

ARCH DEVELOPMENT WITH TRANS-FORCE LINGUAL APPLIANCES

Trans-Force lingual appliances are designed to correct arch form in patients with contracted dental arches. Interceptive treatment with this new series of pre-activated lingual appliances offers new possibilities for arch development, in combination with fixed appliances. Palatal and lingual appliances insert in horizontal lingual sheaths in molar bands. No activation is required after the appliance is fitted, and this principle is extended to a series of appliances for sagittal and transverse arch development. Both sagittal and transverse appliances have additional components to achieve 3-way expansion where this is indicated. The invisible lingual appliances may be used in correction of all classes of malocclusion at any stage of development, from mixed dentition through permanent dentition, and this approach has wide indications in adult treatment. World J Orthod 2005;6:9–16.

Maxillary contraction is a common feature in all classes of malocclusion, and is frequently the primary etiologic factor, with secondary effects on the development of the mandible and the lower dental arch.

Consideration of the transverse dimension is important in relationship to the efficiency of orofacial functions. The airway may be restricted either in the anteroposterior or transverse dimensions. A contracted maxilla is of particular significance, in view of its relationship to constriction of the nasal passages, with direct implications for the airway and fundamental effects on general health. Patients with a restricted airway are subject to nasopharyngeal infection and allergies, and their general health may be adversely affected.^{1,2}

Successful treatment of these conditions is firmly related to early interceptive treatment and is often associated with tooth-size/arch-size discrepancies.³ In many respects, this is contrary to the present philosophy of a regimen for orthodontic practice based on treatment in the permanent dentition.

Based on histologic studies, the prognosis for treatment of labial segment

crowding is better in mixed dentition than in permanent dentition. Melsen⁴ carried out an investigation to determine the histologic effect of rapid expansion of the midpalatal suture in children of various ages. A true stimulation of sutural growth was found only in children who had not attained maximum pubertal growth.

Development of the maxilla to correct the arch form is frequently the first step in treatment to unlock the malocclusion. The maxilla may be contracted anteroposteriorly or transversely, and often in both dimensions, when three-way expansion is indicated. Anteroposterior contraction is characterized by retroclined incisors, as commonly found in Class I bimaxillary retrusion; Class II, Division 2 malocclusion; and Class III malocclusion.

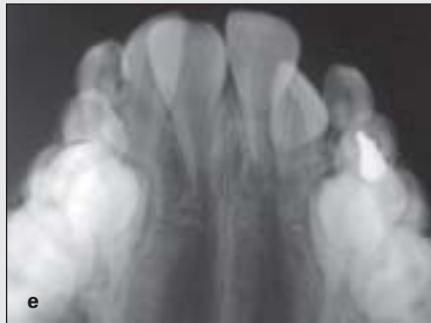
Even in some Class II, Division I malocclusions, the incisors must first be proclined or aligned to allow the mandible to be advanced fully into a Class I relationship. In functional therapy, arch development is often indicated as a preliminary step to mandibular advancement in cases exhibiting crowding and irregularity in the dental arches.

