

An Overjet Reduction of Class II, Division 1 Malocclusion in Twin Block Dentofacial Orthopedic and Fixed Orthodontic Treatment: Case Report

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Abstract

Dentofacial orthopedic treatment is a management of imbalance muscle and skeletal disproportion with functional orthopedic appliances. Functional appliances were developed to correct muscle deviation and jaw relationship to attain facial balance through functional repair of muscle and bone. To obtain more optimal and effective improvements in muscle and bone functions, a combination of fixed appliance and functional appliance treatment is necessary. Overjet refers to a horizontal relationship between maxillary and mandibular incisors. Normal range of overjet is 2-4 mm. Some clinical problems due to increased overjet were injury of maxillary permanent incisors during growth ages, periodontal destruction, difficulty with normal lip closure, and social influences such as lack of confidence for a child. Management of increased overjet depends on some factors related to skeletal pattern and soft tissue, as well as patient's age. One of effective appliances in reducing overjet of class II malocclusion treatment is a functional twin block appliance. Twin block appliance is worn by growth age children for certain periods to allow mandibular movement, easy to wear, and patient will be cooperative. An optimal treatment depends on the compliance of each patient. This appliance is made up with 700 of tilt angulation to occlusal plane. Lateral expansion of maxilla is obtained through expansion screw. Patient should be instructed to wear this appliance for 24 hours a day. In this case report, a 10-year-6-month old male patient with 13 mm overjet treated with twin block appliance and followed by fixed orthodontic appliance to correct his teeth position and occlusion. The use of twin block appliance indicated a reduced overjet into 4 mm in 11 months of treatment periods. Early treatment of this case was effectively resulted in overjet reduction, change of skeletal pattern, and improvement of patient's psychology related to self-confidence with significantly aesthetic repair of patient's face.

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Introduction

Concept of dentofacial orthopedic treatment aims to correct teeth relationship and facial balance in stomatognathic system. In a case of malocclusion which related to musculoskeletal discrepancy, it needs orthopedic approaches.¹ This approach is a treatment of imbalance muscle dan skeletal disproportion with

functional orthopedic appliances. Functional appliances were developed to correct muscle deviation and jaw relationship to attain facial balance through functional repair of muscle and bone. To obtain both functional repair of muscle and bone, it needs a combination of fixed appliance and functional appliance treatment. The principle of dentofacial orthopedic treatment is to modify facial growth pattern and bone structure, in order to stimulate facial growth by means of functional muscle environmental changes during teeth development periods.²

The principle of functional twin block appliance is reposition of retrusive mandibular to anterior position through construction of removable appliance which affects protrusive

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teeth when appliance is being worn. Orthopedic forces is not only active on tolerance level of periodontal membrane but rather on the tolerance activity of orofacial muscle. Orthopedic approaches in malocclusion treatment is not specifically designed to move teeth, but rather to change jaw position in order to correct the relationship of mandibular to maxilla.³

Functional twin block appliance treatment aims to improve functional relationship of dentofacial structure by eliminating undesirable development and muscle function which affects occlusion by changing tooth position and support tissues. Twin block is designed to protrusive bite with modification of occlusal inclined plane through acrylic inclined plane of occlusal bite block.⁴ Its purpose is to protrude the mandibular as correction of skeletal class II malocclusion. Occlusal inclined plane act as a guiding mechanism to be placed downward and forward. When twin block is worn, the patient cannot occlude comfortably in distal position and mandibular is protruded to attain protrusive bite with an inclined plane which fit to occlusion. Undesirable cuspal contacts of distal occlusion are replaced by desirable proprioceptive contacts on the inclined plane of twin block to correct malocclusion and to release the mandibular from locked functional distal position.⁵

Overjet refers to a horizontal relationship between maxillary and mandibular incisors. Normal range of overjet is 2-4 mm. Increased overjet is characterized by the maxillary incisors which are more protrude. The overjet larger than 6 mm may have an impact on children's psychological and social burden due to aesthetic of their facial profile. Increased overjet related to class II malocclusion, a sagittal relationship of skeletal class II and mandibular retrognathism. Increased overjet may be due to some factors. It can occur because the skeletal pattern, such as skeletal class I, class II or even class III. Most often occur in the pattern of class II (75%), it is due to normal size of mandibular with its position which more posterior to cranial base. The second factor is due to soft tissue factors which determined by skeletal pattern, the greater discrepancy the less tendency of patient to have a competent lip.⁶

