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Twin Block, Bionator and Frankel II: comparative study

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Abstract

Many appliances are described in the literature in the second molars class where you want to obtain a mandibular advancement . The aims of this study is to compared, with a literature review using PubMed from 1998 to 2016, dental and skeletal effects of Twin Block, the Bionator and Frankel II. The final results found in our research is that the Twin block appliances determines a greater positive torque of the lower incisors togheter with the benefit of significant mandibular growth. Still today there are different opinions about the mandibular growth, some works in literature said that they are due with the advancement get by the use of these functional device, other says that the mandibular growth is link with the differential growth of the two jaws. However we have to remember that these devices are dependent on compliance and is difficult to compare dental and skeletal effects that have in individual patients.

Introduction

Frankel II, Twin Block and Bionator are functional devices used in order to correct the second skeletal malocclusion class.

The second skeletal class is not a disease but there is a possible link with the instability of the stomatognathic equilibrium. Functional and structural problems (in the three planes of space) should be investigated in order to have a correct diagnostic process.

The diagnosis of second skeletal class is done with cephalometric in lateral view, where the measurement of the ANB angle and Ao-Bo are greater than 2° and 2mm respectively.

The second skeletal class can be a mandibular component, maxillary or mixed. The patient's age is critical to the treatment plan. A patient at the end of growth that has a 9° of ANB for example, to resolve the problems sagittal skeletal is forced to orthognathic surgery.

A patient with the same value of ANB of 11 years through mandibular advancement devices and retrusion of the maxilla can solve the problem through skeletal functional orthodontic appliances. So it's very important selection a treatment plan that is specific for patient and the time sequence of therapeutic strategies for the resolution of the patient's problems. So the diagnostic process at first had to do a problem list, and then plans the treatment that best meets the patient's needs.

The timing for the functional equipment described in the literature is between 9 and 15 years in males and between 8 and 14 in femmes . Each patient has a skeletal age that is not always in line with the anamnestic data, so a radiographic evaluation is critical to monitor the patient's growth.

Twin block determines a greater mandibular advancement compared to Franke II and Bionator and is therefore used in cases of a skeletal overjet.

Frankel II and Bionator are usually used in mixed dentition or even at the peak of growth to advance slightly the jaw and re-educate the musculature or as a restraint of a mandibular advancement already achieved.

The jaw expresses maximum growth in the shortest possible time at the peak of pubertal growth. Thus we need to put the mandibular advancement devices at the beginning of this peak. For aesthetic requirements, functional and to avoid trauma of upper incisor.

Besides Herbst and Twin Block that are fixed appliances, the other are all removable appliances which requires the patient's compliance. The patient should dress the device 24 hours a day and the results are related with the cooperation of the patient. In fact the failures described in the literature of removable equipment are mainly due to lack of cooperation of paziente. This should be aevaluetd by the orthodontic clinician first to began a treatment, we know that here are patients who can not put a removable appliance because they are not followed, in this case clinician should reach with controls, motivation and education constant in time an optimal level of cooperation.

Frankel II

FRANKEL, is a functional device , based on functional orthopedics principles and, in union with muscle gymnastics, creates maxillary morphological changes, restoring the malocculsion. Moss study shown how with a modification of function there is a myofunctional re-education in a growing patient that can lead to a

skeletal changes int the bone structures. Literature described results of mandibular advancement, transverse expansion increases and an improvement in muscle tone with the achievement of an adequate leap seal.

The device consists of two vestibular shields, lower lip shields, a vestibular arch, lingual arch, canine loops and a protrusion arch wire

The vestibular shields are used to limit the pressure of buccinator muscle to get a slight cross-exemption of the palate. It is passive expansion that is not given to the application of an orthopedic or dentoalveolar force but is thanks to the elimination of external muscular forces. 2-3mm deviating from the dental area and the alveolar mucosa to reduce irritation of the soft tissues and to allow a right limiting the pressure of buccinatoria muscles. They must also be parallel to alveolar process.

The lip shields must have a thickness of 0.9mm and have the function to limiting the pressure in hyperactivity of the mental muscle. It must be placed 0,5 mm from the gingival margin and is 34 to 44 and distant from the alveolar process of 2-3 mm. They are positioned below the fornix and the location determines the traction of the perinatal tissue with closed lips.

