

**CLINICAL
SECTION**

The Quatro appliance: a removable aligner with a changeable labial bow

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Lower labial segment irregularity is a feature that is presenting more frequently as greater emphasis is placed on aesthetics than ever before. The authors report on a removable appliance that is easy to construct and use and is designed to deal with mild labial tooth irregularity. In cases of crowding the aligner can be used in conjunction with inter-proximal stripping. The device incorporates a removable labial bow attached bilaterally to a sliding lock. This lock permits the addition of sectional archwires to the labial part of the appliance. The versatility of the aligner allows round and rectangular wires of different materials and dimensions to be placed with or without bends.

Key words: Anterior crowding, aligner, late incisor crowding, removable appliance

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Introduction

Late lower incisor irregularity has been considered a common problem for a long time.¹ With a greater emphasis now on aesthetics than ever before, adult patients have become increasingly aware of this condition.

In 1957, Barrer originally described an aligner or spring retainer, which was designed to reposition teeth to the desired position.² The aligner was based on the principles of simultaneously applying lingual and labial pressure and was used in combination with interdental stripping which Barrer referred to as keystoneing. It is small, discreet and incorporates an active acrylic covered lingual and labial bar. Due to its small size, concerns about possibly swallowing or inhaling the appliance have been raised and recommendations have been made to extend the appliance to utilize undercuts on the lower molar teeth to increase retention.³

Minor tooth movements have also been achieved with Essix appliances (Raintree Essix Inc., Metairie, LA, USA) which use clear aligners formed on plaster models of the teeth. The aligner is then modified with a divot which creates a force to push a tooth and a window which creates the space for the tooth to move into.⁴ Similarly, resilient lining material has been used to generate orthodontic force in thermoformed removable appliances.⁵ If however, significant alignment is required, it is necessary to remake these appliances.

This problem of multiple appliances is inherent in the Invisalign system (Align Technology Inc., Santa Clara, CA, USA).^{6,7} Unless only minor tooth movements are needed, there is a requirement to produce a sequence of aligners with the aid of computers and technologically advanced machinery.

Success with any removable appliance is highly dependent on patient co-operation. This can be less than optimum when there are problems of appliance retention or bulk of lingual acrylic encroaching on the tongue space. In this paper, the authors describe an appliance and technique that incorporates the principles of the Barrer aligner to allow easy and practical alignment of the lower incisors. The appliance is easy to construct, simple to adjust and comfortable to wear.

The Quatro appliance

This appliance has conventional Adams cribs on the mandibular first permanent molars and ball-ended clasps between the premolars.⁸ An ideal lingual arch contacting the lingual surface of the incisor teeth (1 mm stainless steel wire) is embedded in the lingual acrylic. Two buccal arms (1 mm stainless steel wire) are extended on to the labial aspect from the lingual acrylic passing between the canine and the first premolars. Each arm has a sliding lock (Figure 1) (Rocky Mountain Orthodontics Inc., Denver, CO, USA) which may be soldered or purchased pre-soldered on to the buccal

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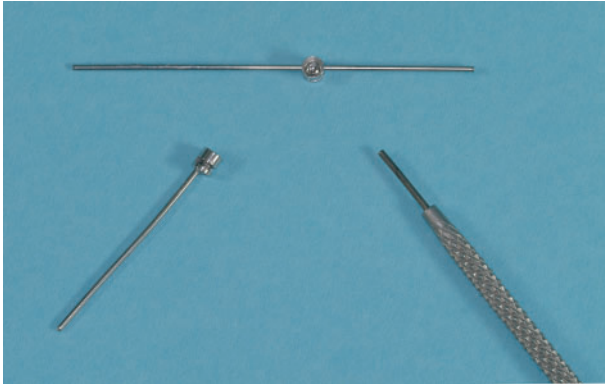


Figure 1 Individual lock which can be soldered to an arm (top), and a lock pre-soldered on an arm (bottom left) shown together with a hex wrench (bottom right)

arms (DB Orthodontics Ltd, Silsden, UK). The sliding locks allow placement of a labial bow extending from canine to canine (Figure 2). The labial bow can be round or rectangular and constructed from nickel titanium, stainless steel or any other material for which the operator has a preference. The appliance can either be constructed for the mandibular or maxillary arch (Figure 3).

