Tollaro *et al.* (1996), the presence of posterior transverse interarch discrepancy (PTID), measured as the difference between the maxillary and mandibular intermolar widths, could be considered as a possible functional cause of distocclusion. In the same paper, Tollaro found that, the differences between molar widths, in a group of adults with a normal occlusion was small and positive. When the teeth were in centric occlusion, the molar width differences were significant in male and female II patients even with no visible molar cross-bite.

A possible approach to the treatment of Class II malocclusion in growing patients is based on resolution of transverse discrepancy in the first phase of treatment. The transverse co-ordination can be accomplished by different modalities. Several authors have suggested that maxillary widening can also be produced by the cervical headgear without any other appliances if the inner bow of the headgear is widened (Ricketts R. M., 1960; Bench *et al.*, 1978; Ricketts R. M., *et al.*, 1979; Staley *et al.*, 1985).

However, the quad-helix and rapid palatal expander are more frequently used for inter-arch discrepancy correction (Haas, 1970). Rapid maxillary expansion (RPE) has been used for more than 100 years to correct maxillary skeletal base constriction. The use of the rapid palatal expander for the correction of maxillary arch constriction in the treatment of Class II malocclusions has rarely been suggested (Kirjavainen *et al.*, 1997). Warren (1993) describes and illustrates a method of treating Class II patients with a headgear-expander appliance.

This article presents the integration of RPE for transverse co-ordination in Class II malocclusion.

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Clinical management

The primary treatment goal was to correct the posterior transverse discrepancy between the dental arches. The following treatment modulations were necessary to provide therapeutic guidance in the approach to Class II connection.

All three patients treated were classified as Class II division 1 malocclusions. They presented with bilateral Class II molar relationship in centric occlusion, bilateral Class II deciduous/permanent canine relationship, protrusion of maxillary incisors, and absence of posterior cross-bite.

The first step in all patients was palatal expansion. All the appliances described in this report have the same type of expansion screw (Dentaurum Inc., Pforzheim, Germany) soldered on the upper first molars only. The expander was activated 1·5 mm (six turns) in the first day and 0·50 mm each successive day by a quarter turn in the morning and a quarter turn in the evening. The patients were seen weekly and during each adjustment, the screw was extended 1–1·5 mm more (4–6 turns). The desired expansion was achieved when the maxillary arch was overcorrected by approximately 2–3 mm and the screw was opened at least 11–14 mm. The screw was then fixed and the appliances was left *in situ* for 3 months for retention. When the expander was removed, a fixed pre-adjusted appliance was inserted.

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Initial alignment in both arches was accomplished with light steel or Ni–Ti arch wires on a pre-adjusted edgewise appliance (bi-dimensional technique). The saggital correction was obtained by using Class II elastics (6 oz/3/16) on $0{\cdot}18 \times 0{\cdot}22$-inch rectangular arches, while the patients wore a lip bumper in the lower arch for 14 hours daily. A segmental torquing $0{\cdot}018 \times 0{\cdot}022$-inch arch was used in the lower arch with labial root torque. Depending upon the dentoskeletal characteristics of the patients, the vertical control was considered as a key factor in order to plan the orthodontic mechanics. When vertical problems are present, intrusive forces need to be applied to posterior teeth to prevent their elongation during treatment. To achieve this purpose high-pull or posterior bite-block were placed in hyperdivergent subjects.

Case report 1

A 9-year-old female presented with a convex soft-tissue profile, dolichofacial growth with retrognathic posteriorly inclined mandible and lip incompetence at rest (Figures 1–3). The patient had a Class II division I malocclusion with an extreme overjet. She was in mixed dentition, and presented with a narrow upper arch. The upper anterior teeth were protruded and over-erupted. The lower anterior teeth were retroclined and slightly crowded (Figures 4–8). Cephalometric analysis revealed a convex skeletal profile, she had a 7-degree ANB, a high mandibular plane angle (34 degrees), the maxillary incisors were at 7 mm and 29 degrees to NA, and the mandibular incisors were at 2 mm and 15 degrees to NB (Figures 9–11, Table 1).