The lingual arch extends from the first premolar or first molar passes lingual to the lower incisors and canines to the contralateral premolar or molar. At the level of the incisors and canines is coated with acrylic resin. The function is to keep the jaw in advancement moreover a spring could be placed in order to keep anterior the lower incisor.

The vestibular arc is passive and stays on the buccal surface of the upper incisors four steps above the hips bend and ends in the vestibular acrylic shields. The arc can be activated in cases of second-class I division.

The canine loop is a portion of wire straight with a bend at the end near the upper canine area that have to be activeted whether is the need to drive the eruption of canino.

The protrusion arc extends between premolar and canine than the contralateral. It determines the level of the canine palatal loop and then extends on the lingual surface of the four upper incisors. It serves to keep in position the incisors or for vestibolarizzarli with the aid of springs applied in the two central incisors in cases of second-class second division.

The palatal arch extends from the distal portion of the upper molar to right, up to the height of the palate forms a loop facing the front teeth and go down to reach the acrylic shield contralateral distal to the first molar. It can be activated or not.

The thickness of threads:

Arc protrusion (Ø 0.7mm)

Palatal arch (Ø 1.0mm (1.1mm))

Rest occlusal (Ø 0.8mm)

central tether (Ø 0.9mm)

side connecting wires (Ø 0.9mm footprint

Impression

The impression is taken in alginate.

Profitt divides the functional devices in "toothborne" (dental anchor) and "tissue borne" (anchor on tissues). In the case of Fraenkel function controller is in between a unit mainly derived from the tissue. This means that the function controller anchoring itself to the vestibule, so it's essentially that during the taken of the impression we included all dentoalveolar process included the fold fornix, so all the soft tissue and alveolar mucosa.

With a suitable measuring instrument it is possible to calculate the thickness of the folds of the fornix. This value is clinically detected by dental technician to adjust on what should be discarded from the plaster model in the region of the front arches, in order to ensure a correct labial position.

Construction bite

The wax bite is taken slightly forward. If are present 7 mm overject in a second skeletal class of important mandibular retrusion we can not advance the jaw for 7 mm, because in this wy the patient is not able to stay with the device in this position. So you there is the necessity to build it in two units: the first advance of 3-4mm and then the second 3-4 mm.

Device insertion

Better practice with the patient in front of a mirror in the insertion of the distal portion of the first shield. Then the patient, with his mouth open and relaxed pushes the sideways function controller and later held ajar her cheek-side with his finger, so that we can introduce the shield also buccal from this side.

The patient is asked to close his mouth and biting. It 'important to control the position of the mouth is closed function controller. If the patient fails to close according to the construction bite, so we have an increased vertical dimension, the cause could be that the buccal shields are too long, particularly in the distal area. The clinician must real care with the finger the top edge of the shield to locate those responsible

points. The upper edge must then be shortened with great caution. Retouched areas will undoubtedly again be well-rounded and polished.

It will indicate to the patient, that because of the height of the shields and labial and buccal shields, it is desirable to have a certain tension in the folds of the lower fornix area and that this is a goal of the therapy.

The device must be brought at first week 2 hours day, in the second 4 hours, 16-8 hours and the third from the fourth week throughout the day. After a month, it is necessary to reviews the patient for an appointment and control, in the fifth week device have to put on for all day and night.

Bionator

Activator developed by Balters in 1950 and built according to the concept that tongue is the center of neuromuscular function.

It is an acrylic resin device, often no more than two or three millimeters of thickness, provided of two loops, that arrive to the upper and lower front teeth, and a palatine loop opposite and free in the lingual parts.

The different modeling that can give you the bend Palatine allow the correction of the lingual posture.

The Bionator provides a construction bite with jaw in the forward position, without extension. The device permits a constant influence on tongue, thanks to a connecting palatal bar, while the front side is free. The continuos influence on the perioral muscles, due to the effect of cold arc shield which, with its side extensions, prevents muscle contact with the dento-alveolar area.

From a practical standpoint, the Bionator strength is represented by the small size that make the daily and nightly application more acceptable.This results, for its supporters, in an action faster than the activator.