The locks carry milled slots and small grub screws, which are tightened on the sectional archwires using a hex wrench. The locks are placed so that as the grub screw is tightened, it pulls the archwire slightly tighter in a distal direction. The labial bow can be selectively adjusted with first order bends and minor tooth movements may be achieved in conjunction with inter-proximal stripping. Slight adjustments of the two arms supporting the locks can alter the vertical height of the sectional archwire.



Figure 2 The labial bow shown extending from canine to canine

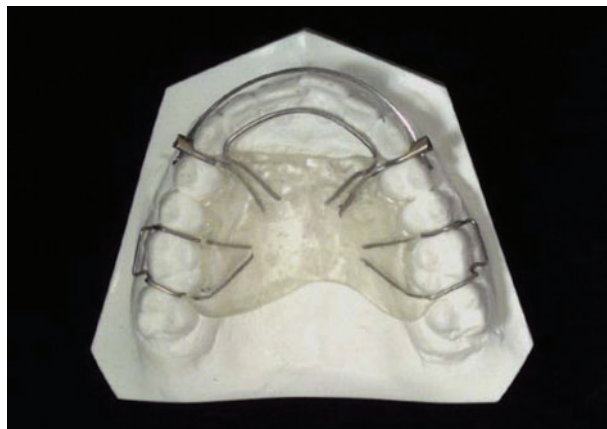
Case report

A 46-year-old female patient attended the clinic requesting treatment for lower incisor crowding, which she reported had worsened over recent years. Clinical examination revealed a well-aligned maxillary arch, but there was some mild crowding in the mandibular arch with imbrication of the lower incisors.

The patient was a well-known singer who was offered conventional fixed appliance therapy in the mandibular arch only, but due to her profession found this option impractical, even with ceramic brackets. A lingual appliance was discussed but this was declined on the grounds that it could interfere with her singing.

The patient had a preference for a removable appliance, so a Quatro appliance was constructed based on a modified Barrer appliance.

Preliminary inter-proximal stripping using abrasive strips was completed at the fitting appointment in the proximal contact areas that were aligned. The patient was subsequently seen on five occasions, on two of which further inter-proximal stripping was carried out.



(a)



(b)

Figure 3 (a,b) The Quatro appliance with Adams cribs on the first permanent molars, an ideal lingual arch and sliding locks allowing for a removable labial bow. Note this appliance can be constructed for the mandibular or maxillary arch