Fig. 1

Fig. 2

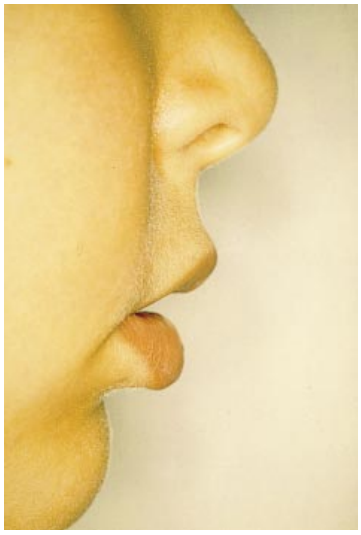

Fig. 3

Fig. 4

Fig. 5

Fig. 6

Fig. 7

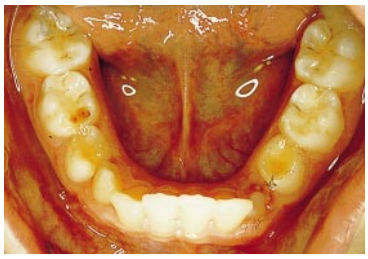

Fig. 8

FIGS. 1–8 Case 1: pretreatment facial and intra-oral photographs.

Fig. 9

Fig. 10

Fig. 11

FIGS. 9–11 Case 1: pretreatment records and cephalometric tracing.

Fig. 12

Fig. 13

Fig. 14

Fig. 15

FIGS. 12–15 Case 1: transverse expansion produced with RPE after 1 week.

TABLE 1 Case 1: cephalometric summary

Measurement	Initial	Final	Difference
SNA°	83°	81°	−2°
SNB°	77°	78°	+1°
ANB°	6°	3°	−3°
Pg to NB	0 mm	2 mm	+2 mm
Go/Gn to Sn	34°	33°	−1°
1 to NA	7 mm	2 mm	−5 mm
1 to NA°	26°	22°	−4°
1 to NB	2 mm	4 mm	+2 mm
1 to NB°	15°	23°	+8°
1 to 1	130°	133°	+3°
N–ANS/N–Me	44·2	46·2	+2
ANS-Me/N-Me	55·8	53·8	−2
NLA°			
NasoLabial Angle	79°	87°	+8°

Treatment progress

The treatment objective was to achieve a symmetrical Class I occlusion without extractions and to improve facial appearance. The first phase of the treatment involving transverse expansion of the upper arch was produced with RPE. The expansion screw was soldered on the upper first molars and was activated for 1 week until a sufficient overcorrection was gained (2–3 mm). Then the screw was fixed and left *in situ* for about 90 days for retention (Figures 12–15). The alignment of the upper arch was completed with a continuous stainless steel archwire (0·016-inch), while a segmental torquing 0·018 × 0·022-inch archwire was used in the lower arch, with labial root torque placed at incisors and molar teeth. Class II elastics were used 14 hours daily (Figures 16–20). The patient was seen regularly every 4 weeks for 6 months. Minor adjustment of occlusion

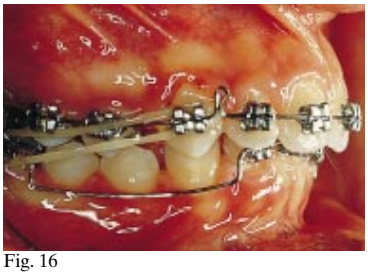
Fig. 16


Fig. 17

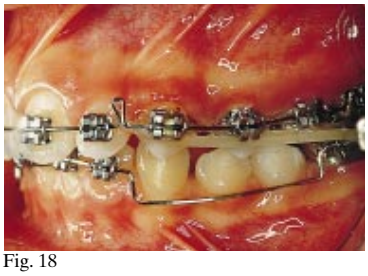
Fig. 18


Fig. 19


Fig. 20

FIGS. 16–20 Case 1: bonded maxillary arch with Class II elastics and a segmental torquing 0·018 × 0·022-inch wire in the lower arch.

