CASE REPORT

Class II malocclusion treatment using combined Twin Block and fixed orthodontic appliances – A case report

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Abstract The effect of the Twin Block functional orthodontic appliances is mostly dento-alveolar with small skeletal effect. There are certain clinical indications where functional appliances can be used successfully in class II malocclusion e.g. in a growing patient. The use of these appliances is greatly dependent on the patient’s compliance and they simplify the fixed appliance phase. In this case, a 13-year old adolescent was treated with Twin Block appliance followed by fixed appliance to detail the occlusion. The design and treatment effects were demonstrated in this case report.

1. Introduction

Functional appliances may be defined as an orthodontic appliance that uses the forces generated by the muscles to achieve dental and skeletal changes. These appliances have been used in clinical orthodontics for a long time and extensively featured in the literature (O’Brien et al., 2003a). Functional appliances can be removable or fixed. The mode of action differs depending on the design; however, their effect is produced from the forces generated by the stretching of the muscles (Mills, 1991). There are a number of clinical indications for the use of functional appliances to correct class II malocclusion (Lund and Sandler, 1998). The Twin Block appliance was developed by Clark in 1980s (Clark, 1988). It is the commonly used functional appliance partly due to its acceptability by patients (Chadwick et al., 1998). The following is a case report of a 13-year old male patient treated by a Twin Block functional appliance in combination with fixed appliance to manage his class II malocclusion.

2. Diagnosis and etiology

The patient had a mild class II skeletal pattern with average Frankfort-mandibular planes angle and lower anterior face height. There was no facial asymmetry and the lips were incompetent with the lower lip trapped at rest behind the upper central incisors. In the intra-oral assessment, the oral hygiene was fair but needed improvement prior to orthodontic treatment (Fig. 1). All teeth from the permanent second molars have erupted in both the upper and lower arches. The maxillary arch was spaced with a midline diastema. Furthermore, there was mild lower labial crowding (4 mm). The incisor rela-
The molar relationship was class II division 1; the overjet was 8 mm whereas the overbite was increased and complete to the palate. The centerlines were coincident and the buccal segment relationship was 1/2 unit class II on both sides (Fig. 2).

The Dental Panoramic Tomogram (DPT) confirmed the presence of all permanent teeth including the developing upper left and right and lower left third molar. At this stage, there was no sign of a developing lower right third molar (Fig. 3). Root morphology appeared normal and there were no obvious carious lesions. In the cephalometric assessment (Fig. 4), the ANB value of 5° suggested a mild class II skeletal pattern. The vertical proportions were within normal value. The upper incisors were proclined at 125° and the lower incisors were of average inclination at 93°. The interincisal angle was reduced at 114°. The lower incisor to APo and the lower lip to E line were within normal limits.

The main objectives for phase I of the treatment were as follows:

1. Reduce the overbite and overjet.
2. Achieve class I molar relationship and gain anchorage.

In phase II of the treatment, the aims were:

1. Relieved lower arch crowding.
2. Level and align the arches.
3. Close upper labial segment space.
4. Achieve class I canine and incisor relationship.
5. Long term retention with upper and lower vacuum formed retainers.

3. Treatment rationale

Phase I of treatment involved the use of functional appliance (Clark Twin Block appliance) to reduce the overjet, achieve
class I molar relationships and gain anchorage at the start of treatment to simplify the fixed appliance stage (Fig. 5). Furthermore, there is the theoretical advantage of improving the patient’s profile by causing a small skeletal change (O’Brien et al., 2003b). The design of the upper component of the twin block involved an acrylic baseplate which covers the palate and occlusal surfaces of the first molars and second premolars. There was an inclined plane at the end of the mesial end of the acrylic block. A labial bow was used for anterior retention of the appliance. A midline screw was also included. The lower component consisted of a lingual acrylic baseplate covering the edge of the lower incisors. Both blocks had Adams clasps on the first molars and first premolars to provide posterior retention. This phase was followed with upper and lower fixed appliances (0.022” slot brackets) to close spaces, detailing and finishing of the case.

