Myofunctional Appliances

(Twin Block Example)

A Continued Education Lecture

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Definitions

Treatment	Appliance	Target
Orthodontic	Fixed/removable	PDL proprioceptive fibers/teeth
Orthopedic	EOT/Headgear, chin cup and reversed headgear	Periosteum/bone remodeling+ PDL
Functional/ Myofunctional Orthopedic	Frankel/ Twin Block, Herbst…	

What is functional appliance?

A removable or fixed interceptive orthodontic appliance usually used in class II div1

utilizes or eliminates forces of facial muscles and muscles of mastication

modifies the growth at the maximum pre-pubertal age

by posturing the mandible forward and restraining the maxillary growth

History of functional appliances

"bone development might be adapted to functional and nutritional stimuli"

Wilhelm Roux (1881)

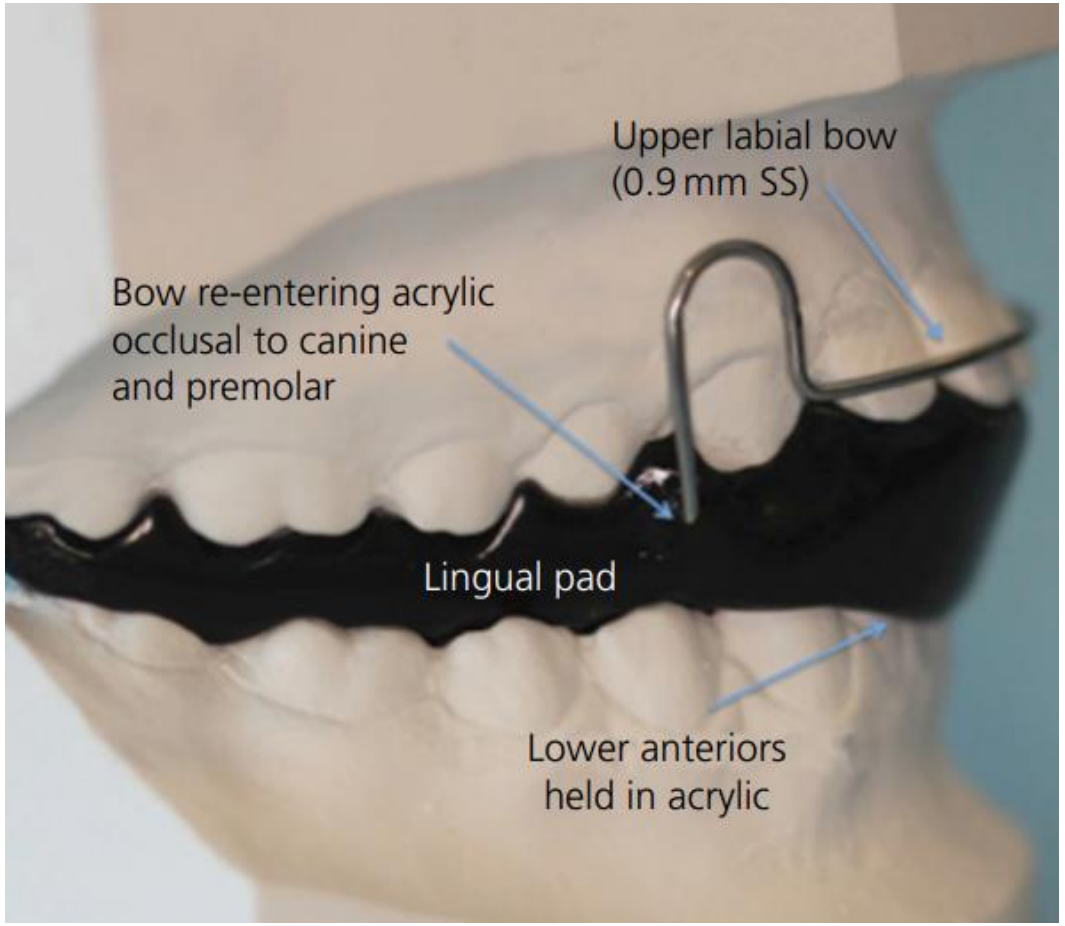
- origin in Europe
- use of precious metal alloys was banned due to World Wars
- functional appliances freshened as alternative solution.
- role of Pierre Robin
- Edward Angle made a modification to molar bands to posture the mandible forward to address Class II occlusion
- Nowadays, removable functional appliance more popular in Europe but in US fixed ones

Myofunctional jaw orthopedic appliances

Activator

Originated by Andresen and Karl Haupl in Norway in 1908 and subsequently popularized as the Andresen–Häupl appliance.

- Rigid
- tooth-borne
- bulky appliance
- loosely fitting
- Has grooves to produce mesial tipping of lower teeth and distal tipping of upper posterior teeth



Bionator

- Wilhelm Balters developed a reduced bulk activator
- It was a one-piece appliance
- The upper and lower components were joined together by a rigid wire

A little agreement in literature on the skeletal effects that this appliance may achieve

Functional regulator

- developed by Dr Rolf Fränkel in East Germany 1967
- Dr Fränkel adopted Moss functional matrix theory
- tissue-borne appliance
- buccal shields eliminate buccinator buccal forces on the outside
- rarely used

Limitations

patient cooperation, technical skills construction and design, and careful case selection

4 versions

FR1	Class II malocclusion with malaligned teeth
FR2	large overjet or deep overbite
FR3	for the correction of Class III
FR4	for the correction of anterior open bite

Fixed functional appliances

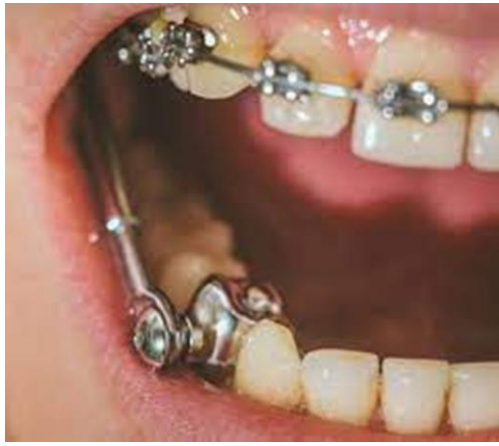
advantages

- less patient compliance
- offer 24-hour wear under forces of mastication
- enabling the clinician to bond fixed orthodontic appliance

disadvantage

- risk of fatigue and breakage.

Herbst appliance



- the most popular in the US and parts of Europe
- Developed in 1905 by Herbst but popularized 1970 by Pancherz
- Fixed upper and lower splints with an interconnecting piston

Disadvantages

It is robust/rigid but still subjected to breakage of piston mechanism due to masticatory lateral excursions

HOW WORKS?

All functional appliance used in Class II correction involve:

- stretching of the tissues
- transmission of forces from the stretched muscles through the appliance to the dentition
- restraint of maxillary growth with full-time wear
- forward posturing the mandible by remodeling/associated changes in the position of the glenoid fossa and condyle

WHEN WORKS?