TABLE 2 Case 2: Cephalometric summary

Measurement	Initial	Final	Difference
SNA°	89°	84°	−5°
SNB°	79°	80°	+1°
ANB°	10°	4°	−6°
Pg to NB	0 mm	2 mm	+2 mm
Go/Gn to Sn	38°	33°	−5°
1 to NA	2 mm	3 mm	+1 mm
1 to NA°	17°	22°	+5°
1 to NB	6 mm	5 mm	−1 mm
1 to NB°	26°	27°	+1 mm
1 to 1	125°	127°	+2°
N–ANS/N–Me	41·3	41·6	+0·3
ANS–Me/N–Me	58·7	58·4	−0·3
NLA°			
NasoLabial Angle	61°	72°	+11°

TABLE 3 Case 3: cephalometric summary

Measurement	Initial	Final	Difference
SNA°	79°	79°	0
SNB°	73°	75°	+2°
ANB°	6°	4°	−2°
Pg to NB	0 mm	2 mm	+2 mm
Go/Gn to Sn	42°	40°	−2°
1 to NA	6 mm	2 mm	−4 mm
1 to NA°	30°	25°	−5°
1 to NB	3 mm	6 mm	+3 mm
1 to NB°	20°	30°	+10°
1 to 1	122°	124°	+2
N–ANS/N–Me	40	42·3	+2·3
ANS–Me/N–Me	60	57·7	−2·3
NLA°			
Nasolabial angle	72°	90°	+18°

was performed with continuous archwires during the following 3 months.

Results

The treatment time was 24 months; a full Class I cuspid and molar relationship was achieved (Figures 24–28). There was little change in the drape of the soft tissues and lip competence (Figures 21–23).

Cephalometric analysis shows an improvement in mandibular plane angle (Go–Gn:33 degrees), in pogonion position (pog to N: 1 mm), in maxillary incisor angulation (to NA: 20 degrees), in lower incisor angulation (to NB: 23 degrees), and in interincisal angle (133 degrees) (Figures 29–32, Table 1).

Case report 2

The second patient was a 10-year-old female, presenting with a convex profile, protruding upper incisors and lip incompetence (Figures 33–35). She had a Class II malocclusion in the mixed dentition, with an increased overjet and overbite, and crowded maxillary and mandibular incisors (Figures 36–40). Cephalometric analysis revealed a convex skeletal profile with an increased mandibular plane, severe Class II malocclusion and a mandibular retrusion (Figures 41–43, Table 2).

Treatment progress

Treatment objectives were:

(1) to control the occlusal plane;
(2) to promote counterclockwise rotation of the mandible with intrusion of the posterior teeth;
(3) to obtain Class I occlusion.

The first phase was based on expansion of the upper arch with RPE. After over-correction, the screw was fixed and a headgear (high-pull), was prescribed to be worn 12–16 hours per day. The headgear controlled the vertical dimension by intrusion of the upper first molar and promoted

Fig. 21

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Fig. 26

Fig. 27

Fig. 28

FIGS. 21–28 Case 1: post-treatment facial and intra-oral photographs, after 24 months.

Fig. 29

Fig. 30

Fig. 31

Fig. 32

FIGS. 29–32 Case 1: post-treatment records, cephalometric tracing and superimposition.

Fig. 33

Fig. 34

Fig. 35

Fig. 36

Fig. 37

Fig. 38

Fig. 39

Fig. 40

FIGS. 33–40 Case 2: pretreatment facial and intra-oral photographs.

Fig. 41

Fig. 42

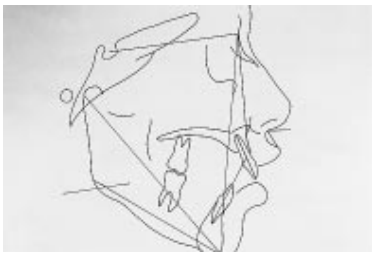

Fig. 43

FIGS. 41–43 Case 2: pretreatment records and cephalometric tracing.

autorotation of the mandible to prevent an increase of the lower facial height (figures 44–48). A lower lingual-arch was placed to maintain lee-way space. She wore a 'bite-block' 16 hours per day to obtain the intrusion of lower first molars. After 12 months, the upper and lower incisors were bonded and aligned with archwires progressing to segmental 0·018 × 0·022-inch torquing wires. Class II elastics from the lower first molar to the upper arch were used for 3 months to promote settling (Figures 49–56).

Final alignment was performed with full fixed appliances and Ni–Ti archwire.