When the lips are incompetent, closure of anterior area will affect incisors position; if lower lip is immersed down below the maxillary incisors, then it affects increased overjet, however if

incisors can be retracted with control on lower lip afterward the prognosis of stability will be increased. The third factor is bad habits such as thumb sucking which may cause proclination of maxillary incisors and retroclination of mandibular incisors. Effects of this habit relate to frequency, intensity, and duration of bad habits. It needs proper steps to stop bad habit before starting the treatment of overjet reduction actively. Increased overjet reflects the presence of skeletal discrepancy. Lower lip position also act as one of factors that triggers the excess overjet, if in rest position the lower lip is right behind maxillary incisors, this condition will cause more proclination of maxillary incisors which results in increased overjet.⁷

Increase in overjet can provide the following effects are trauma. Previous studies showed high incidence of incisors trauma due to large overjet. Factors involved in the occurrence of trauma such as short upper lip, incompetent lips, lip closure difficulty, and mouth breathing. All of these factors related to each others that is tissue destruction. Patient with overjet more than 8 mm tends to show greater loss of bone support than patient with normal overjet. Continuous tooth migration is a physiological process due to disturbance on periodontal tissue. Periodontal destruction with increasing age, periodontal ligament become less resistant to pressure of atypical lips associated with difficulty in attaining normal lip closure. Plaque accumulation and gingivitis. In a study which combined scores for gingivitis and periodontal pocket, higher score was obtained in individual with larger overjet (Helm and Petersen, 1989). Social influence. Some studies reported social impacts perceived by children with excess overjet. Increased overjet condition is considered as an unattractive appearance. Overjet greater than 6-9 mm provokes some reactions such as ridicule, rejection, joke, pity, curiosity and immoderate stare by others around children.⁸

In Angle's classification based on occlusal pattern, increase in overjet which a characteristic of class II, division 1 malocclusion is associated with skeletal relationship of maxilla, anterior teeth protrusion as well as skeletal retrusion of mandible. Increased overjet can be seen as disharmony orofacial in someone who has thumb sucking habit or incompetent lips. A study of Baccetti et.al. (2010) revealed that increased overjet is a significant occlusal characteristic

which related to dentoskeletal of class II, division 1 malocclusion.^{9,10}

Functional twin block appliance may be defined as an oral functional orthodontic appliance that optimize the forces generated by muscles around oral cavity resulting in bone changes and ideal and harmony teeth. Twin block appliance has been used in clinical orthodontic of dentistry and well-documented in the literature, include clinical orthodontic studies. Functional twin block appliance is widely used in treating class II malocclusion although many dentists are not aware about the effectivity and efficacy of this twin block appliance. Functional twin block appliance can be removable or fixed. Its mode of forces differs based on appliance design, effects resulting from the forces generated by muscle stretching.¹¹

The twin block appliance was developed by Clark in 1980s, it is a functional removable appliance consisted of acrylic plates with maxillary and mandibular bite blocks. It is used in accordance to requirement and indication of patient. In the following case report, a 10-year-6-month old male patient with class II, division 1 malocclusion treated by twin block appliance and followed by fixed orthodontic appliance.¹²

Case Report

A 10-year-6-month old male patient attended Dental Hospital of Faculty Dentistry, Hasanuddin University, Makassar with a chief complaint of his upper anterior teeth were more protrude than lower anterior teeth. Patient came with good general health. His facial profile is convex, symmetry. He had incompetent lips with lower lip is right behind the maxillary central incisors when in rest position (Fig.1).



Figure 1. Clinical photograph of patient's facial profile before treatment.

From intraoral examination, his oral hygiene was moderate thus scaling was done before orthodontic treatment. Right and left

molars relationship was Angle's class II malocclusion, with 6 mm of overbite and 13 mm of overjet. (Fig.2,3).



Figure 2. Intraoral photograph before treatment.