Craniofacial growth

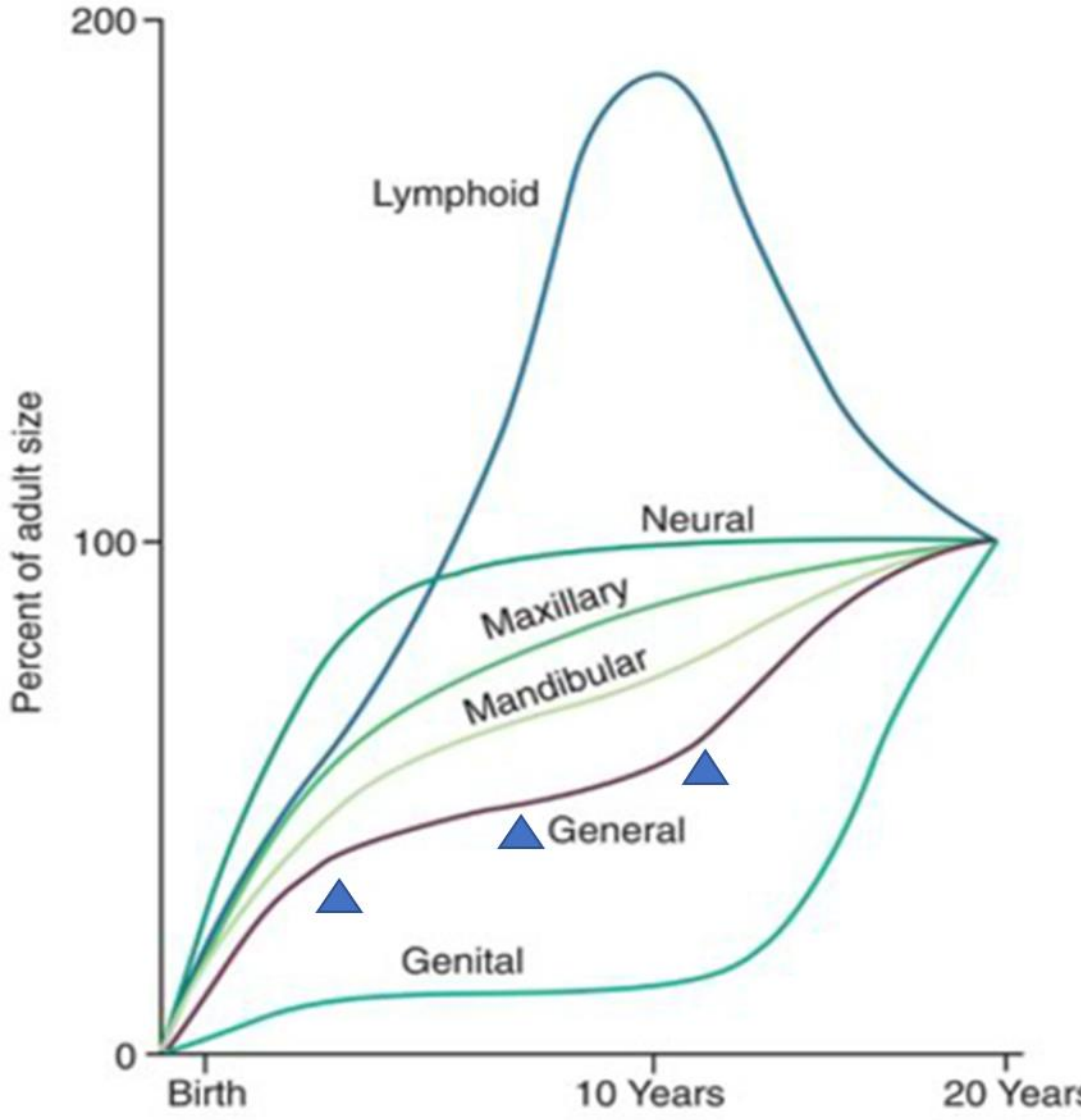
Both maxilla and mandible develop from intra membraneous ossification

But different in:

- timing
- curve of events

❑ growth spurts are 3

Arbitrarily chronological age of 10 to 13 years in females and 11 to 14 years in males is **acceptable as pubertal growth spurt**

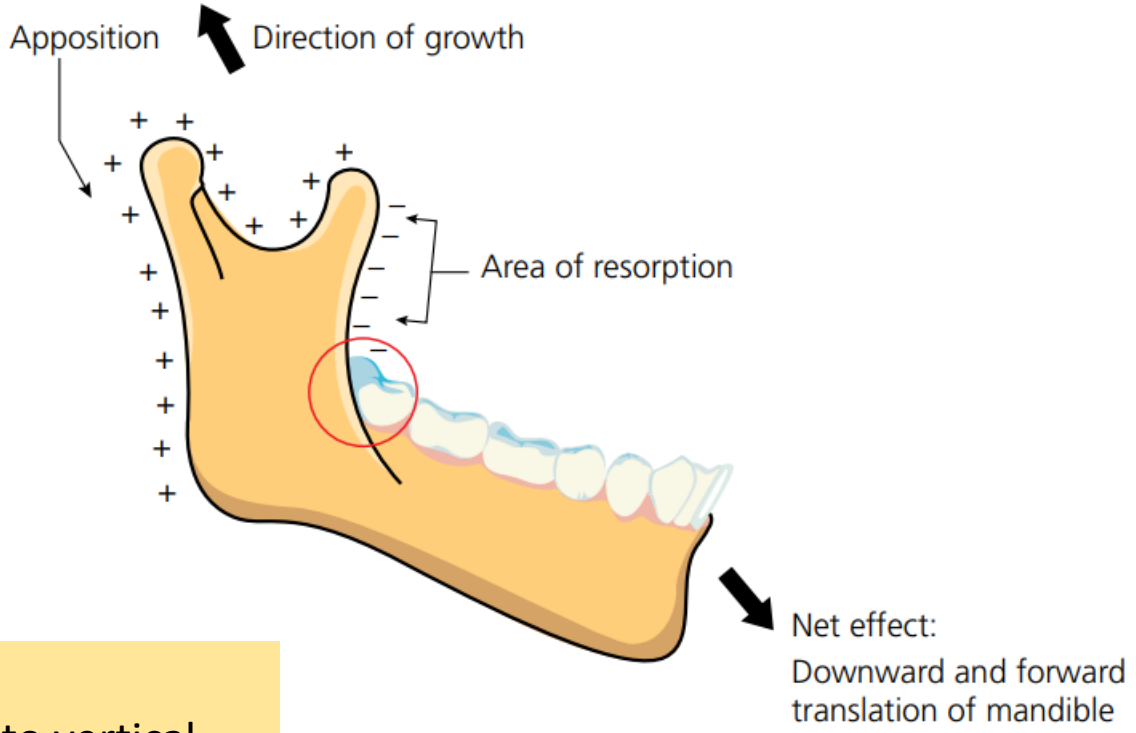


SCAMMON CURVE

Genetic vs epigenetic control

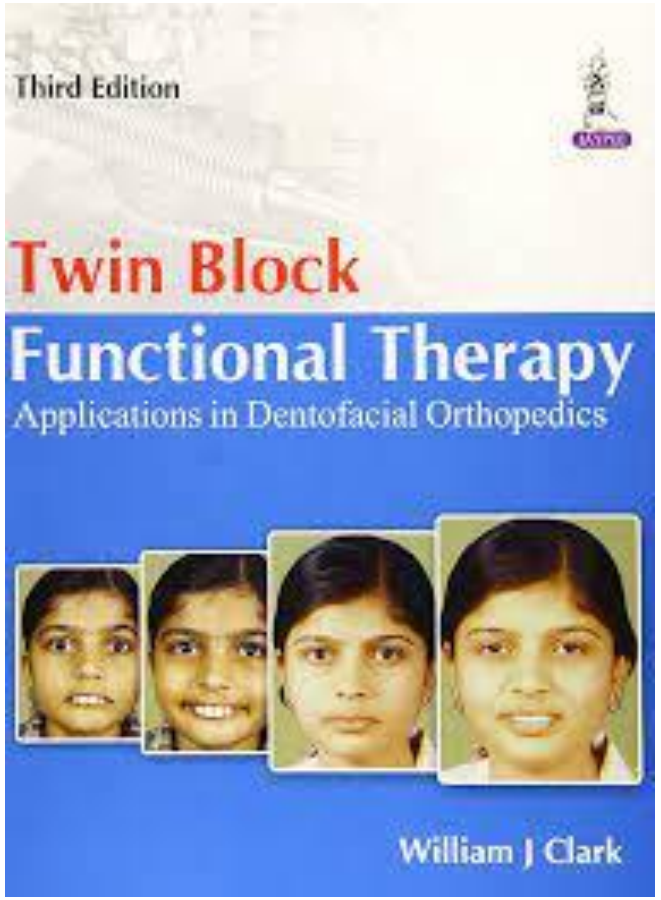
Controversy/debate between 2 schools:

- Classic: strict genetic control (primary growth center)
- Moss functional matrix hypothesis: epigenetic (indirect genetic control) affected by soft tissues matrix signals
- Proffit suggests that maxilla growth → interlocking of the occlusion → mandibular forward translation

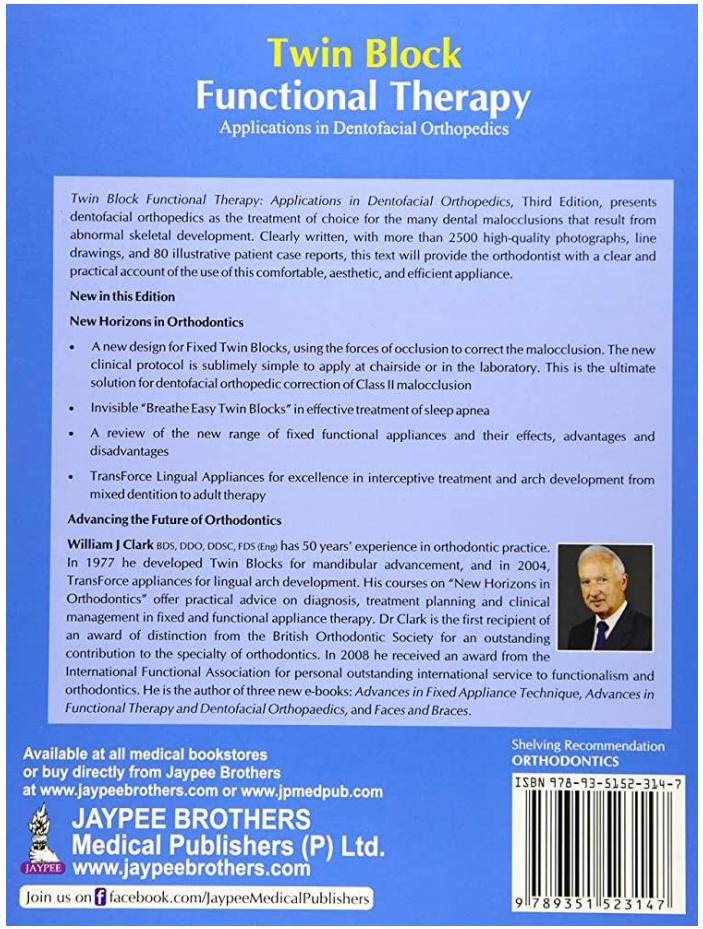


Net results are downward forward rotation via:
1- condylar growth in a posterior and superior direction leads to vertical displacement
2- resorption / deposition (remodeling) leads to forward movement of the ramus

TWIN BLOCK



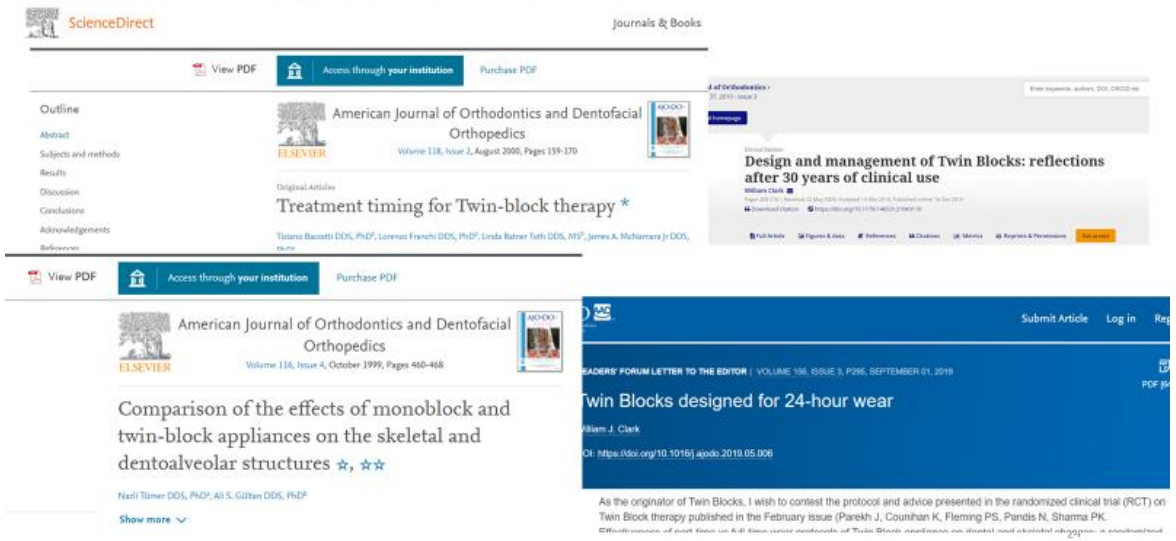
Developed by William Clark in 1977
Dundee University/ Scotland/UK



Twin Block

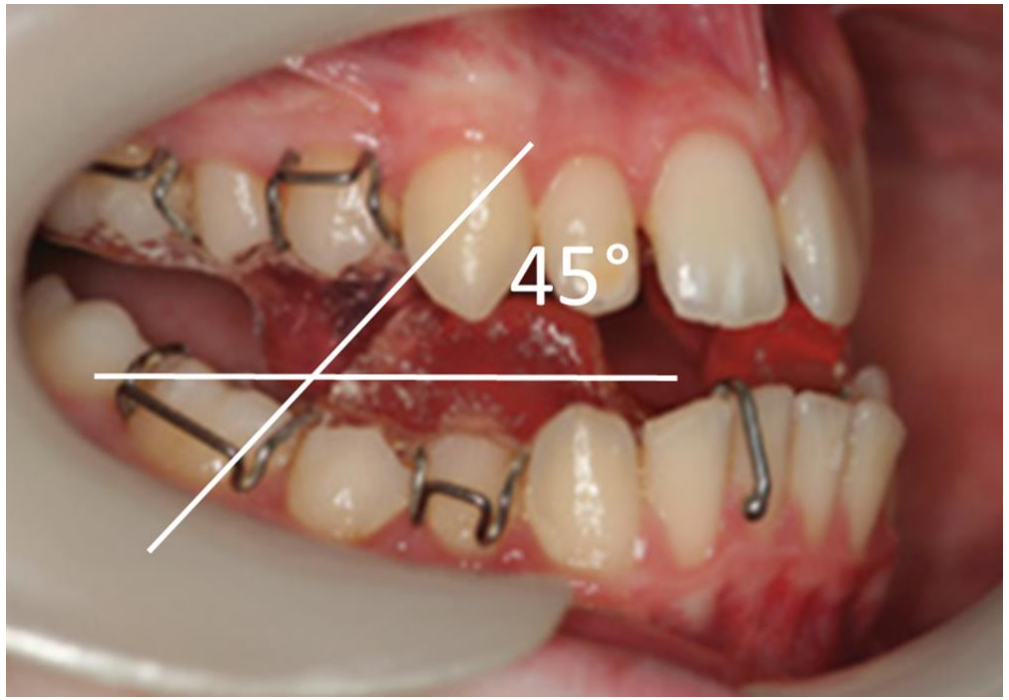
- *The story of its invention*
- most popular functional appliance in the UK
- primarily aimed at correction of mandibular retrognathia
- largely alternative to functional regulators and activators
- subject of a number of controlled clinical trials due to its effectiveness