Results

Active appliances were removed after a total of 24 months of treatment. A good occlusion was achieved with a Class I canine and molar relationship (Figures 57–60). Comparison of pre- and post-treatment cephalometric tracings showed little change with vertical height reduction (33 degrees) Figures 65–68, Table 2. Because of proclination of the incisors during the treatment, the intercisal angle improved from 125 to 127 degrees.

Fig. 44

Fig. 45

Fig. 46

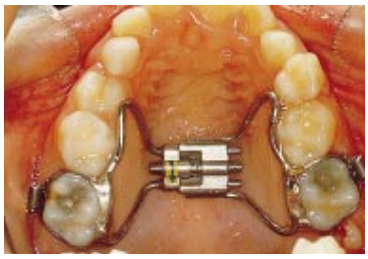

Fig. 47

Fig. 48

FIGS. 44–48 Case 2: Phase I treatment—transverse expansion and headgear in place.

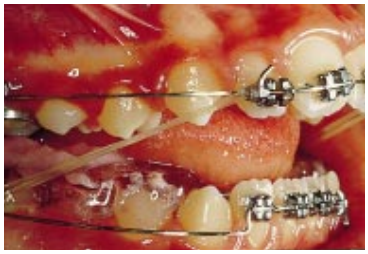

Fig. 49

Fig. 50

Fig. 51

FIGS. 49–51 Case 2: Phase II treatment—Class II elastics on segmental 0·018 × 0·022-inch torquing wires and bite-block in place.

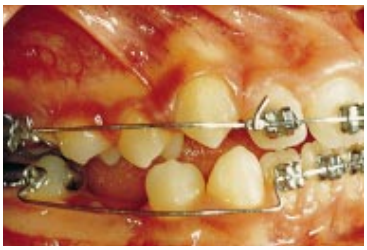
Fig. 52


Fig. 53

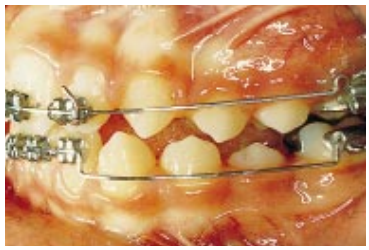
Fig. 54


Fig. 55


Fig. 56

FIGS. 52–56 Case 2: after 15 months, sagittal correction was achieved.


Fig. 57

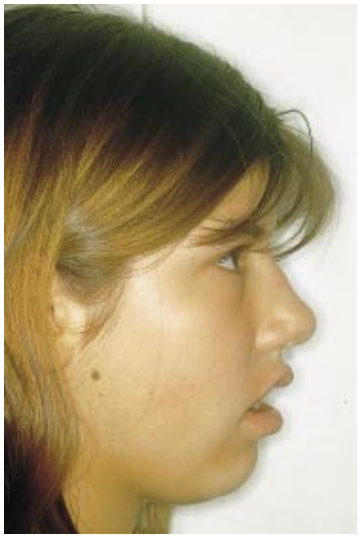
Fig. 58


Fig. 59


Fig. 60


Fig. 61


Fig. 62


Fig. 63


Fig. 64

FIGS. 57–64 Case 2: post-treatment facial and intra-oral photographs.

Fig. 65

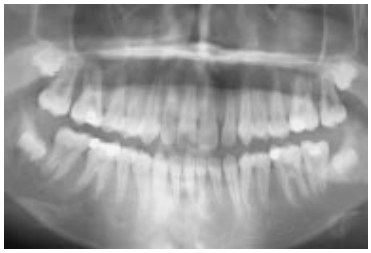

Fig. 66

Fig. 67

Fig. 68

FIGS. 65–68 Case 2: post-treatment records, cephalometric tracing and superimposition.

Fig. 69

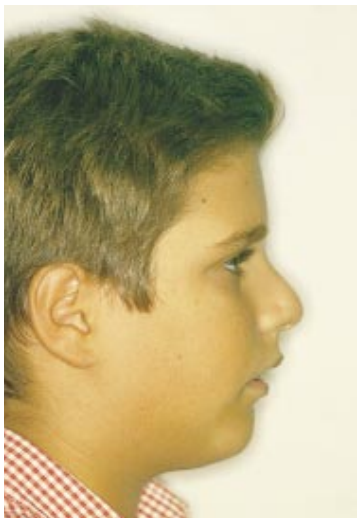

Fig. 70

Fig. 71

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Fig. 74

Fig. 75

Fig. 76

FIGS. 69–76 Case 3: pretreatment facial and intra-oral photographs.

