Erfan Salloum
Declan T Millett and Grant T McIntyre

The Twin-block Appliance for Correction of Class II Division 1 Malocclusion

Abstract: The twin-block appliance is a widely used functional appliance for the correction of Class II division 1 malocclusion in growing children and adolescents. This article outlines the indications and case assessment, the steps in clinical management and appliance design. Evidence regarding the mode of action, effects and prediction of treatment outcome of the twin-block appliance for Class II division 1 malocclusion are also presented.
CPD/Clinical Relevance: The twin-block appliance is a widely used functional appliance in the UK for the correction of Class II division 1 malocclusion in growing children and adolescents.
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The twin-block appliance (TBA) was developed by Dr William Clark and consists of interlocking upper and lower bite blocks to posture the mandible forward for overjet correction.[1]

Indications and management

TBA treatment is only successful in well-motivated and growing children and adolescents, typically at 10–13 years in girls or 11–14 years in boys. In addition, the following features should be present:

- Mild to moderate Class 2 skeletal discrepancy with low or average Frankfort-mandibular plane angle and no facial asymmetry,
- Uncrowded arches,
- Proclined upper incisors,
- Upright or mildly retroclined lower incisors
- Half unit or greater Class II molar relationships.

Extra-oral and intra-oral photographs, study models and appropriate radiographs including a lateral cephalogram are required for treatment planning (Figure 1). The lateral cephalogram should be analysed to assess the anteroposterior and vertical skeletal pattern, as well as the incisor inclinations. The cervical vertebral maturation (CVM) stage may also be assessed.[2] Recording standing height at baseline and during treatment will also give an indication of growth rate.

Appliance construction

Fully extended alginate impressions or an intra-oral scan with accurate recording of all standing teeth and supporting soft-tissues are required. The appliance is then manufactured according to the postured bite registration and prescription.

Postured bite registration

Freehand positioning of the upper and lower working models in the laboratory to simulate the desired construction bite is not advised. The following clinical techniques are, however, recommended.

Wax roll

A horseshoe-shaped roll of softened wax is indented on the occlusal surfaces and incisal edges of the upper teeth. The mandible is then postured to an edge-to-edge position with 2–3-mm incisal separation and coincident centre lines. When the wax has cooled, the registration

Erfan Salloum, BDS, PG Cert(Orth), MFDRCSI, MFDSRCPS(Glag), DClinDent(Orth), MOrthRCSEd, FFDRCSI(Orth), IMOrthRCSEng, Specialist Orthodontist, Dublin Orthodontics, Dublin, Ireland. **Declan T Millett**, BDSc, DDS, FDSRCPSGlasg, FDSRCSEng, DOrthRCSEng, MOrthRCSEng, FHEA, Professor of Orthodontics, Oral Health and Development, Cork University Dental School and Hospital, University College Cork, Ireland. **Grant T McIntyre**, BDS, FDSRCPSGlasg, MOrthRCSEd, PhD, FDSRCPSGlasg(Orth), FHEA, FDSRCSEd, FDTFed, Consultant/Honorary Professor, Dundee Dental Hospital and School, Dundee, UK.
email: erfan_salloum@live.com

Figure 1. (a–k) Case assessment records for treatment with the twin-block appliance.

is removed from the mouth, chilled and retried for accuracy.

Projet bite recorder

A Projet bite recorder is used with thickened soft wax applied to the buccal sections.[3] There are three grooves on one surface and a single notch on the other. Operator preference determines orientation, but the appropriate groove and notch must be aligned with the incisors edge-to-edge. For deep overbite cases, a blue Projet bite recorder (Figure 2) provides 2-mm incisor clearance and 5–6-mm premolar clearance. Where the overbite is reduced, a white Project bite recorder (Figure 2) increases incisor clearance to 4 mm, but maintains 4–5-mm premolar separation.

One-step or incremental advancement

One-step mandibular advancement was proposed by Clark.[1] Incremental advancement reduces soft-tissue stretch and increases patient comfort. This theoretically enhances compliance, but has not proved superior to one-step advancement in terms of treatment outcome.[4] In cases with an overjet greater than 10 mm or where maximal advancement cannot be tolerated, the appliance should be re-activated in the laboratory or re-made during treatment. Re-activation requires the addition of acrylic to the inclined planes. Use of light-cured acrylic additions is not approved for intra-oral use.

