Modifications of Twin Block : A Review Article

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Abstract
Myofunctional and fixed functional appliances are the mainstay of growth modification procedures for skeletal Class II correction. Most commonly used appliance for the treatment of growing Class II skeletal pattern nowadays is twin block appliance. The advantages of using twin block appliance are simultaneous correction in transverse, vertical and sagittal plane. The original design of the twin block appliance can be modified to meet the treatment goals of individual patients. Based on the patient needs, various authors have customised the original design of the appliance but it is difficult to find all the modifications in one place. So, the aim of this review article is to describe the various modifications and the indications of these modified designs of the twin block appliance.
Key words – Twin block appliance, Modifications of twin block appliance, Myofunctional appliance, Skeletal Class II correction

Introduction

The treatment modalities of skeletal problems depend upon the growth status of the patients. The treatment for growing individuals is focused on growth modification whereas for non-growing adults fixed appliance therapy is considered, which includes dental camouflage and in severe cases orthognathic surgery. Growth modification procedures for Class II malocclusion target at restriction of maxillary growth using orthopaedic appliance or mandibular advancement using functional appliances or a combination of two therapies[1].

Myofunctional and fixed functional appliances are the mainstay of growth modification procedures for skeletal Class II correction[1].

Proffit[2] classified myofunctional appliances as - Tooth borne passive appliances (e.g., activator, bionator), Tooth borne active appliances (e.g., appliances incorporating active springs and screws – Twin block) and Tissue borne appliances: mostly located in the vestibule. (eg.,Frankel`s Functional Regulator)

The major drawback of monobloc appliances were the patient's cooperation as these are single appliances and the patient faced difficulty in speech as well as discomfort during treatment time. These drawbacks of monobloc appliances and Frankel Regulator led to the introduction of Twin block appliance by William J. Clark in 1977 for treatment of Class II malocclusion[3].

Twin block

Philosophy : Cuspal inclined planes play an important part in determining the relationship of the teeth as they erupt into occlusion. Clark believed that the occlusal inclined plane is the fundamental functional mechanism of the natural dentition. If mandible inclined planes are in distal relation to maxillary then force acting on mandibular teeth will have a distal vector leading to Class II tendency. Since, this appliance is worn full time and allows mandibular movements; the masticatory forces can be transmitted from occlusal inclined planes of appliance via the dentition to the bony trabeculae. Hence, the unfavourable cuspal contacts of distal occlusion are replaced by favourable proprioceptive contacts[1]. The forward positioning of mandible by bite blocks results in shortening of lateral pterygoid muscle followed by stretching of articular disc resulting in activation of proprioceptors in these areas and increased vascularity in retrodiscal tissue making it uncomfortable for patient to position his mandible back (pterygoid reflex). As occlusal forces are transmitted through dentition, proprio-ceptors in teeth and periodontium also initiate a proprioceptive stimulus. Thus, this proprioceptive sensory feedback mechani-cally controls the muscular activity and provides a functional stimulus for downward and forward positioning of condyles in glenoid fossa, which is balanced by upward and backward pull in muscles supporting the mandible. This allows adaptive skeletal remodelling in response of functional stimulus.

During the evolution of technique, the angulation of the inclined plane varied from 90° to 45° to the occlusal plane, before arriving at an angle of 70°. At 90° the patient had to make a conscious effort to occlude in a forward position, which was difficult for the patient to maintain and the patient would revert back to his old distal occlusion position. This was resolved by altering the angulation of the bite blocks to 45° to the occlusion. At 45° the occlusal inclined planes produced equal vertical and horizontal component of forces, whereas more of horizontal component is desired for forward positioning of mandible. Hence, the angulation was finally changed to 70° to the occlusal plane to apply a more horizontal component of force[1].

Advantages of Twin Block

There is less interference with normal function because the mandible can move freely in anterior and lateral excursion without being restricted by bulky one-piece appliance. Patient's speech is normal as tongue movement is not restricted. The patient's appearance and profile is noticeably improved immediately which is an excellent patient motivator[1].

The ease of incremental mandibular advancement without changing the appliance is possible.