4. Alternative treatment plans

The upper buccal segment could be distalised using headgear appliance to correct the molar relationship and create space to reduce the overjet. The headgear treatment also has a

<table>
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<th>Variable</th>
<th>Pre-treatment</th>
<th>normal</th>
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<tr>
<td>SNA</td>
<td>83°</td>
<td>82° ± 3</td>
</tr>
<tr>
<td>SNB</td>
<td>78°</td>
<td>79° ± 3</td>
</tr>
<tr>
<td>ANB</td>
<td>5°</td>
<td>3° ± 1</td>
</tr>
<tr>
<td>Upper incisor to maxillary plane angle</td>
<td>125°</td>
<td>108° ± 5</td>
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<tr>
<td>Lower incisor to mandibular plane angle</td>
<td>95°</td>
<td>92° ± 5</td>
</tr>
<tr>
<td>Interincisal angle</td>
<td>114°</td>
<td>133° ± 10</td>
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<tr>
<td>Maxillary mandibular planes angle</td>
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<td>55%</td>
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<td>1</td>
<td>0-2mm</td>
</tr>
<tr>
<td>Lower lip to Ricketts E Plane</td>
<td>-1</td>
<td>-2mm</td>
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Figure 4  The pre-treatment cephalometric radiograph, tracing and the values with the normal figures for Caucasians taken from Houston et al. (1992).

Figure 5  The Twin Block appliance design used in this case.
restrain effect on the maxilla which is beneficial in this case (Wieslander et al., 1993). The patient was shown both appliances and he preferred to wear the Twin Block appliance over the headgear. It could be argued that this case might be treated only with fixed appliance using class II intermaxillary traction but the main disadvantage with this approach is that it will lead to further proclination of the lower incisors and molar correction to class I may be difficult to achieve. Moreover, anchorage must be reinforced, since any anchorage loss by mesial movement of the upper molars will make overjet reduction and molar relationship correction more difficult.

5. Treatment progress

The aims of the functional treatment phase were achieved successfully due to good patient compliance. This phase of treatment was completed over 9 months. The upper incisors were retroclined by 9° while the lower incisors proclined by 4°. This resulted in reduction of the overjet (Fig. 6). The patient was instructed to activate the midline screw twice a week and was reviewed every four weeks. There was a concern about worsening the periodontal condition of the lower left central incisor with treatment. However, this was managed with careful monitoring of the tooth and continuous encouragement of the patient to maintain good oral hygiene particularly around this area. The second phase of treatment with the fixed appliances aimed to close the remaining spaces and finish the case which lasted 12 months (Fig. 7). The upper posterior teeth were tied together with stainless steel ligatures during canine traction to reinforce anchorage. The overall treatment time was 24 months i.e. 9 months functional appliance wear, 3 months transient phase between functional and fixed and 12 months fixed appliance treatment.

6. Treatment results

The treatment objectives were achieved. The profile of the patient has improved after the treatment (Fig. 8). The lower arch crowding was relieved by proclination of the lower incisors. The spaces of the upper arch were closed with the use of closing coil spring during the fixed appliance phase of treatment. The incisor, canine and molar relationships were class I at the end of treatment (Fig. 9). The overbite and overjet were reduced to the average values. The growth changes are demonstrated in Fig. 10, overall superimposition of the lateral cephalometric radiographs is shown in Fig. 11 and the maxillary and mandibular superimpositions are illustrated in Fig. 12.

Figure 6  Post-functional photographs. Note that the molar relationship was overcorrected to a class III relationship.
Figure 7  Mid-treatment photographs showing upper and lower 0.019" \times 0.025" SS arch wires in situ. Nickel Titanium coil springs to close the space in the upper arch.

Figure 8  Post-treatment clinical photographs.
7. Discussion

Twin Block functional appliance has several well established advantages including the fact that it is well tolerated by patients (Harradine and Gale, 2000), robust, easy to repair and it is suitable to use in the permanent and mixed dentition. There are potential disadvantages such as the proclination of the lower incisors and development of posterior open bites. In this case, the treatment objectives were achieved largely due to the good compliance by the patient. The patient’s chief complaint was the increased overjet. Thus by reducing the overjet with the functional appliance, the patient’s confidence has improved and also the risk of sustaining trauma to the upper incisor was minimised (O’Brien et al., 2003c). Due to the fact that the patient was instructed to activate the midline screw only twice a week (0.25 mm of expansion per turn), this may contribute to the limitation of the severity of the posterior open bite at the end of the functional appliance phase. In this case, more expansion would help to reduce the amount of the transverse discrepancy. The posterior open bite was managed by the part time wear of the functional appliance during the transient phase between functional and fixed appliance (Fig. 6) and also by coordinating the stainless steel arch wires during the fixed appliance phase.

The selection of functional appliances is dependent upon several factors which can be categorised into patient factors e.g., age and compliance and clinical factors e.g., preference/familiarity and laboratory facilities.