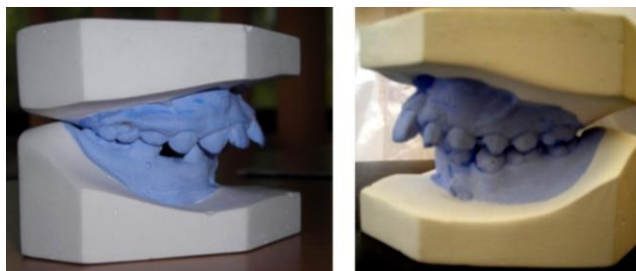


Figure 3. Study cast before treatment.

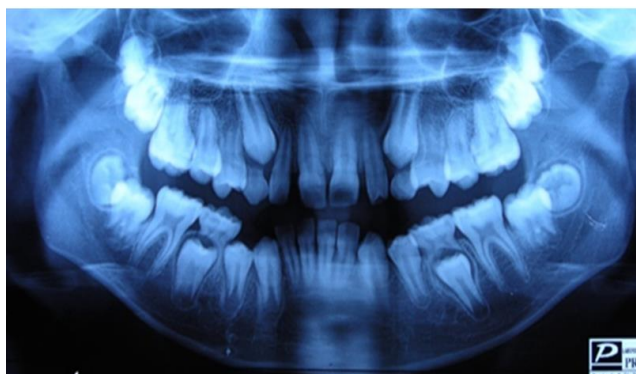


Figure 4. Dental panoramic tomography before treatment.

After extraoral and intraoral examination and cephalometric analysis, the author diagnosed the patient with skeletal and dental class II malocclusion ($ANB = 5^{\circ}$) which was due to mandibular retroposition and maxillary protrusion. All second permanent molars were

erupted, both in maxilla and mandibula. There was labial crowding on mandibula. Incisors relationship was class II division 1. Dental Panoramic Tomogram (DPT) showed all first permanent molars were erupted, premolars is developing but maxillary canines are not erupted yet. Root morphology appeared to be normal and there is no carious lesion (Fig.4). On cephalometric analysis, the ANB value of 5° indicated a skeletal class II. The vertical proportions were within normal range. Maxillary incisors were proclinated and mandibular incisors were of average onclination at 73°. The interincisal angle was 113°. (Table 1.)

	Before	Average	After
<SNA (*)	76	82	79
<SNB (*)	71	80	76
<ANB (*)	5	2	3
1 to NA (mm)	9	4 mm	6
<1 to NA (*)	36	22	27
1 to NB (mm)	7	4 mm	5
<1 to NB (*)	32	25	23
<Pg to NB (mm)	5	2 mm	3
<1 to 1 (*)	113	131	120
<OkI to SN (*)	25	14	22
<GoGn to SN (*)	37	32	36

Table 1. Change of cephalometric analysis before and after treatment.

The phase 1 of the orthodontic treatment was aimed to correct jaws relationship by means of: correction of class II relation, improve the soft tissue profile, harmonize maxillary and mandibular relationship, attain normal overjet and overbite, and create a good smile line by using functional twin block appliance. The patient was instructed to wear this appliance not more than 20 hours a day for 12 months, not only as bite blocks of maxilla and mandibula to protrude the mandibula but also to retract the maxilla with additional expansion screw in maxillary jaw (Fig.6). Because this appliance covered tooth surface, the patient was instructed to clean this appliance and his oral cavity regularly before wearing it, so as caries can be prevented.

In phase 2 of treatment, the objectives were to relieve crowding on mandibular arch, level and align jaw arch, close the space in labial segment of maxilla and attain class I incisors and

canines relationsip.

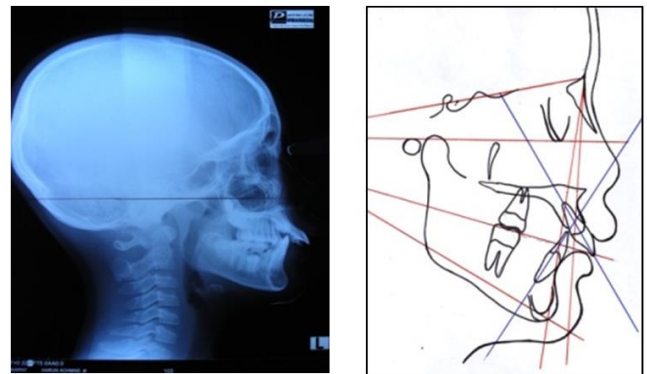


Figure 5. Cephalometric radiograph, tracing before treatment.