Appliance design

The original design of the TBA

In the original TBA design, the upper block was retained by two 0.7-mm Adams' clasps, spanning two buccal segment teeth, which included a headgear tube for a 'Concorde' facebow. A midline expansion screw and a labial bow were also included. A palatal bow was occasionally incorporated to control maxillary incisor inclination. In the mixed dentition, the use of 0.7-mm 'C' clasps for the lateral incisors in addition to Adams' claps for the first permanent molars was suggested.[1]

Ball-ended and delta clasps were used for the mandibular incisors and premolars, respectively. A 1.5-mm midline hook

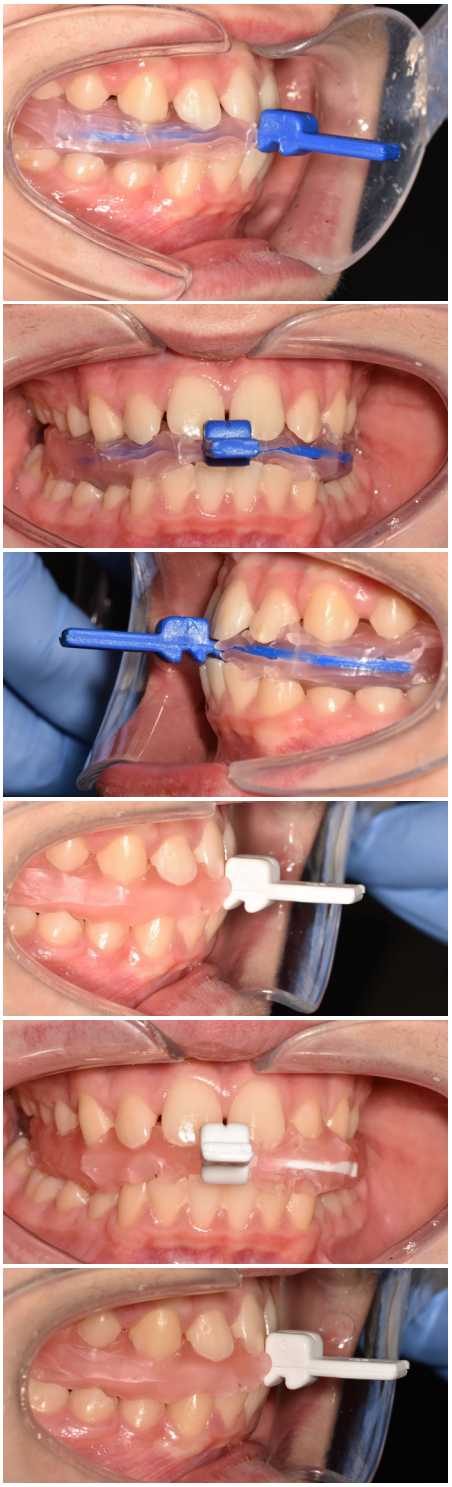

Figure 2. (a–f) Rojet bite recorder (**blue**: normal or deep overbite; **white**: reduced overbite).

was incorporated in the acrylic lingual to the mandibular incisors for Class II inter-maxillary traction to a midline hook soldered to the Concorde facebow.

Figure 3. Contemporary TBA design **(a)** at fitting and **(b)** intra-oral view.

The bite blocks were originally articulated at a 45-degree angle with inter-occlusal separation in the premolar region of 4–6-mm. The articulation has subsequently been increased to 70° to maintain a comfortable forward mandibular postured position, enhancing skeletal change.[3] Blocks shallower than 5 mm are, however, less likely to be effective at maintaining forward mandibular posture.

Modifications

Appliance designs should be modified to the individual features of the malocclusion and have incorporated the following:

- Labial bow: this had no influence on skeletal or dento-alveolar changes or on the amount and rate of overjet reduction (Figure 3).[5]
- Z-springs: these may be incorporated to facilitate alignment to enable arch co-ordination in the postured position
- Southend clasps: maxillary and mandibular incisor clasping produced greater skeletal correction and reduced incisor tipping.[6]
- Torquing spurs: inclusion of maxillary incisor torque control spurs minimised retroclination and extrusion enhancing mandibular growth.[7]
- Magnets: these provide an additional stimulus to mandibular protrusion, but have not gained widespread acceptance.[8]
- Mini blocks: reduced posterior bite blocks along with maxillary incisor torque control springs and incremental mandibular advancement did not produce greater mandibular growth.[9]
- Clip-on/clip-over: plint clips and modified bite blocks have been used with fixed appliances.[10]
- Headgear: controlling vertical and sagittal maxillary growth with headgear incorporated in the maxillary block resulted in greater Class II correction.[11]
- Lower incisor capping: this did not reduce lower incisor proclination.[12]
- Timers: these have been incorporated as a measure of compliance, but actual wear fell below that prescribed on a full-time or part-time basis.[13]