During treatment, the SNA value was reduced by $1^\circ$ while the SNB value increased by $1^\circ$. As a consequence the ANB value decreased by $2^\circ$ towards class I skeletal pattern (Fig. 11). The maxillary mandibular plane angle remained relatively unchanged. The upper incisor inclination reduced to $116^\circ$ and so they remained proclined. The lower incisors were proclined by $4^\circ$. The vertical proportions increased during treatment. The lower incisors to the APo line remained relatively unchanged whereas the lower lip to the E plane was reduced by 2 mm. This has resulted in improvement in the patient’s profile which is largely attributed to the favourable growth and may be partly due to the functional appliance.

The superimposition of the lateral cephalometric radiographs taken during pre-treatment and pre-debond demonstrated that the patient grew in a favourable direction.
towards a class I skeletal pattern (Fig. 12). The radiographs were registered on stable structures in the anterior cranial base (Decoster line). The maxilla demonstrated vertical growth. The upper incisors were extruded and the molars moved mesially. The mandible demonstrated down and forward growth with a slight anterior growth rotation. The lower incisors were proclined despite the use of acrylic capping which was reported to reduce the amount of lower incisors proclination (Mills and McCulloch, 1998). The lower molars moved mesially. It has been proved in the literature that functional appliances do not produce long term skeletal changes and most of their effects are dento-alveolar (Lee et al., 2007). In a prospective controlled trial (Lund and Sandler, 1998) with twin blocks and controls to investigate the skeletal and dental effects showed that the ANB angle reduced by $2^\circ$ which was almost entirely due to mandibular length increase which was $2.4 \text{ mm}$ compared to the controls as measured from Ar-Pog. There was no evidence of a restriction in maxillary growth. However, it can be seen in this case that functional appliance can facilitate the fixed appliance phase dramatically to achieve good result (Fig. 8).

In terms of soft tissue changes, a study aimed to identify and quantiﬁy soft tissue changes during treatment with Twin Block and Dynamax appliance using the techniques of three-dimensional (3D) optical surface laser scanning, cephalometric-

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<tr>
<th>Variable</th>
<th>Pre-debond</th>
<th>Overall change</th>
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<tbody>
<tr>
<td>SNA</td>
<td>82°</td>
<td>-1°</td>
</tr>
<tr>
<td>SNB</td>
<td>79°</td>
<td>1°</td>
</tr>
<tr>
<td>ANB</td>
<td>3°</td>
<td>-2°</td>
</tr>
<tr>
<td>Upper incisor to maxillary plane angle</td>
<td>116°</td>
<td>.9°</td>
</tr>
<tr>
<td>Lower incisor to mandibular plane angle</td>
<td>97°</td>
<td>4°</td>
</tr>
<tr>
<td>Interincisal angle</td>
<td>119°</td>
<td>5°</td>
</tr>
<tr>
<td>MM angle</td>
<td>30°</td>
<td>2°</td>
</tr>
<tr>
<td>Face height ratio</td>
<td>55%</td>
<td>1%</td>
</tr>
<tr>
<td>Lower incisor to APo line</td>
<td>6mm</td>
<td>5mm</td>
</tr>
<tr>
<td>Lower lip to Ricketts F Plane</td>
<td>-3mm</td>
<td>-2mm</td>
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Figure 10 Pre-debond cephalometric analysis.

Figure 11 Overall superimposition of pre-treatment (black colour) and pre-debond (red colour) cephalometric radiographs, registered on the Decoster’s line.
ric, and clinical measurements (Lee et al., 2007). It was found that there is a soft tissue difference after treatment which is likely to be clinically relevant. In this particular case, the profile had improved (Fig. 8) and in addition, the gingival condition around the lower left central incisor was maintained due to adequate oral hygiene practice by the patient. The patient was satisfied with the outcome and the appliances were removed. The patient was provided with upper and lower Essix retainers covering all the teeth from the first molars and he was instructed to wear them night time only. (Rowland et al., 2007). There are claims in the literature that Essix retainers are more effective in maintaining the labial segments as well as cost-effective, and patients preferred them over the Hawley retainers (Hichens et al., 2007). Arrangement has been made to review the patient regularly during the retention phase of treatment. It was explained to the patient that long term wear of the retainers is required to ensure stability (Little, 1999). Furthermore, he was referred to his general dental practitioner for regular check-up appointments.

8. Conclusions

The effect of Twin Block functional appliances is mostly den-to-alveolar with small skeletal component. There are a number of situations where functional appliances can be successfully used to correct class II malocclusion. It is important that functional appliances are used in a growing patient to achieve the maximum benefit. They simplify the following phase of fixed appliance by gaining anchorage and achieving class I molar relationship. In this case, the patient was treated with Twin Block appliance followed by fixed appliance phase. The design and effects of the appliance were demonstrated in this case report.

Acknowledgments

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References