Figure 6. Twin block appliance design.

INITIAL TREATMENT

The phase 1 treatment with functional twin block appliance was aimed to reduce the overjet, attain the class I molar relationship and anchorage in the initial treatment so that to simplify the phase of fixed appliance treatment (Fig.5). The design of maxilla, tein block component with acrylic baseplate covered palatal area and occlusal surfaces of second premolar and forst molar. There was inclined plane in the mesial ends of acrylic bite block. The application of labial bow was as anterior retention and midline screw in maxilla. Mandibular component consisted of acrylic baseplate which covered lingual surface. Both blocks had Adam clasps on first molars and premolar as posterior retention. The patient was instructed to wear this appliance both in maxilla and mandibula by himself and activate the expansion screw twice a week and control in every 2 weeks. The patient was instructed to maintain his oral hygiene especially around the regio which covered by acrylic plate. Besides that, the patient also need to keep clean

the plate or twin block appliance after eating because foods may accumulate within plate, the appliance must be cleaned thoroughly using a toothbrush and tooth paste the washed with cold water. This phase was followed by fixed appliance of maxilla and mandibula (0,022 slot brackets) for closing the remaining spaces, correction the angulation and finishing of this case.



Figure 7. Clinical photograph of patient's facial profile.



Figure 8. A. Intraoral photograph of post-functional. B. Study cast photograph of patient's post-fungsional.

TREATMENT PROGRESS

The progress of functional treatment was successfully achieved because of patient's compliance (Fig 6). This functional treatment was completed in 8 months. Maxillary incisors was retroinclined by 9° , while lower incisors was proclined by 4° . This resulted in reduced overjet (Fig 7). The second phase of treatment with fixed appliance was aimed to close the remaining spaces and this phase was completely done in 12 months (Fig.8). Maxillary posterior teeth were retained with stainless steel ligatures along canines traction to reinforce the anchorage. Total of treatment duration was 24 months (8 months of functional appliance wear, 4 months for transient phase of combination between

functional and fixed appliance and 12 months for fixed appliance treatment).



Figure 9. Clinical photograph of patient's face after treatment.

Results

The treatment objectives were achieved in which the patient profile improved after the treatments (Fig.9). Crowding on mandibular arch was reduced due to proclination of mandibular incisors. In the end of treatment, class I relationship of incisors, canines and molars was attained (Fig.10). Overbite and overjet were reduced. The developmental changes was demonstrated in Fig.11, all of superimposition from lateral cephalometric radiograph was revealed in Fig.12 and the facial profile changes before and after treatment with twin block appliance resulted in more harmony and balance facial profile (Fig.12).



Figure 10. Photograph of treatment results shows fixed appliances on maxilla and mandibular.



Figure 11. Intraoral photograph of treatment results shows some changes.

The treatment results from the use of functional twin block appliance were corrected overbite, overjet and facial profile, and class I molar relationship in interdigitating. Superimposition before and after treatment was revealed that the SNA angle had a slight increase and the SNB angle was greatly

increased, thus the ANB decreased from 5° into 3° . The movements of maxillary and mandibular incisors was tipping to lingual and labial gradually. The mandibular plane (FMA) was changed in before and after treatment.



Figure 12. Patient's facial profile before and after treatment.

Discussion

Orthopedic appliance forces is effectively limit maxillary growth in downward and forward directions, resulting in retraction of maxillary teeth. Application of twin block is one of effective methods in correcting overjet problem of class II malocclusion. Orthopedic appliance forces are distributed to teeth arch by means of an appliance which is not design to move tooth individually, but to move all mandibular teeth and stimulate the adaptation on mastication muscles. Muscle is a main motor in growth process, and bone remodeling related to functional needs of muscle activities. The objectives of functional appliance are as follows: to reduce proprioceptive responds of orofacial muscle receptors and ligaments, and as secondary respond which affects bone growth pattern based on functional support of new environment for tooth development.¹³