Case report 3

A 10-year-old boy presented for orthodontic treatment (Figures 69–76). There were no remarkable features in his medical history, although a mouth breathing habit was reported by the parents. He presented with a Class II skeletal malocclusion characterized by mandibular retrusion, anterior open bite, severe overjet, and maxillary and mandibular arch length discrepancies, accompanied by a deficient mandible and high mandibular plane angle with lip incompetence (Figures 69–71). The initial panoramic radiographs revealed that all permanent teeth were present. Dentally, the patient exhibited a Class II division I malocclusion with the overjet was measured at 10 mm. A constriction of the maxillary arch resulted in a V-shaped maxillary arch form, but no posterior crossbite was present. The lower arch exhibited a late mixed dentition and leeway-space was present (Figure 76). The naso-labial angle was upright. The lips and chin were retruded according to the skeletal pattern and an incompetence of the lips was evident (Figures 77–79, Table 3).


Fig. 77


Fig. 78

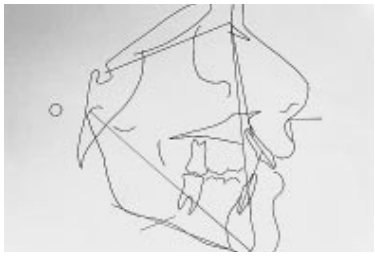
Fig. 79

FIGS. 77–79 Case 3: pretreatment records and cephalometric tracing.


Fig. 80


Fig. 81


Fig. 82


Fig. 83


Fig. 84

FIGS. 80–84 Case 3: Phase I treatment—RPE and bite-block in place.


Fig. 85


Fig. 86

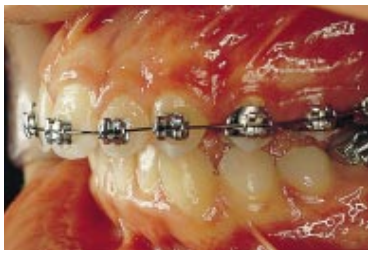
Fig. 87

FIGS. 85–87 Case 3: bonded maxillary arch after expansion.

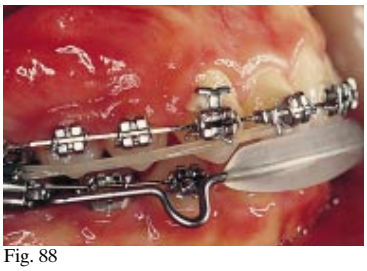
Fig. 88

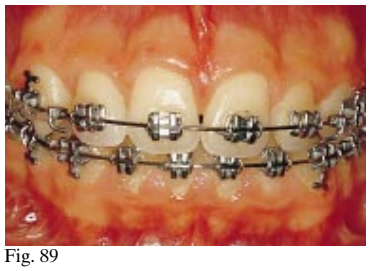
Fig. 89

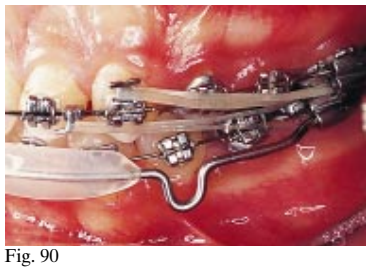
Fig. 90


Fig. 91


Fig. 92

FIGS. 88–92 Case 3: Class II mechanics with lip-bumper in the lower arch for anchorage.


Fig. 93


Fig. 94


Fig. 95


Fig. 96


Fig. 97


Fig. 98


Fig. 99


Fig. 100

FIGS. 93–100 Case 3: post-treatment facial and intra-oral photographs, after 29 months of active treatment.