There are three types of activators:

- Bionator 1 (type) used in normal occlusion with crowding in Class II Division 1 and 2.
- Bionator 2 (shielded) has a resin screen that serves to eliminate the interposition of the tongue, used in atypical swallowing and open bites
- Bionator 3 (reverse), with vestibular arch for retraction of the lower incisors, used in reverse bites and III class.16

The device consists of:

-Block Acrylic resin in the horseshoe shape that extends from the last molar erupted in the contralateral.

Omega palatal bar of 1mm diameter of wire that extends from the last erupted moral at the first premolar and must be distanced 2 mm from the palatal mucosa to avoid irritation. the The dorsal surface of the bar drive in anterior position the mandible and the tongue in an upper position.

labial-arch with buccal extensions. The arc is made of 0.9 mm wire diameter. The labial arch extends from the point of contact between upper canine and first premolar than the contralateral. Distally the buccinator loops ending in the molar region. The labial arch can be active or passive depending on the needs. The loops pushing the muscles of the cheeks and creates a transverse dentoalveolar and skeletal arch expansion.

Moreover in the appliance is possible to add specific auxiliary to achieve other goals, such as screws for the cross-expanding, springs and screws to align individual teeth, inferior vestibular arches, Adams hooks to increase stability 17

IMPRESSION

Unlike the apparatus of FR-2 Frankel presenting an essentially supporting tissue, the Bionator has components with tooth support. For an accurate design of the instrument, an adequate reproduction of the teeth and the associated soft tissue is required. Particular importance is the soft tissue in the lower lingual region.

Wax bite

The construction of the wax bite is made directly in the mouth. With the use of a wax of average hardness of 5-10 mm thickness, in a tapered shape or a horseshoe to orient the upper and lower dental arches in all three planes of space .For the Bionator type 2 the bite of construction is taken end to end.18

Indications

The appliance must be brought all afternoon and night. The checks should be performed every month.

Twin Block

The device presented by William J. Clark in 1982, is functional apparatus suitable for the therapy of Class II both hyperdivergent and hypo divergent one. It can be removable or fixed. Given the extensive literature about we focus on the Twin removable block. 19

It is composed of a double plates anchored with the hooks or cemented, which presents the vertical occlusal increases (bite-blocks) that come into contact through the ramps present in the second premolars level. The meeting of the ramps is responsible of mandibular advancement 20-21

The goal of orthodontic treatment according to Dr. Clark uses the Twin Block: double plate with two seats inclined planes on the occlusal Bite Blocks which is very comfortable for the patient.

The two inclined planes of the upper and lower bite blocks are in contact with an angle of 70 ° in closing, resulting in a comfortable posture of the mandible till a end to end of incisor position.

The occlusal inclined plane is fundamental functional mechanism in the dentition, the planes of the cusps are decisive for the occlusal relationships of the posterior teeth and therefore may represent a block for the growth and development of the jaw which, remaining in a distal position, also represents a block for the development of the maxilla.

Objective of the Twin Blocks is to cancel the action of unfavorable cusp contacts, both of the back teeth than those of upper canines through the release of the occlusion, this is made possible thanks to resin thickness (Bite Blocks) that stimulate proprioceptive contacts favorable of inclined planes which allow to the jaw an forward movement.19-20-21-22

According to Clark, if the mandible occludes in a distal relationship with respect to the upper jaw, the occlusal forces which act on the lower teeth during function have a distal component of force that is not good for a normal mandibular development.

Thus Twin-block, changing the occlusal plane using acrylic inclined planes placed on the occlusal bite blocks, reposition the mandible forward, and use the occlusal forces to correct the skeletal malocclusion Class II.

The unfavorable cusp contacts the distal occlusion are replaced, then, by proprioceptive a favorable contacts the inclined planes of the Twin-block, which goes to free his jaw locked in its functional position distale.23

The cut off of posterior-superior bite-blocks allows selective extrusion of lower molars followed by an opening of the bite and the resolution of the hypo divergent condition. In cases of hyperdivergent molars should be in contact with bite-blocks counteracting the eruptive process. In this case at the end of therapy there would be a posterior bite that will be closed with the intrusion of upper teeth in case of gummy smile or lower if there is no gummy smile (that way we'll have an anterior rotation of mandible) 24-25

The effects of the Twin Block are both dental and skeletal.

The unit is composed by various component:

A central screw for transversely expanding higher or lower arch when necessary

increases occlusal angled at 75 ° to the occlusal plane, that occlude each other and come into contact in the distal region of the lower premolars or the first molars, resulting in a mandibular advancement.