Evidence-based Twin Block

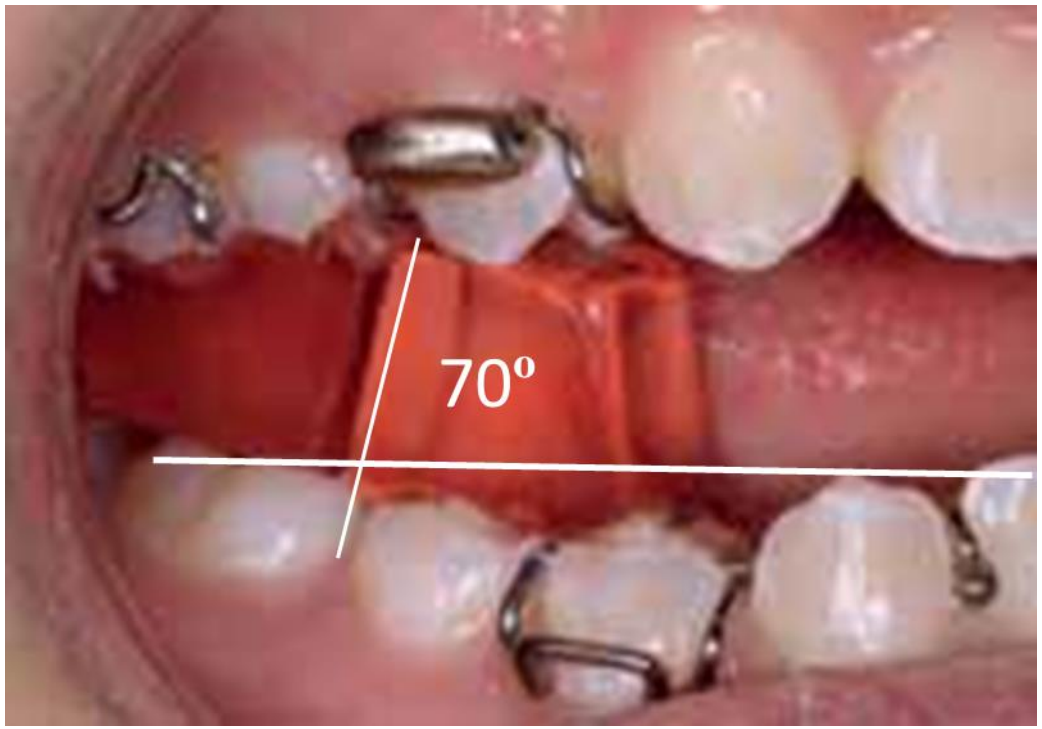


Component parts and design

First the inclined plane was set at 45 degrees, Clark subsequently modified the design to increase the depth of the blocks, which are now set at approximately 70 degrees with the occlusal plane



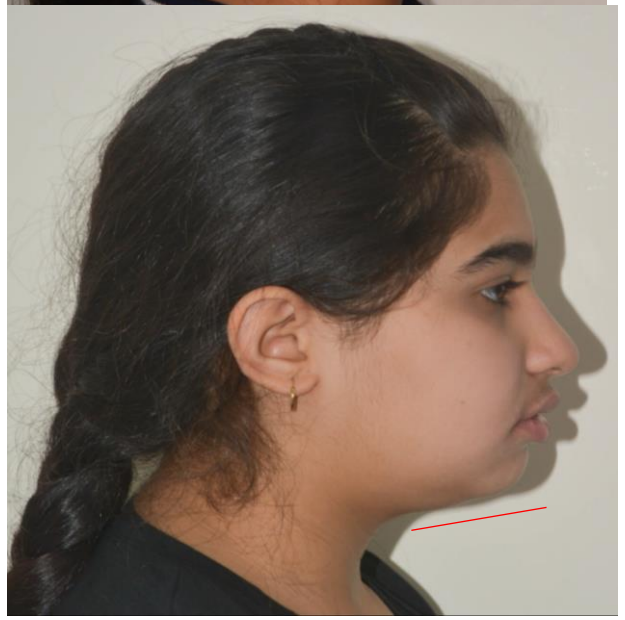
More horizontal force



Advantages of Twin Block

1- Efficiency: Overjet reduction is typically rapid < 6 months.

- straightening of the profile
- reduction in facial convexity



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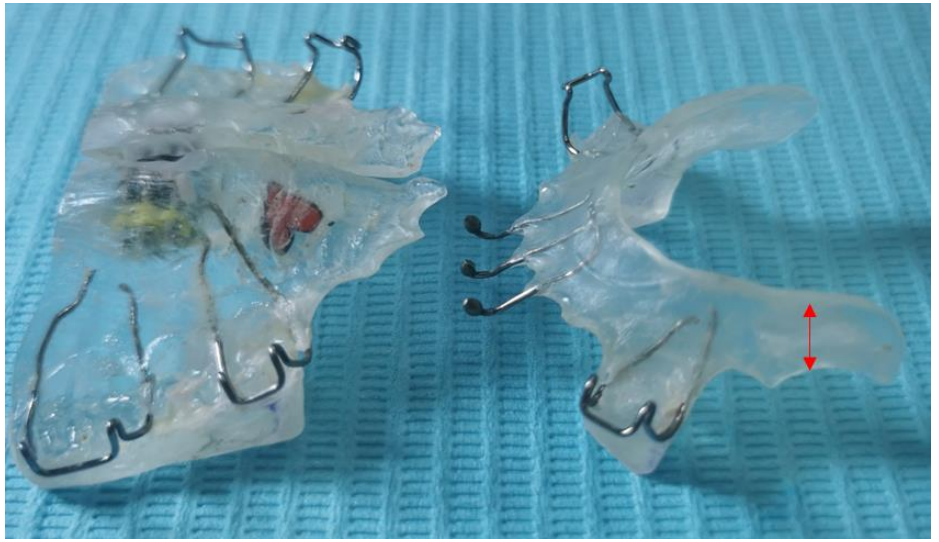
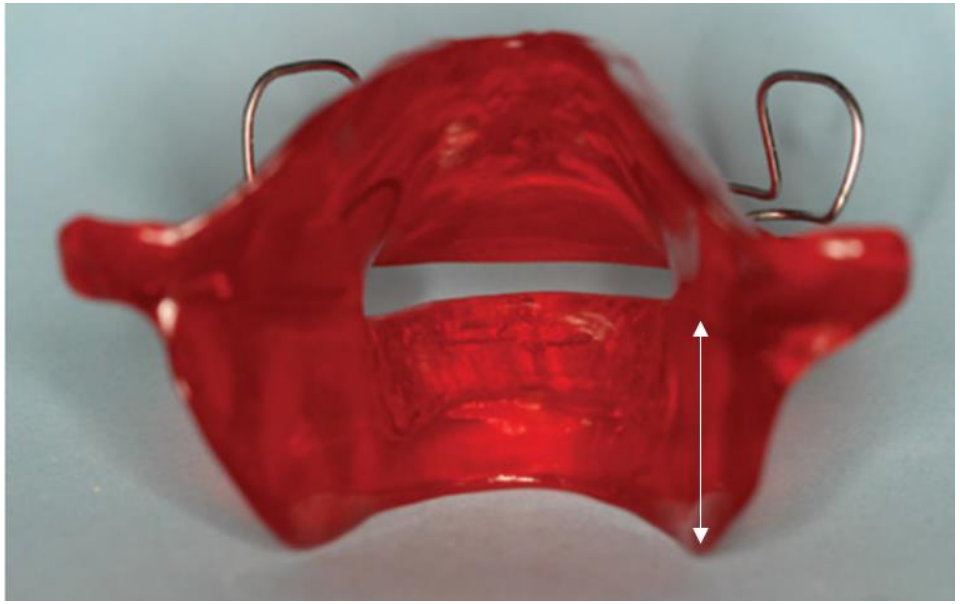
2- Less visible and potentially more comfortable in comparison to other functional appliances