Other advantages include its versatility in being able to correct sagittal, transverse and vertical discrepancies. By incorporating midline jackscrew, a deficiency in the transverse plane, often encountered with a skeletal Class II can be corrected. This helps to optimise the safety valve mechanism by which expansion in maxillary arch helps in the forward growth of mandible. Vertical development to correct deepbite is done by sequential trimming of upper bite block at each appointment by 1-2mm in occlusodistal direction to allow eruption of mandibular molars till it comes in occlusion. During trimming the leading edge of the inclined planes of the upper bite block should remain intact leaving a triangular wedge in contact with lower bite block. When the lower molars have erupted into occlusion, a lateral openbite is evident in premolar region that is reduced by trimming the upper occlusal surface of lower bite block by 2mm, while maintaining the adequate inclined plane.

Case Selection

The important factors while selecting a case for standard twin block are

1. Skeletal Class II division 1 malocclusion with minimal crowding
2. Growth potential should be present

3. Orthognathic maxilla and retrognathic mandible
4. Positive VTO
5. Upright/retroclined mandibular incisors

Bite Registration

Bite registration is the first step before fabrication of any myofunctional appliance. Generally the mandible is positioned forward by 70% of its maximum protrusive movement, thereby bringing incisors in edge to edge relationship and for large overjet reductions stepwise advancement is preferred. The vertical considerations include 2mm interincisal clearance with not less than 5mm of wax thickness in premolars. If interocclusal clearance is >4mm in premolars, then vertical thickness of wax can be increased accordingly. The wax bite with models is articulated for fabrication of Twin block.

Standard Twin Block (Fig 1)

The original appliance designed by Clark[1] was simple to construct and had the following components:

1. Maxillary and mandibular acrylic plates with bite blocks with steep inclined planes constructed at 70° to the occlusal plane.
2. Delta claps on upper first molars and lower first premolars.
3. Ball end clasps on lower anteriors.
4. Labial bow to retract the upper incisors (indicated in cases of proclined upper incisors). The labial bow is activated after skeletal correction is achieved.
5. Expansion screw in upper base plate so as to have transverse coordination with mandibular arch on being forwardly positioned.

The original design of the twin block appliance can be modified to meet the treatment goals of individual patients. Based on the patient needs, various authors have customised the original design of the appliance but it is difficult to find all the modifications in one place. So, the aim of this review article is to describe the various modifications and the indications of these modified designs of the twin block appliance.

Modifications of Twin Block

The following modifications of twin block are seen:

For treatment of Class II division 1 malocclusion:

1. Fixed twin block
2. Twin block with Hyrax
3. Twin block with lower acrylic labial bow
4. Twin block with lower labial bow
5. Twin block with lower lip shields
6. Twin block with two expansion screws in maxillary plate
7. Twin block with expansion screws in both maxillary and mandibular plates
8. Twin block for step wise advancement
9. Twin block with high pull head gear
10. Magnetic twin block

For treatment of Class II division 2

1. Twin block with double cantilever spring
2. Twin block with additional anterior screw
3. Twin block with three screws
4. Twin block with Three way screw/ Y-shaped screw

For treatment of Class III

1. Reverse twin block
2. Twin block with reverse pull facial mask
3. Twin block hybrid appliance

Treament of Class II Div 1 Malocclusion

1. Fixed Twin Block

· **Indication:** In patients who are not motivated enough to wear appliance for 24hrs.

· Patients who are at or just beyond pubertal growth spurt.

· **Design:**

1. The upper block attached to Palatal Arch

a. This component consisted of a transpalatal arch soldered to wire assembly adapted along the gingival margins of the maxillary posterior teeth. The occlusal inclined planes were made of acrylic over the wire assembly on the posterior teeth. The inclined planes can also be secured by occlusal wire tags that are an extension of the transpalatal arch. These occlusal inclined planes can be either cemented directly or the entire assembly can be secured in Wilson lingual tubes on upper molar bands by the standard Wilson plug in attachment[1] (Fig 2).

b. Instead of a transpalatal arch, a continuous transpalatal bar can be incorporated in the design[1] (Fig 3).

2. The lower block attached to Lingual Arch

a. The occlusal inclined plane component in the lower arch is combined with the lingual arch (conventional or Wilson 3D lingual arch), and extends over the occlusal surfaces of the lower deciduous molars, or premolars, depending on the stage of development[1] (Fig 4).

2. The Twin Block Hyrax Appliance (Fig 5)

· **Design:**

· Transverse development can be combined simultaneously with mandibular advancement by adding twin blocks to a rapid maxillary expansion appliance.

· The lower appliance same as fixed twin block[1].