In correcting the mandibular retrusion with twin block appliance, mandibular is in protrusion position pass through occlusal contact of functional appliance which involve as many teeth as possible in both arches. The goal of functional

appliance is not only to move the teeth, but also to move the mandibular down and forward, and to improve space of maxillary interjaw in anteroposterior and vertical dimension. Reposition of mandibular stimulates the positive respond of proprioceptive of mastication muscle, the purpose is to stimulate adaptive skeletal growth by maintaining the mandibular in anteriorly position which corrected for certain period of time thus facilitate the adaptive skeletal changes that may occur in the functional stimulus.¹⁴

Twin block is designed for 24-hours wear per day to obtain functional forces which distributed to teeth, include mastication force. Interlock bite block of maxilla and mandibula is in 70° angle when worn in close position. This is due to mandibular in anterior position to edge-to-edge position with maxila, which gives comfort for patient. in the treatment of calss II malocclusion, the inclinasion plane in mesial position to maxillary and mandibular premolars with maxillary blocks covers maxillary molars and second premolar or decidui molars, and mandibular blocks with mesial extension from second premolar or decidui molar regio. Maxillary and mandibular bite block involves mesial aspect of permanent first molar on tilt angle of 70° to the occlusal plane when mandibular is positioned ahead. Incisors position is edge-to-edge with 2 mm of vertical separation to hold and direct the incisors out of occlusion. The patient should attempt to reposition his/her mandibular forward to occlude the bite block in protrusion bite. In this case treatment, the patient has successfully performed the activation process control of his appliance consistently thus significant functional improvements was achieved. In this case, the treatment objectives mainly achieved due to patient's compliance.¹⁵

Twin block functional appliance has several advantages include the fact that this appliance can be well received by patients, easily repaired, and suitable for use in mixed and permanent dentition periods. This appliance also has a size that is easy to wear by patient, so that distraction while talking is minimal. The main complaint of this patient is increased overjet. Thus, reducing the overjet with functional appliance can improve the confidence of patient. Functional appliance selection depends on few factors which is categorized as follows: age and patient's compliance, and also habitual factor.¹⁶

During treatment, the SNA value was improved to 3° and SNB value was improved up to 5°. As consequences, the ANB value was reduced 2° to the pattern of class I skeletal (Fig.11). The angle of maxilla-mandibular plane was relatively no change. Maxillary incisors inclination was reduced to 27° however the proclination is still exist. The mandibular incisors proclination was 26°. The vertical proportion was improved during the treatment.^{15,16}

In the present case with large overjet treatment, the bite block was reduced selectively to stimulate posterior mandibular teeth eruption in increasing the vertical dimension and occlusal plane. Maxillary block was reduced in occluso-distal and remained a 2-3 mm space in mandibular molars relieved from occlusion thus stimulated the eruption process of mandibular molars and also reduced the overbite. By maintaining the minimal space distance between maxillary bite blocks and mandibular molars, the tongue movements was limited to lateral of teeth. This distance caused the eruption of molars was faster. In the next visits of control, maxillary bite block was reduced gradually to relieve occlusion with mandibular molars allowing the eruption, until all acrylic removed from occlusal surface of maxillary molars followed by removal of mandibular part to allow total eruption when occlusion. Regardless of minimal removal of maxillary bite block, this activation reduced the overjet from 13 mm to 4 mm in 11 months. In 1998, Lund and Sandler conducted a study with twin block appliance and control to understand the effect of wearing twin block on teeth and skeletal, this study showed that based on measurement of Arthere were 2° of ANB reduced due to growth of mandibular length up to 2.7 mm compared to the control. There was no evidence of maxillary growth limitation. The present case showed that functional appliance could simplify the use of fixed appliance. Patient's profile was getting better (Fig 11). It is necessary to tell the patient to wear long-term retainer to ensure the stability.¹⁷

Conclusions

Functional twin block appliances mostly affects the dentoalveolar with small skeletal components. There are few conditions where a functional appliance can be successfully used in correcting class II malocclusion. The most

important thing is that functional appliances may attain optimal results if they used in growing child patient. The simplicity of fixed appliance treatment due to anchorage and the class I relationship of molars was obtained.

Declaration of Interest

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