3 - Simplicity and low cost



4- well-extended lower impressions with adequate lingual depth not required

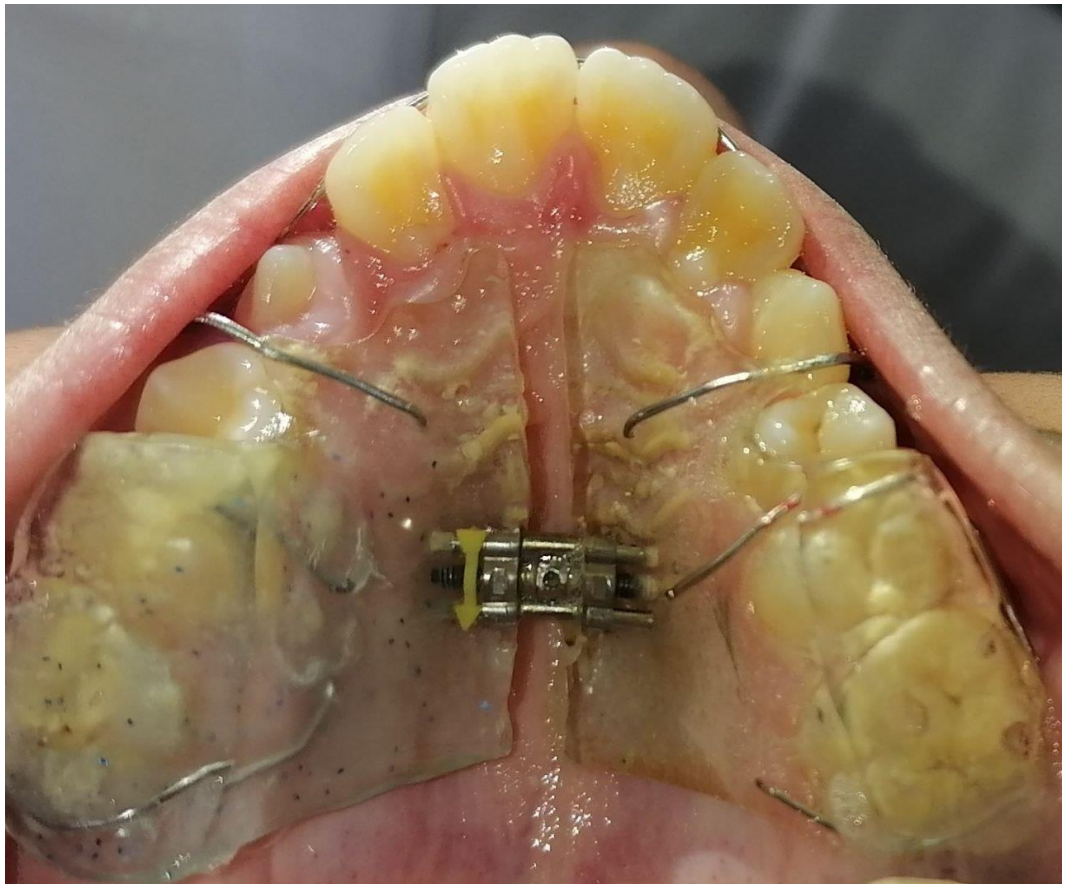


5- Good patient tolerance/Twin Block- induced tolerance

6- Lip trainer

7- Versatility:

It allows concomitant expansion, and there is the ability to add headgear and to vary the design depending on vertical skeletal and occlusal requirements.



Case selection

- when the forward posture of the mandible is aesthetically desirable
- late mixed or early permanent dentition, as there are sufficient erupted teeth to anchor and retain the appliance
- preferable, complete eruption of the 4s /upper 6s is desirable to allow optimal retention of the appliance
- patients should ideally be sufficiently mature to understand the objective of the appliance and the requirement to establish a forward habitual posture

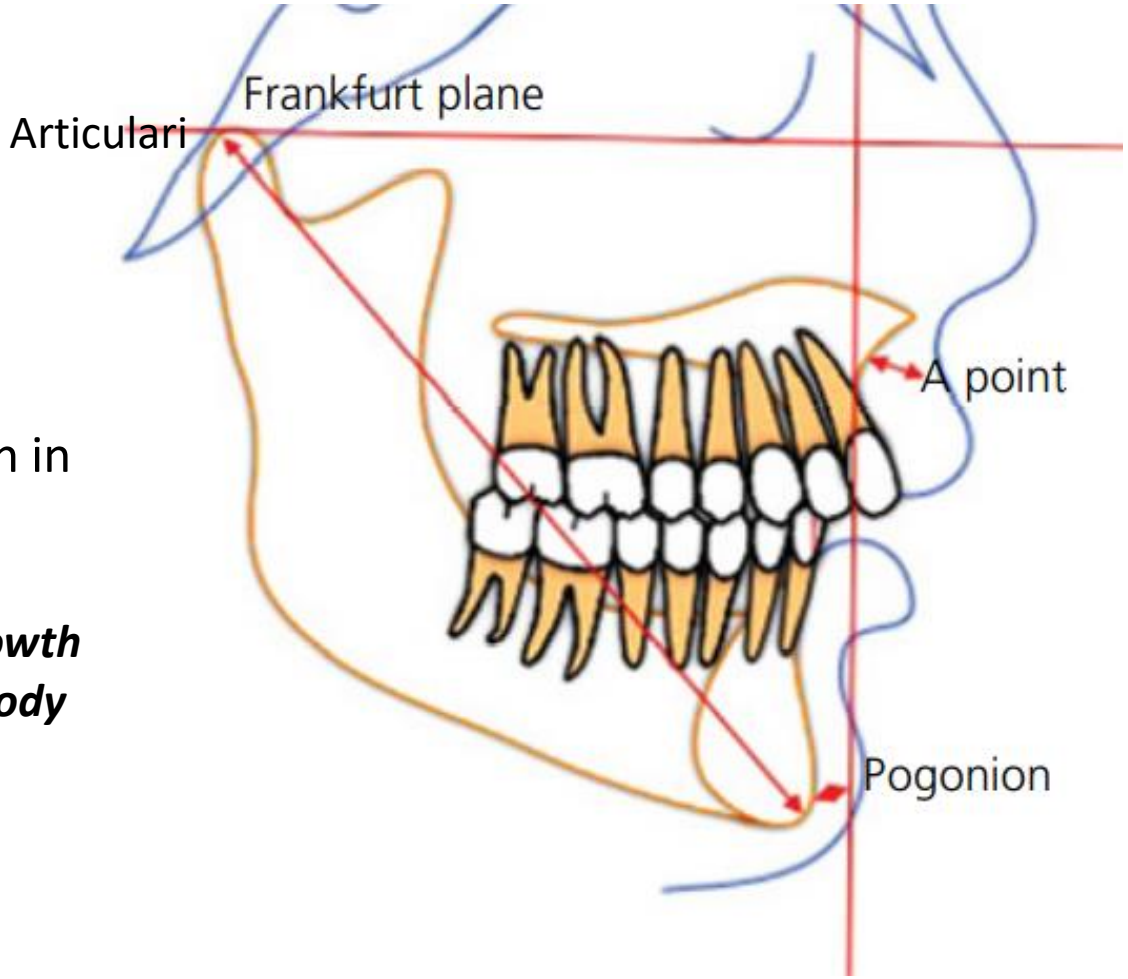
Limitations

- removable nature
- excellent compliance to achieve Class II correction
- limited capacity to integrate with fixed appliances

Is the mandible length increasing in response to Twin Block

Woodside et al (1987) found that activation of the appliance by 7–10 mm resulted in postural forward movement of the mandible without significant growth in its length.

Mossey (2016) stated "***it is not possible to stimulate growth to produce an ultimate increase in mandibular ramus or body length beyond that which is genetically predetermined".***



What may happen in the glenoid fossa?

The visco-elastic theory

The condylar cartilage is a secondary cartilage capable of regional adaptive growth, contrasting with primary long-bone epiphyseal articular cartilages

“condyle is unique and acts as the ‘pacemaker and organizer of mandibular growth”

Sarnat and Robinson

EFFECT OF THE APPLIANCE ON THE SOFT TISSUES

1-deep labio-mental fold will be flattened

2- anterior oral seal development

3-incompetent lips associated with a lower lip trap behind the maxillary incisors tends to improve resulting in a prolonged stability

4-however, lip incompetence without a lip trap due to increased vertical skeletal dimension, interfering with the response to Twin Block therapy.