3. Appliance with lower acrylic labial bow[4] - Mills CM (1998) (Fig 6).

· **Design:**

· The appliance consisted of acrylic labial bow to improve retention of lower appliance and hooks for vertical elastics to be worn at night soldered on to the delta clasps of upper/lower appliance

4. Appliance with lower labial bow[5] (Fig 7):

· The lower acrylic labial bow of above appliance is replaced with a lower labial bow.

5. Twin block with lower lip shields[6] (Fig 8):

Applying Frankel's philosophy to standard appliance, lower lip pads are added to break up abnormal perioral muscle habits (lip trap etc.), shield away the undesirable effects of lip musculature and to exert a stretch effect on underlying periosteal layer enhancing basal bone development.

· **Design:**

· Rhomboidal or parallelogram lower lip pads made of acrylic are added to the lower base plate which is rested away from the gingival tissues in the vestibule.

6. Twin block with two expansion screws in maxillary plate[7] (Fig 9).

Used for simultaneous expansion in anterior and posterior region in constricted arches

7. Twin block with expansion screw in both maxillary and mandibular plates[8] (Fig 10).

· Combination of Schwarz appliance and twin block.

· Maxillary plate – standard appliance with expansion screw

· Mandibular plate – screw is added in the midline, called as Bowbeer Appliance.

8. Modified Twin-Block Appliance for Stepwise Overjet Reduction[9] (Fig 11)

· Gradual advancement of the bite chairside provides a greater orthopedic effect with less incisor tipping in Class II, division 1 cases with overjet >10mm

· Advancement screws are incorporated in the maxillary blocks and activated by the insertion of cylindrical acetal resin spacers of various thicknesses.

· Bite reactivations of as much as 7mm can be readily achieved using the standard 12mm advancement screws.

· For greater activations, the longer 16mm or 20mm screws may be required.

9. Twin-block appliances combined with highpull headgear and torquing springs[10] (Fig 12)

· Used in Class II division 1 case with prognathic maxilla, retrognathic mandible and vertical growers.

· The twin block appliance with highpull headgear controls vertical and sagittal growth of maxilla while allowing the mandible to autorotate and increase its forward displacement.

· Highpull headgear also maintains the palatal plane, and prevents posterior rotation of maxilla, occlusal and mandibular plane.

· **Design:**

· Maxillary base plate – torquing spurs are positioned on the maxillary central incisors to prevent their unwanted retroclination, flying headgear tubes are embedded in the acrylic bite next to the maxillary second premolars or first molar for high-pull headgear, exerting an extraoral force of 400g per side, worn 12 hours per day.

· Mandibular base plate – similar to the standard design.

10. Magnetic Twin Block[1] (Fig 13)

· The purpose of magnets in twin block therapy is to encourage increased occlusal contact on the bite blocks to maximize the favorable functional forces applied to correct the malocclusion.

· Both Samarium Cobalt and Neodymium Boron magnets have been used as attractive magnets. Neodymium Boron delivers a greater force from a smaller magnet.

· Magnets should be used only when speed of treatment is an important consideration or when the response to non magnetic appliance is limited.

· **Attracting magnets**

1. Increased activation can be built into the initial construction bite for the appliance.
2. The attracting force pulls the appliances together and encourages the patient to occlude actively and consistently in forward position.
3. The functional mechanism of twin block stimulates a proprioceptive response by repeated contact on the occlusal inclines.

· **Repelling Magnets**

1. They may be used in twin blocks with less mechanical activation built into the occlusal inclined planes.
2. The repelling magnetic force applies additional stimulus to the forward posture as the patient closes into occlusion.
3. The repelling magnets can be used to induce additional forward mandibular posture without reactivation of the blocks.

· **Disadvantage:**

1. The amount of activation is not clear and reactivations of inclined planes deactivate the magnets.
2. These appliances tended to create a large posterior open bite, which had to be corrected using fixed appliances.
3. They do not have the desired vertical dimension control.

Treatment of Class II Division 2 Malocclusion:

Retroclined upper incisors are responsible for the distal position of the mandible. In such horizontally growing patients, labial tipping of the upper incisors is required to correct the distal occlusion.

1. Appliance with a double cantilever spring[11] (Fig 14): To advance the retroclined upper incisors, the springs are added lingual to the upper incisors

2. Twin Block appliance with additional anterior screw[11] (Fig 15): The design is modified by addition of sagittal screw in the appliance for advancing the upper incisors labially and upper buccal segment distally.