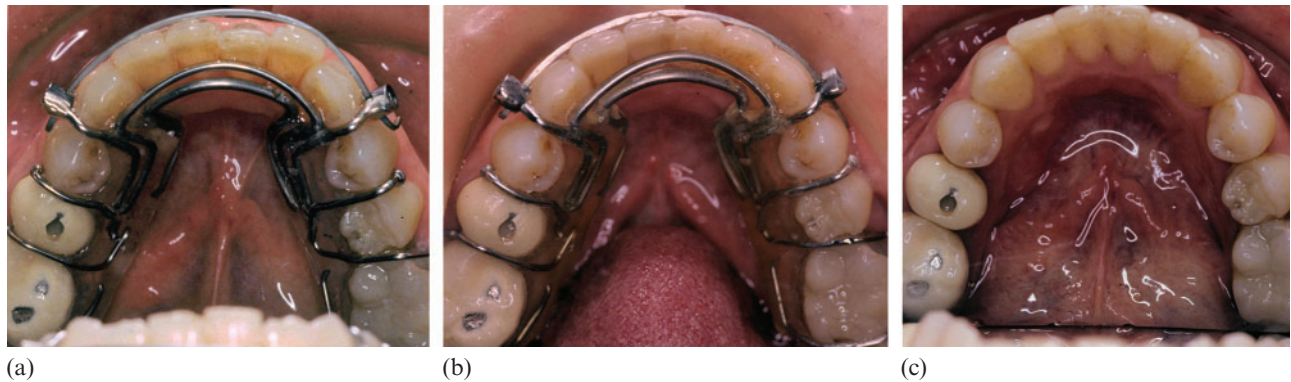


Figure 4 The Quatro appliance at: (a) start of treatment; (b) progress at seven months; and (c) end of treatment (14 months)

The initial aligning wire was round nickel titanium for a period of four months, followed by rectangular wire of the same material for four months. A rectangular stainless steel wire was used for the remaining treatment, which was adjusted to incorporate de-rotation bends. Total duration of the treatment was 14 months, and a bonded lingual retainer was placed once the treatment had been completed. Figure 4 shows the stages of the treatment. This prolonged period was primarily due to the patient not wearing the appliance full time. While this is not encouraged, the nature of the patient's profession prevented her from wearing the appliance all the time. Had it been worn continuously, the treatment time would probably have taken less than half the time.

Discussion

Other removable aligners have been described in the literature,^{9,10} and while they are capable of correcting malaligned teeth, the limitations of a removable appliance must be accepted. These are primarily problems of compliance and retention, but also important is the lack of versatility of the wirework, which limits the tooth movements that can be achieved.

The Bloore removable aligner⁹ is one type of removable aligner for which a patient should meet certain criteria for a successful outcome. The requirements for the Quatro appliance can be considered the same as those of the Bloore aligner. A patient should have:

- good posterior occlusion;
- incisor crowding of no more than 2.5 mm;
- adequate crown anatomy;
- incisor apices in adequate positions;
- healthy periodontium.

The Barrer appliance requires a laboratory procedure to correct the malpositioned incisors, with the teeth dissected from the model and waxed into a well-aligned

position. Judicious alteration to the individual teeth on the model is necessary before the addition of acrylic to help the correction of rotations.² Similarly, modification of the models is required in order to achieve tooth movement with Essix appliances.⁴ Construction of the Quatro appliance requires no additional laboratory procedure such as tooth alignment since the appliance can be made on the original cast working model. The use of a pre-soldered lock further reduces laboratory time.

When using a removable appliance to treat cases where the teeth to be corrected are severely malaligned it is sometimes necessary to construct a new appliance mid-treatment. Indeed, this is the basis of the Invisalign method.^{6,7} Additionally, this technique requires polyvinyl siloxane impressions which can be difficult to take and there is a considerable laboratory cost involved.⁶ Due to the versatility of the appliance described in this paper, the changeable archwires eliminate the need for additional aligners to be constructed during the course of the treatment. The use of nickel titanium or stainless steel archwires is permissible; these may be of varying dimensions and can be easily tightened or slackened and various bends may be incorporated.

A conventional Hawley retainer can be used as an active appliance but its limitations for correcting rotations and malpositions is well known. The labial bow can only move the teeth lingually, but Curetan uses elastomeric modules pulled into holes on the lingual acrylic with ligature wire to exert a labial force on the teeth.¹⁰ This technique, however, has a fixed labial bow. While the Quatro appliance has its limitations for this type of movement, the placement of an ideal lingual arch will allow for a satisfactory correction.

Conclusion

The Quatro appliance is designed to deal with mild labial irregularity, is easy to construct and use and is

acceptable by patients not able or willing to wear fixed appliances. In cases of mild dental crowding, this removable aligner may be used in conjunction with inter-proximal stripping. The device incorporates a removable labial bow attached bilaterally to a sliding lock, which permits the addition and replacement of sectional archwires to the labial part of the appliance. This versatile appliance should form part of the orthodontist's armamentarium in dealing with mild labial crowding.

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