MSc
Russul

Contraindication

If the forward posture produces excessive lip incompetence, it is likely that the anterior vertical facial dimension is increased, and a Twin Block is unlikely to be appropriate.

Nevertheless, in these patients:

- restraint of vertical maxillary growth should be attempted
- encourage a more horizontal vector of forward mandibular growth by
- restricting downward–backward mandibular rotation and adjunctive use of orthopedic headgear

An example of cautious use of Twin Block in patient with maxillary growth excess

- straightening of the profile
- reduction in facial convexity

Before

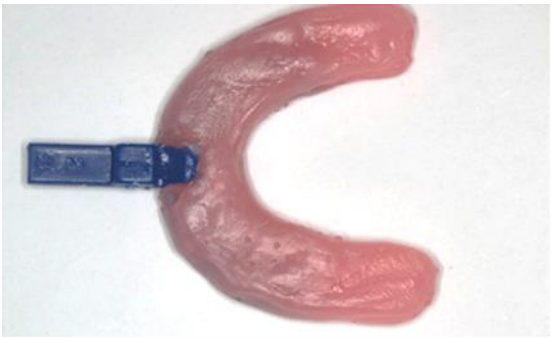
After

MSc Hibba

Bite registration

Correct appliance positioning requires that the lower block engages anterior to the upper block to maintain the forward posture of the mandible

Using EXACTOBITE, bite should be registered when opened beyond the freeway space, and the posterior teeth are 5mm or more out of occlusion



EXACTOBITE

Appliance Insertion

- The upper and lower components are fitted separately and the retention of each is checked.

- The patient should be able comfortably to position the mandible downward and forward with lower block in front of the upper.

Troubleshooting
Uncomfortable wearing may be due to too deep or the protrusion is excessive
1- reduce the height of one or both blocks
2- Ideally it Is better re-register the bite

Wearing time

- Because Twin Block is patient friendly appliance, full-time wear from the beginning is desirable.

- However, often the appliance is removed for eating initially and then worn full time after the first follow-up appointment.

Single step vs 2 steps advancement

- Considerable debate and disagreement have surrounded the merits of incremental/gradual mandibular advancement manner versus one-step advancement.

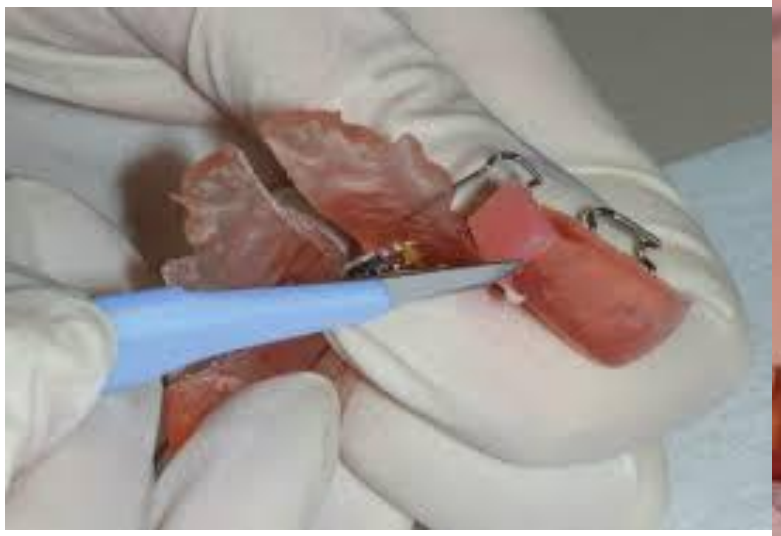
- Intuitively, it would be expected that larger initial advancement may result in greater soft tissue stretch, leading to more pronounced dental changes than with more gradual advancement.

- It appears, however, on the basis of prospective research that little difference in the relative proportion of skeletal to dento-alveolar effects is likely with either approach

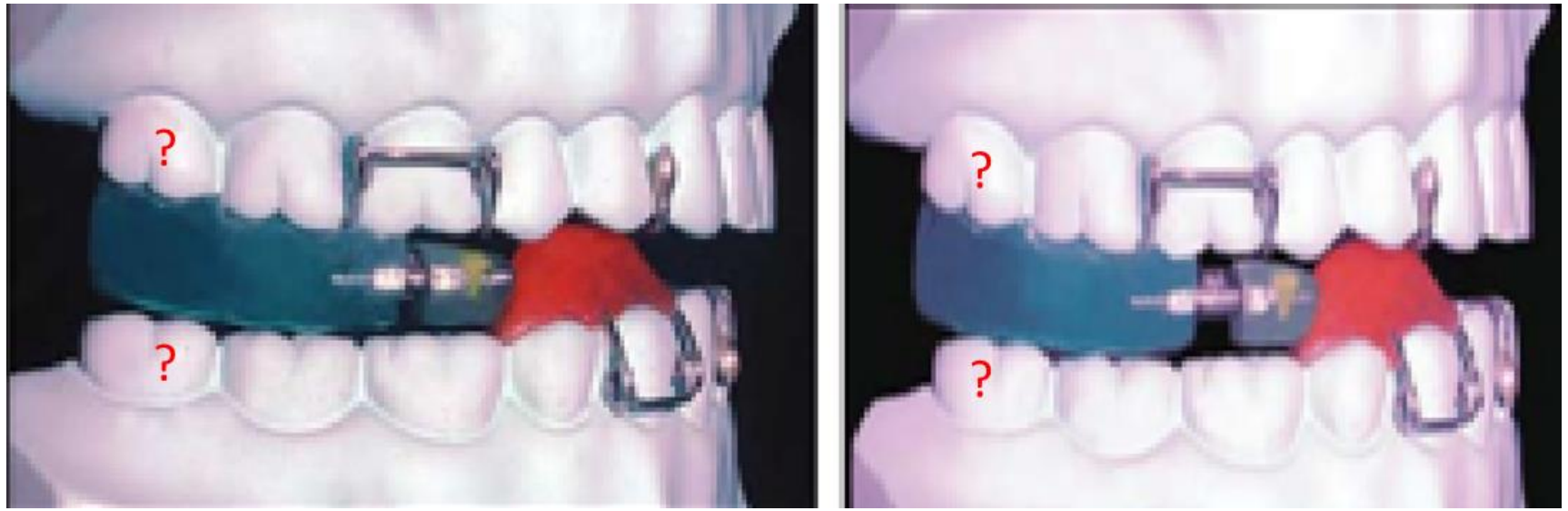
Reactivation of Twin Block

An additional activation is necessary if OJ is >10mm.

1- light cure acrylic on the anterior surface of inclined bite plane



2- Incorporating a jackscrew to advance the upper inclined block

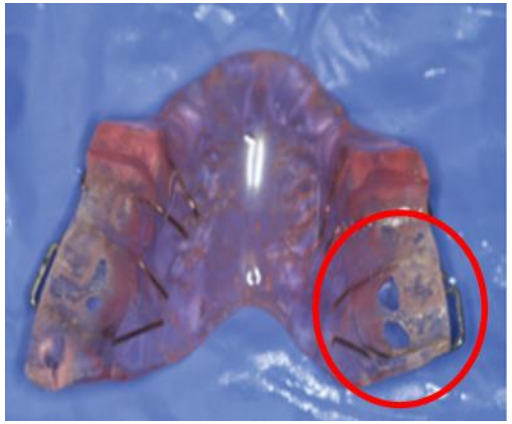


Signs of patient’s compliance

4-6 weeks postinsertion visit, the following signs should be noticed otherwise the patient does not engage with the appliance:

1- Patient speech normally while the appliance in the mouth

2- signs of tear and wear on the appliance



3-patient spontaneously occludes in the new protruded position while the appliance outside

4- a small degree of lateral open bite should present due to the presence of the acrylic blocks and clasping of the first permanent molars.