· The antero-posterior positioning of the screws and location of the cuts determine whether the appliance acts mainly to move upper anteriors labially or to distalize the upper posterior teeth.

· If the anterior cut is positioned distal to the canines or first premolars, its increases the distalization of posterior teeth.

· Activation

· One-quarter turn twice weekly.
· Less activation in older children.

3. Twin Block Appliance with two screws in different directions[8] (Fig 16):

· The two screws are used to improve arch form both sagittaly and transversely.

4. Twin Block with Three way screw / Y-shaped screw[8] (Fig 17)

This incorporates two screws housed in a single unit, which can be operated independently to expand the transverse and sagittal dimension.

Treament of Class III Malocclusion

1. Reverse twin blocks[1] (Fig 18)

· Correction of Class III malocclusion is achieved in twin block technique by reversing the occlusal inclined planes to apply a forward component of force to the upper arch and a downward and backward force to the mandible.

· **Design:**

· Three-way expansion is usually required in the upper arch to develop the maxilla anteroposteriorly and transversely.

· Sagittal screws cut anterior to the upper molars have the effect of increasing the activation of the inclined planes to advance the premaxillary segment by driving the blocks distally against the resistance of the lower inclined planes.

2. Twin block with Reverse Pull Facial Mask[12] (Fig 19)

· The reverse pull facial mask applies an additional component of orthodontic force to advance the maxilla by elastic traction (Delaire) attached to the upper twin block to maximize the forward component of force on the maxilla.

3. Twin Block hybrid appliance[8] (Fig 20)

· This modification is done to increase the forward movement of the incisors by adding upper lip pads (which are originally used in the Frankels appliance) attached to the upper anterior segment of the twin block.

Phases of treatment with Twin block:

The Phase I consists of active phase with Twin block extends over a period of 6-9months and accomplishes skeletal correction in sagittal and transverse plane. This is followed by vertical correction in support phase by selective trimming of bite blocks. Retention phase is achieved by guide planes or Rickonator and patient can be shifted to Phase II fixed Orthodontic therapy for finishing and detailing of occlusion.

Conclusion

Over the years Twin Blocks remains as one of the most commonly used removable functional appliance. Its advantages over other functional appliances are multifold.

By selecting different modifications as per the requirement of case, the correction of skeletal and dental discrepancy can be achieved as part of Phase I therapy, thereby reducing duration of Phase II therapy.

References:

References are available on request at editor@healtalkht.vom

Fig 1. Standard Twin Block

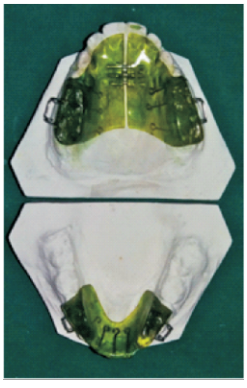


Fig 2. Upper Fixed Twin Block attached to Transpalatal arch

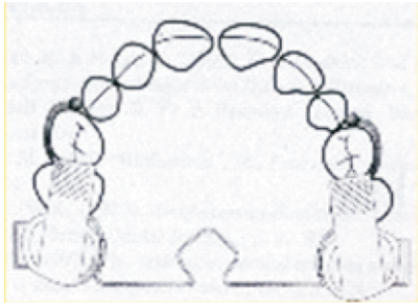


Fig 3. Upper Fixed Twin Block attached to Transpalatal bar

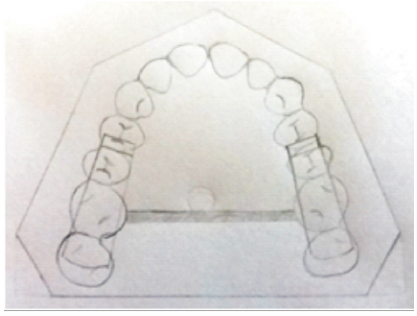


Fig 4. Lower Fixed Twin block attached to Lingual arch

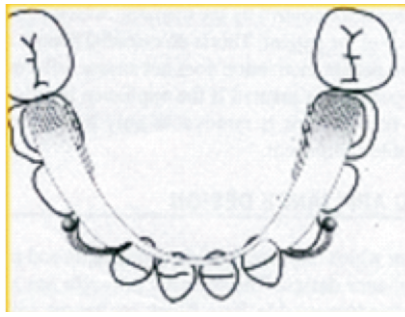


Fig 5. Upper Fixed Twin Block attached to Hyrax

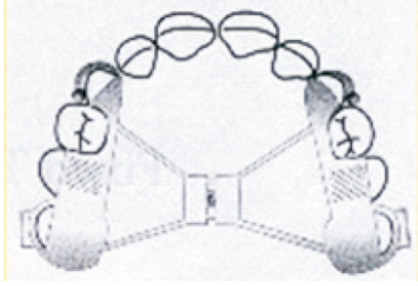


Fig 6. Twin block with lower acrylic labial bow

Fig 7. Twin block with lower labial bow

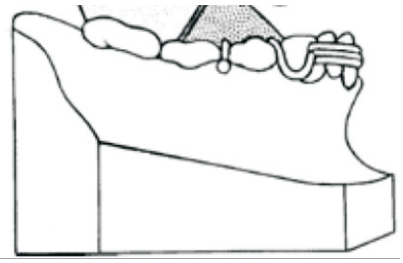


Fig 8. Twin block with lower lip shields

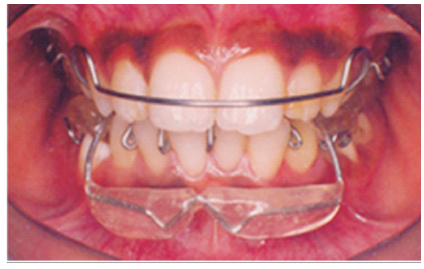


Fig 9. Twin block with two expansion screw

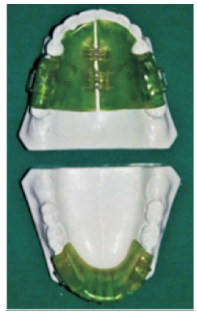


Fig 10. Twin block with expansion screw in maxillary and mandibular plates

Fig 11. Twin block with advancement screw

Fig 12. Twin block with torquing spurs and headgear tubes

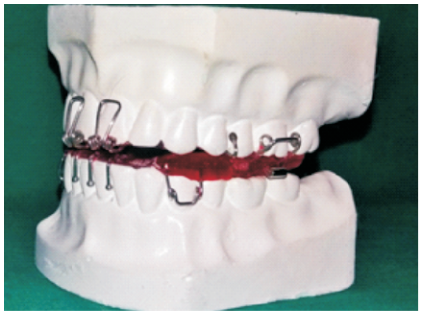
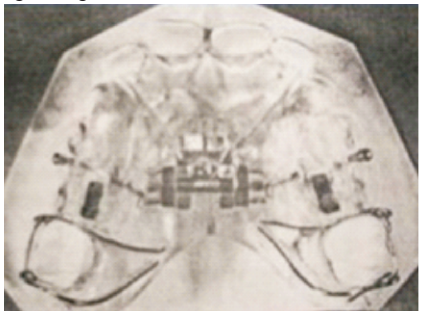


Fig 13. Magnetic Twin block



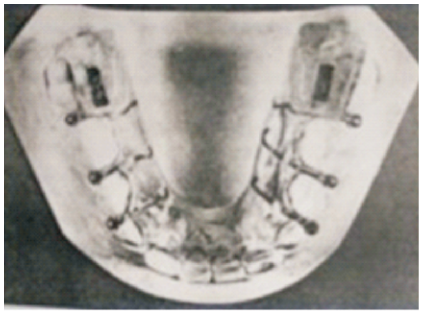


Fig 14. Twin block with double cantilever spring

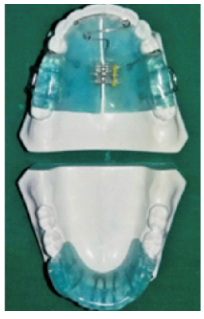


Fig 15. Twin block with additional anterior screw

Fig 16. Twin block with sagittal and transverse screw

Fig 17. Twin block with 3-way screw

Fig 18. Reverse twin block

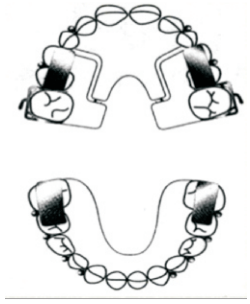


Fig 19. Twin block with reverse pull face mask

Fig 20. Twin block hybrid appliance