Fig. 101

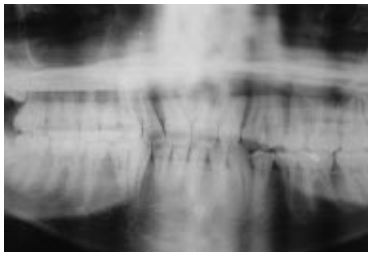

Fig. 102

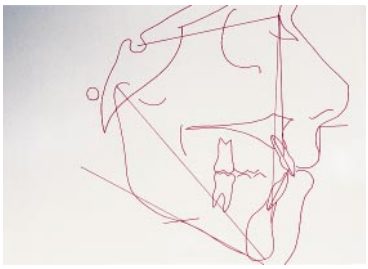

Fig. 103

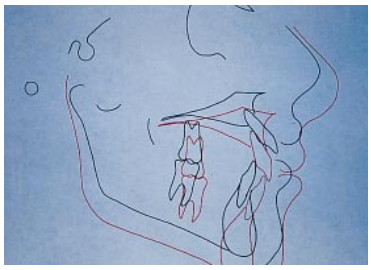

Fig. 104

FIGS. 101–104 Case 3: post-treatment records, cephalometric tracing and superimposition.

Treatment progress

A rapid palatal expander was used for 12 weeks to widen the maxilla and to obtain a transverse inter-arch co-ordination. A mandibular 'bite-block', worn for 9 months, was placed on the posterior teeth to guarantee vertical control during the expansion (Figures 80–84). After the RPE was removed, initial levelling in both arches was accomplished with 0·014-inch Ni–Ti archwires on a pre-adjusted edgewire appliance (bi-dimensional technique; Figures 85–87). The class correction was obtained by using Class II elastics (6oz/3/16) on 0·18 × 0·22-inch rectangular arches, while the patient wore a lip bumper in the lower arch for 14 hours daily (Figures 88–92). The patient's co-operation was excellent and the treatment was completed in 29 months (Figures 93–100). Retention was accomplished with maxillary and mandibular acrylic retainers.

Results

The patient grew considerably during the 29 months between the serial cephalograms (Figure 104).

A good result was achieved with a significant improvement in occlusal and skeletal relationships. After the treatment the facial aesthetics was well balanced and the lips were nicely related to each other (Figures 93–95). A normal molar and canine Class I relationship was obtained with a reduction of overjet from 10 to 1·mm, and the overbite was corrected to normal standards.

A significant increase in both the maxillary and mandibular arch widths, and a change in arch shape were observed (Figures 99–100). The overall vertical dimension remained relatively stable, but a small change was obtained on the lower facial height as observed by N–ANS–Me measurement. The maxillary incisors were uprighted to 2 mm to NA, while the lower incisors proclinical up to the NB line (Table 3).

References

Bench, R. W., Gugino, C. F., Hilgers, J. J., and Schulhof, R. J. (1978)
Bioprogressive therapy, part V,
Journal of Clinical Orthodontics, **12**, 48–692.

Haas, A. J. (1970)
Palatal expansion: just the beginning of dentofacial orthopedics,
American Journal of Orthodontics, **57**, 219–55.

Kirjavainen, M., Kirjavainen, T. and Haavikko, K. (1977)
Changes in dental arch dimensions by use of an orthopedic cervical headgear in Class II correction,
American Journal of Orthodontics and Dentofacial Orthopedics, **111**, 59–66.

Ricketts, R. M. (1960)
The influence of orthodontic treatment on facial growth and development,
Angle Orthodontist, **30**, 103–33.

Ricketts, R. M., Bench, R. W., Gugino, C. F., Hilgers, J. J. and Schulhof, R. J. (1979)
Bioprogressive therapy,
Rocky Mountain Orthodontics, Denver.

Staley, R. N., Stumtz, W. R. and Petersen, L. C. (1985)
A comparison of arch width in adults with normal occlusion and adults with Class II Division 1 malocclusion,
American Journal of Orthodontics, **88**, 163–169.

Tollaro, I., Baccetti, T., Franchi, L. and Tanasescu, C. D. (1996)
Role of posterior transverse interarch discrepancy in Class II, Division 1 malocclusion during the mixed dentition phase,
American Journal of Orthodontics and Dentofacial Orthopedics, **110**, 417–422.

Warren, D. W. (1993)
Rapid Class II correction with a Headgear-Expander,
Journal of Clinical Orthodontics, **27–9**, 503–507.