5- patient can reinsert the appliance confidently

Retention

- Lab work on rats showed type III collagen resorbable after 7months appliance wear.
- However, **O' Brien et al**. doubling the period showed signs of bone formation
- A Twin Block on a nighttime wear basis may be considered to preserve antero-posterior correction
- However, withdrawal of the postured bite at an earlier stage is subject to antero-posterior relapse..

Relapse

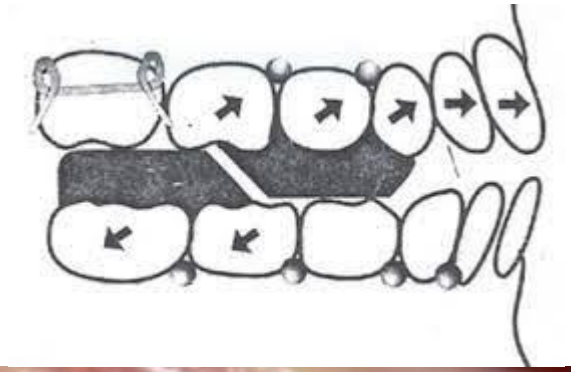
Clinical trials showed after 1 year of full-time appliance wear the overjet relapse is not more than 1 mm.

Treatment Phases

Active phase 1st-6^{th} month
Support phase 6^{th} -9^{th}
Retentive phase 9^{th} -12^{th} /15^{th} month

Modifications

1- Reverse Twin Block



Standard

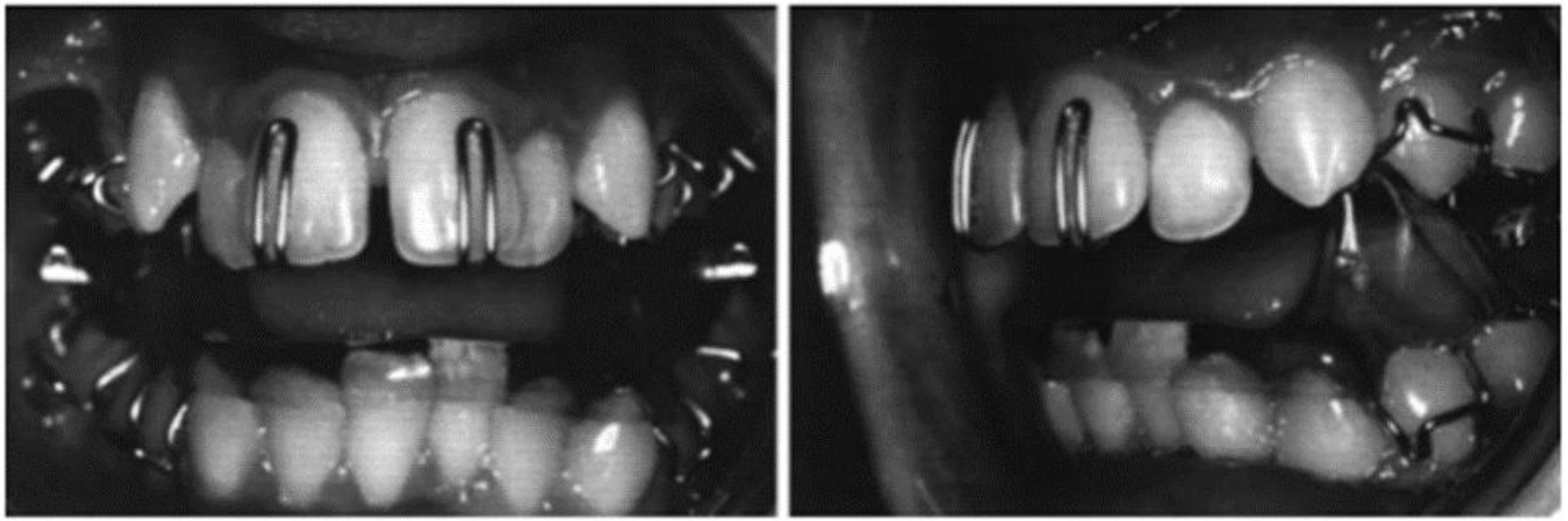
Reversed

2. Twin block with lip pads to work like Frankel III

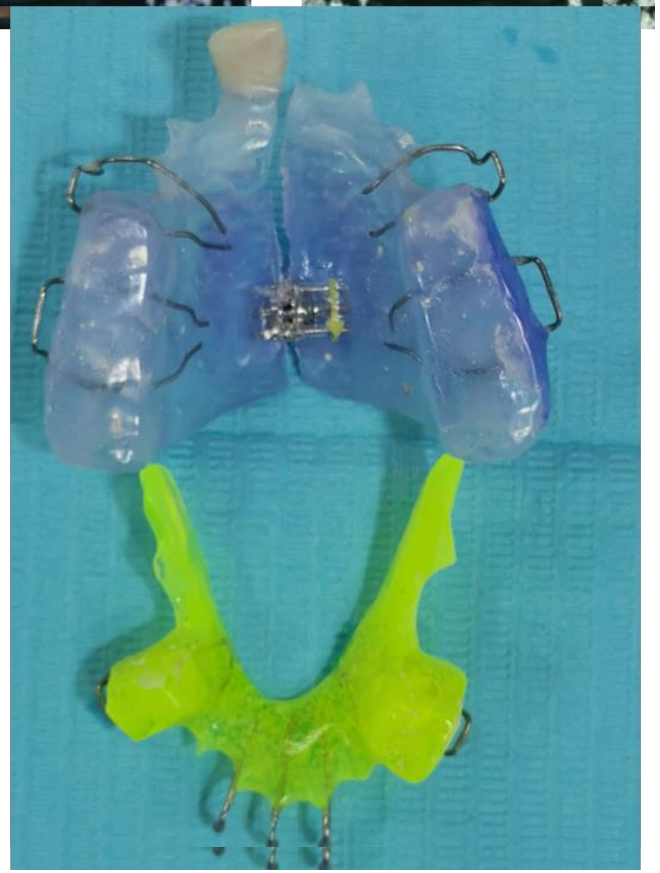
- rhomboidal in shape
- Class III malocclusion is easy to diagnose but challenging to treat.
- It was believed that adding rapid expansion, hyrax screw, could yield more skeletal changes

3- Twin Block to Control Incisor Inclination

The reduction in incisor proclination was statistically and clinically very significant as compared to appliances with labial bow