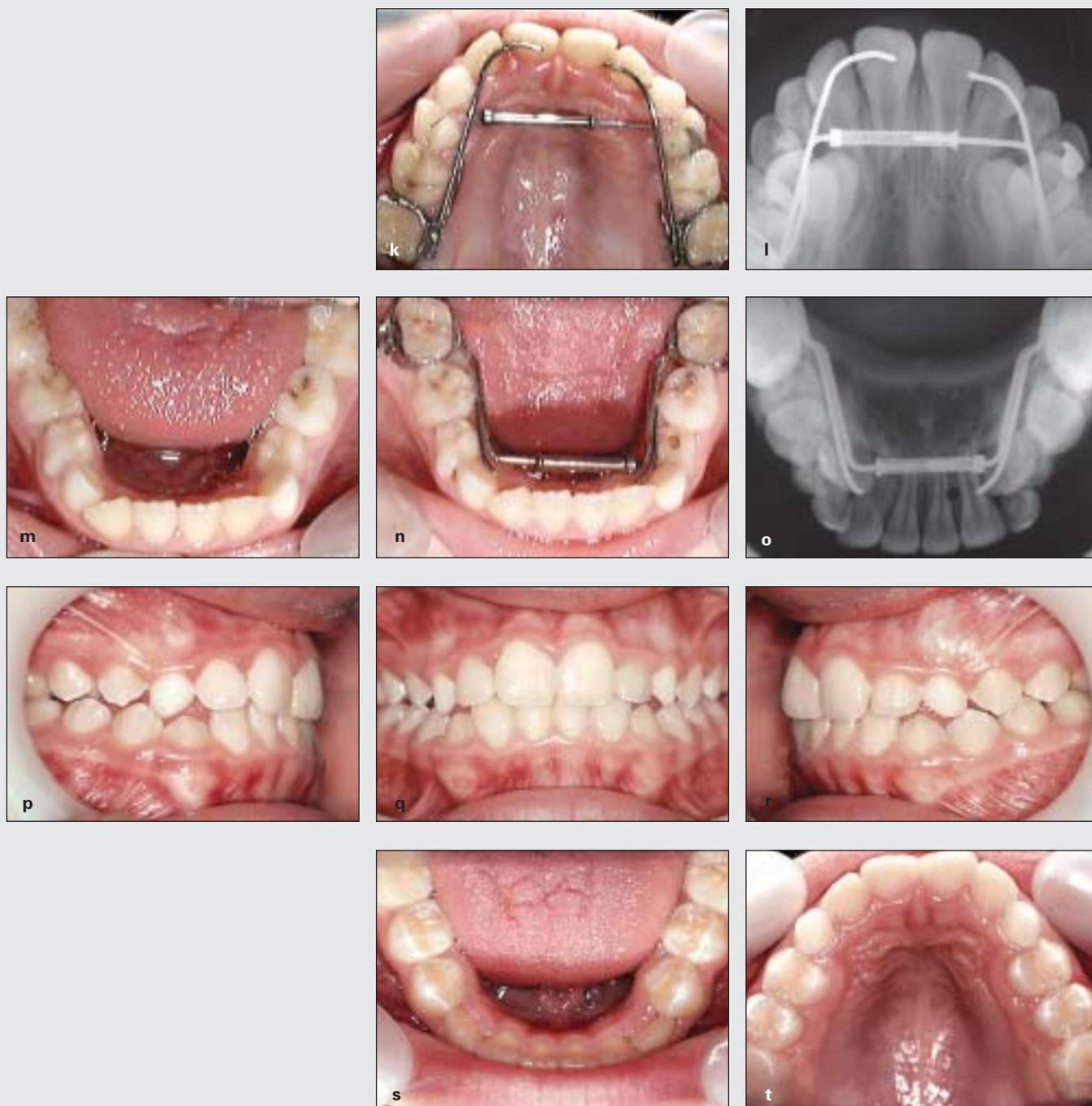
¹Private practice of orthodontics, Lundin Links, Scotland, United Kingdom.

CORRESPONDENCE

Dr William J. Clark
Lundin Lea
41 Leven Road
Lundin Links
Fife K68 6AJ, Scotland, UK
Fax: + 1333 320662

CASE 1: S.O. (Age 8 years)





Severe contraction of the maxillary arch in a Class III malocclusion resulted in severe crowding in the upper labial segment (**a to e**). A maxillary Trans-Force transverse appliance was the only appliance used to expand the maxilla and align the anterior teeth (**f,g**). The maxillary incisors were aligned after 8 months (**h to j**). At this stage, a mandibular transverse expander was fitted to initiate correction of lower arch width (**m to o**), while the maxillary appliance was used to retain the position. Palatal radiographs show progress after 8 months treatment (**k,l**). (**p to t**) The same patient at 1 year after appliance removal. Note that the premolars have erupted; the permanent canines still have to erupt. These images (p to t) courtesy Dr Charles Cole.

CASE 2: S.D.C. (Age 10 years 10 months)



A Class III malocclusion in mixed dentition with crowding and irregularity of the maxillary incisors (**a to c**) benefits from a short period of first-phase treatment with a sagittal Trans-Force appliance to correct the lingual occlusion (**d to i**). This is followed by the addition of brackets on the maxillary incisors to correct alignment. Interceptive treatment in mixed dentition simplifies completion of treatment when the remaining premolars and canines erupt.

The most natural method of arch development is by gentle pressure from the lingual aspect by the tongue. Lingual appliances for arch development simulate this natural process by applying gentle controlled forces to the lingual surfaces of the teeth, causing the teeth to migrate through the alveolar bone toward ideal arch-form position. Lingual arch development is well established as a method of correcting arch form in interceptive treatment as a first phase of treatment. Lingual appliances are used to eliminate crowding, gain arch length, and correct arch form prior to functional therapy or fixed appliance finishing. The lingual approach has excellent potential in adult treatment, especially as the appliances do not cover the palate and do not interfere with speech.

Trans-Force lingual appliances are readily integrated with conventional fixed appliances, as illustrated in the case reports presented in this article. Spring-driven forces, applied from the lingual aspect, are used to activate a preformed lingual arch to extend arch form by applying gentle pressure to the lingual surfaces of the teeth. Several designs are available specifically to control arch form in the sagittal and transverse dimensions. The appliances are pre-activated by a new expansion module incorporating a nickel-titanium coil spring enclosed in a tube to deliver a smooth, continuous force. The force is calibrated within a range of 100 to 200 g according to the requirements of arch development for sagittal or transverse activation.