Clinical management of the appliance

Patients should be reviewed after 2 weeks of fitting the TBA to ensure appliance comfort and to provide encouragement regarding prescribed wear. Time-sheets should also be checked as part of motivation. Full-time wear has been advised and, as the crucial time for establishing wear is at the start of treatment, temporary cementation or bonding the clasps *in situ* has been suggested. Subsequent reviews should be scheduled at 6–8-week intervals throughout treatment. At each appointment, the appliance should be checked for signs of wear, and speech assessed with the appliance in place. Because a false impression of treatment success may occur due to the postural effect of the TBA, it is essential that the occlusal changes are recorded with the mandible in the maximum retruded position. Overjet and molar relationships should be noted.[14] Wear data should be logged when the TBA incorporates a microsensor as a measure of compliance. Retentive or active components may require adjustment.

Lateral open bites

Following overjet correction, lateral open bites are usually present. To allow closure with mandibular molar eruption, these may be managed as follows:

- Progression to night-only appliance wear;
- Removal of mandibular permanent molar clasps and progressive trimming of the upper block contacting the

a

b

Figure 4. (a, b) Twin-block with acrylic trimmed from upper block and mandibular molar clasps removed to allow these to erupt.

mandibular molars to provide 2-mm clearance (Figure 4);

- Provision of an upper removable appliance with a steeply inclined anterior bite platform to maintain the sagittal correction;
- Transition to fixed appliances with the maintenance of overjet correction using light intermaxillary Class II elastic traction.

Mode of action and effects of the TBA

The TBA uses 'push' and 'pull' forces generated by the orofacial musculature that are transmitted to the dentoskeletal tissues. The theories relating to mandibular posture include lateral pterygoid stretch, functional matrix hypothesis and neuromuscular reflexes. The reactive forces transmitted to the maxilla restrain anterior and downwards growth.[15]

Dento-alveolar changes are the major contributor to overjet correction (70–80%) through retroclination of upper incisors and proclination of lower incisors.[16] In addition, mesial movement of lower molars and minimal movement of upper molars occurs.[17,18] Although the appliance is used to correct mandibular retrognathia, paradoxically, minimal skeletal change (1–2 mm) appears to result from an increase in condylar growth and volume, mandibular length and lower face height. Forward maxillary growth is also restricted.[19] The precise skeletal effect is related to favourable mandibular growth and compliance.[16] A significant improvement in facial profile has also been identified[20] with 3–4-mm linear advancement of the lower lip and chin, together with an increase in the lower facial soft-tissue volume.[21] When microsensors were used to measure compliance, there were no differences in dental or skeletal outcomes with prescribed full-time over part-time wear.[13]

Treatment timing

Treatment timing should coincide with the circumpubertal growth spurt. Although TBA treatment alone may be sufficient to correct a Class II division 1 malocclusion, more often than not, a further phase of fixed appliance treatment, with or without extractions, is required.

While it may be tempting to treat in the early mixed dentition, the shortcomings are documented in several well-designed randomized controlled trials.[16] These include an overall increase in treatment time and no overall occlusal gain compared to deferring treatment until adolescence. There is, however, a reduction in the incidence of incisal trauma.[22] For all children with an increased overjet, a mouthguard should be advised for contact sports.

Success with the TBA

A large multicentre study reported complete overjet reduction with TBA treatment in around 66%.[23] The expected rate of overjet reduction is around 1 mm per month and treatment usually takes 9–12 months to complete.[23] Evidence of poor compliance requires a re-assessment and a probable change in the treatment plan. Where the overjet has not reduced by 50% in the first 6 months of treatment, TBA treatment should be discontinued.[24]

Predictors of successful TBA treatment outcome

In Europeans, mandibular retrognathia-reduced vertical facial proportions and a large initial overjet have been identified as predictors of successful treatment.[24–26] These, and proclined upper incisors, have been found to predict favourable soft-tissue outcomes in Koreans.[27]

Conclusions

TBA treatment is effective for the correction of Class II division 1 malocclusion in growing children. The postured mandibular position must be recorded using a suitable registration technique and appliance design tailored to the malocclusion. Monitoring of compliance is necessary to ensure treatment success. Occlusal changes must be recorded with the mandible in maximum retrusion. The mode of action primarily involves dento-alveolar changes with minimal additional mandibular growth.

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Compliance with Ethical Standards

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