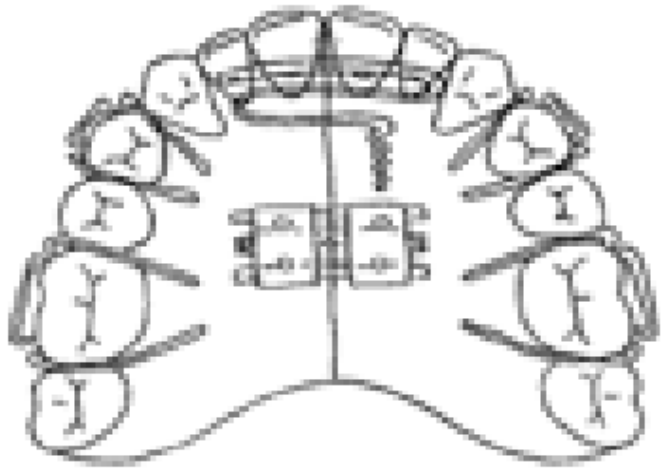


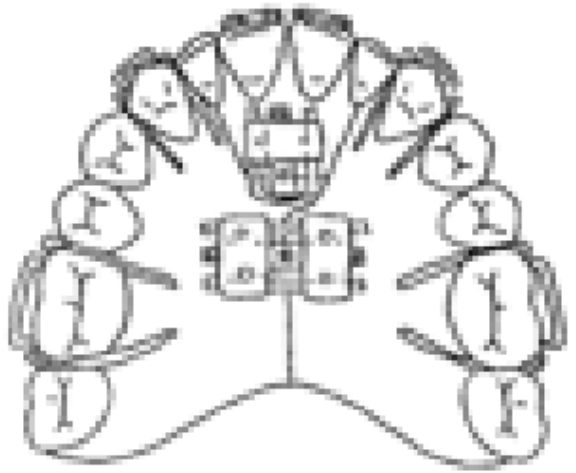
4- Adding teeth to improve esthetics



5- Modified Twin Block for class II div2

Screw
Z spring
T spring





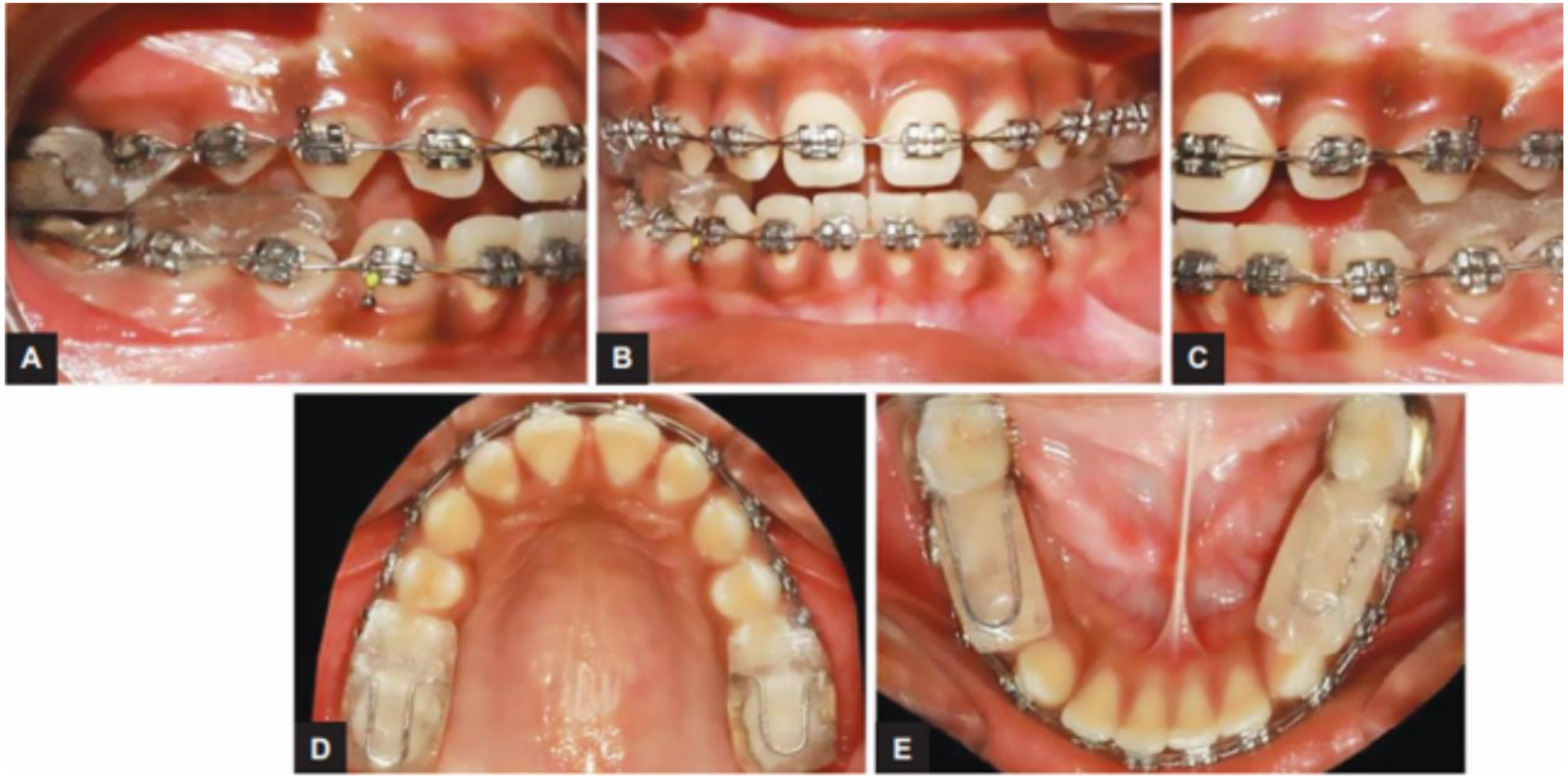
DOI: 10.1093/ORTHO/28.4.271 • Corpus ID: 20307052

The modified twin block appliance in the treatment of Class II division 2 malocclusions.

F. Dyer, H. F. McKeown, P. J. Sandler • Published 1 December 2001 • Medicine • Journal of orthodontics

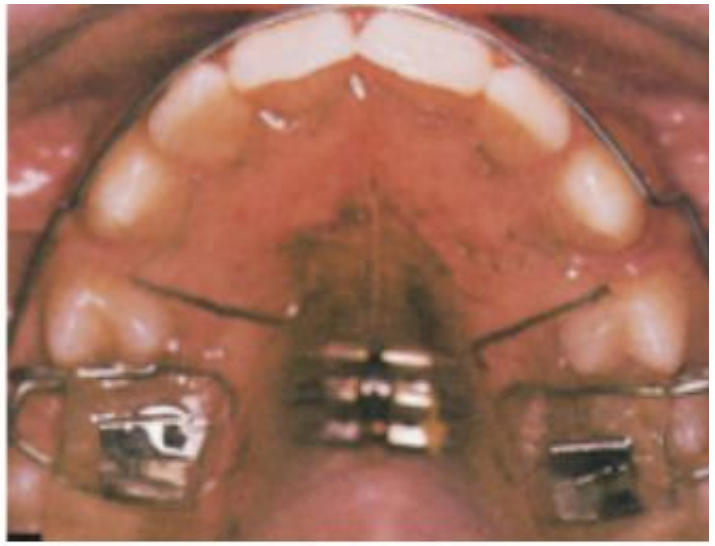
Two case reports illustrate the effective treatment of Class II division 2 malocclusion with modifications to the Twin Block appliance. This approach may reduce the total treatment time and reduce the need for extra-oral anchorage. In each of the cases presented treatment has been carried out on a non-extraction basis with full correction of the malocclusion.

6- Fixed Twin Block



7- Magnetic twin block

Magnets can encourage increased occlusal contact on the bite blocks to maximize the favorable functional forces



To conclude:

1- functional orthopedic therapy comprises one of main interceptive contemporary orthodontic means

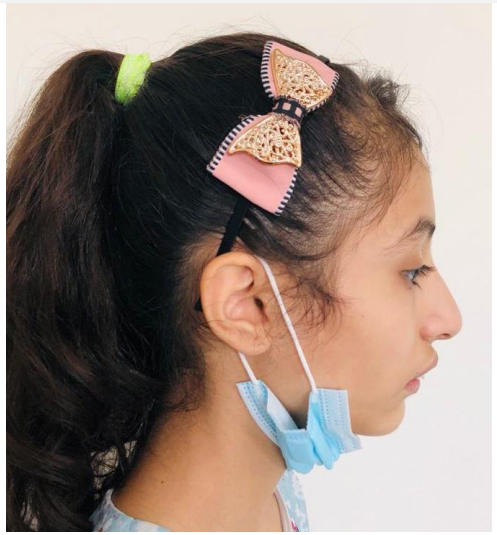
2- mandibular condylar cartilage is primary growth center at infancy and juvenile age, but epigenetically controlled at pubertal age.

3- adaptive condylar/glenoid fossa growth may take place in response to functional therapy rather than a significant increase in mandibular body length

4- Twin Block appliance is the most popular functional therapy in the UK for its versatile properties

5- Colleagues at this department are invited to involve in clinical trials to evaluate the Twin Block efficiency on Iraqi patients

Twin block experience at this school



Twin block at this school

Acknowledgement

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Thank you