TRANS-FORCE SAGITTAL APPLIANCE

The Trans-Force sagittal appliance is specifically designed for anteroposterior arch development in the maxilla or mandible, and is often indicated for simultaneous use in both arches. The appliance operates on the slide principle and may be used unilaterally or bilaterally to extend arch length. It incorporates bilateral expansion modules activated by a coil spring enclosed in a stainless steel tube. The distal portion of wire is recurved

and retained in a horizontal sheath on the molar band and extends mesially at the gingival level to engage the anterior segment of the lingual arch. The expansion module is activated to lengthen the arch by reciprocal forces on molars and incisors, and as the module expands it also achieves expansion of the intermolar width. The Trans-Force sagittal appliance is preactivated to achieve the amount of expansion required.

In its simplest form, the sagittal appliance acts reciprocally on incisors and molars to lengthen the dental arch. An additional transverse component to increase arch width in the premolar or canine region may be added by activating the recurved wire extending mesially from the molar tube. Custom modification for distal movement of molars is possible by cutting the anterior wire in the midline and bending the wires into the palate to be incorporated in a Nance button. Anterior anchorage may also be reinforced to achieve this objective during fixed appliance therapy.

Selecting the correct size of appliance

A clear template is provided to show a scale model of the sagittal appliance in both compressed and fully extended forms. The arch length may be measured on the models from the mesiolingual cusp of the first molar to the interdental papilla between the central incisors. By laying the template over a study cast, the size is selected to fit the individual case. The compressed outline of the appliance should fit inside the lingual outline of the teeth. The extended outline shows the amount of pre-activation in the appliance.

Appliance fitting

Separators must be placed, preferably within 3 days of the appointment, to fit the appliance. Molar bands are first selected and tried in the mouth. The appliance is then assembled and tried in the mouth prior to cementing. Minor adjustment may be required to adapt the

CASE 3: M.L. (Age 14 years)





A Class II Division 2 malocclusion with retroclined maxillary incisors and buccally displaced maxillary canines requires arch development prior to correction of the distal occlusion (**a to f**). Two months of treatment with a Trans-Force transverse appliance is sufficient to widen the arch form and advance the incisors to accommodate the canines (**g to j**). At this stage a maxillary fixed appliance is fitted to complete the orthodontic correction (**k to p**). Expanding the maxilla and proclining the incisors unlocks the malocclusion and facilitates forward translation of the mandible to improve the distal occlusion (**q**).

appliance to the individual patient. It is easier to attach the molar bands to the lingual wire and fit the appliance in one piece, rather than fitting the bands first then inserting the appliance in the lingual sheaths. In fitting the appliance, the springs are compressed to enable the lingual wire to fit behind the incisors.

Maintenance

After fitting the appliance, maintenance should be minimal and may be limited to routine visits at 6- to 8-week intervals to check progress. If mesial extensions are used to control arch width of the premolars or canines, slight adjustment may be necessary. This is normally done intraorally with triple beak or concavoconvex pliers.

At any stage during treatment, the appliance can be made passive by crimping the tube to compress it on the wire and prevent further activation.

Removal/retention

The appliance is normally left in situ after activation is complete to act as a retainer. Arch development may be followed by bonded fixed appliances for detailed finishing. The lingual appliance may be integrated with fixed appliances, or alternatively it may be removed by compressing the coil spring to remove the wire tags from the molar sheaths.

TRANS-FORCE TRANSVERSE EXPANDER

The Trans-Force lingual expander has an expansion module to increase the intercanine width, and may be used in maxillary or mandibular arches when expansion is required to accommodate crowding in the labial segments. This is an ideal replacement for the upper or lower Schwarz plate, by achieving a similar effect with a fixed/removable appliance, thus eliminating problems with the noncompliant patient. The Trans-Force

transverse expander is pre-activated to achieve the amount of expansion required. The transverse appliance is provided in two sizes for the maxillary arch and two sizes for the mandibular arch.

Appliance selection and fitting

The process of appliance selection and fitting is similar to that described for the sagittal appliance. A clear template is provided to show a scale model of the transverse appliance in both compressed and fully extended forms. The arch width before treatment is measured with the help of the millimeter scale on the template, measuring the intermolar width from the gingival margin of the molar and the intercanine width from the gingival margin of the canines. This distance may be compared with the compressed width and extended width of the transverse appliance to determine the correct size and the range of activation.

CONCLUSION

Arch development techniques are effective in the correction of all classes of malocclusion and may be indicated from early mixed dentition to adult treatment. Invisible Trans-Force lingual appliances are acceptable to patients who might otherwise be reluctant to wear orthodontic appliances.

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