The essence of the two plates that constitute the T.B. It is enclosed in these resin occlusal thicknesses which allow to realize the inclined planes are able to advance the mandible.

On average are achieved with an angle of 70 ° with respect to the occlusal plane but, where there is a difficulty of the patient to stay in this new position, this angle may be reduced.

Initially, the author realized the first appliance with a 90 ° angle, in this way the patient must make a considerable effort to occlude in progress and resulted impossible in some cases, so to eliminate the ' inconvenience an angle of 45 ° was made, but this angle promotes the growth forward and downward. After careful analysis it was concluded that the ideal angle is 70 ° +/- 5 upon the tolerability of patient and the ability to determined a more horizontally directed force 19

Hooks delta : on the first upper molars and the first lower premolars, molars or dairy.

It is one of the peculiarities of T.B. This hook was invented by the author and is very similar to the Adams hook, the difference lies in the retention shape which initially were triangular (Delta name) but may also be circular.

This type of closed-loop, compared to the handles open "U" of Adams, makes this new hook less exposed to risks of deformation and break and does not require

adjustments, also ensures excellent retention for both molars that for premolari 5 6.

For the construction, which is extremely simple, it is a Angle gripper framework round nose pliers and wire 0.7 mm Leowire.

ball hooks mesial to the lower canines

Vestibular arc stabilized the unit maxillary arch. The vestibular arc continues with a loop that forms a slight curve apical to the gingival margin of the maxillary canine. The canine loop after its curvature, verticalizes itself again to go into the space between the canine and the first upper premolar or deciduous molar.

At first in the Clark's drawing the superior plate is anchored to the jawbone by ball hooks, placed distal to the canines.

The action that this plate exercised in the upper teeth caused an overcorrection angle of the same, this can be a lock for the programmed mandibular

advancement.

The use of T.B. throughout the day determines a good lip seal, then lips are the same in function as vestibular arch, working in a natural way on the verticality of the incisor.25

These considerations have led Clark to eliminate the vestibular arc, except for the cases of excessive flaring of the incisors. It is evident that this makes the device more aesthetic.

Review

Patient compliance is the most important prognostic factor for the success of therapy with mobile devices. One of Arreghini A, S Trigila the 2016 study, "Objective assessment of compliance with an intra extraoral removable appliances" published on Angle Ortodontics journal has conducted an objective assessment of the level of compliance in young patients prescribed various types of removable appliances and determine the influence of the type of device, the duration of treatment, and the patient's age, sex, psychological maturity, and control consciousness.

In their sample 30 patients were treated with a class 2 (Frankel or Bionator) or a class 3 (mask) removable prosthesis, each with a chip indicator of conformity, and were instructed to wear them for 13 hours a day. Compliance was monitored by means of the sensor for an average of 8 months. Of the patients, 14 were informed that their equipment has been fitted with a monitoring sensor, and 16 were not. Psychological maturity of all patients was assessed on the Nowicki-Strickland Locus of Control Scale, and the effect on the compliance of this score, as well as the variables-patient and considered related to treatment were determined through the analysis of the results statistics: the average recorded compared to the chips was 8.6 ± 2.9 hours, far less than the 13 hours provided, and younger patients showed significantly greater than adolescents ($P < .01$). However, no significant differences in compliance were found between intra and extra-oral appliances, and neither sex, psychological scores, duration of treatment, nor the knowledge of being monitored has had no significant effect.

The study shows how the majority of patients regardless age, sex and psychological maturity have a poor ability of cooperation which must therefore be taken by the clinician when you want adopt appliance that are based on the patient's cooperation.

Twin Block and Frankel must be taken 24 hours a day to exert the most of the goals of therapy while the Bionator can be brought 14-15 hours/day.The results show how Bionator presents a minor degree of cooperation compared with Frankel and at Twin Block..27

The dental effects.

All three devices cause a forward inclination of lower incisors, a retroinclination of the upper incisors, a mesial movement of the lower molars and distalization of the upper molars. The extrusion or limitation extrusion of posterior sectors can be handled better in the Twin Block respect to the other two devices. The Twin Block causes a flaring of the lower incisors more than in the Frankel and Bionator.28-29

The skeletal effects.

In the transverse plane all three devices determine a dentoalveolar and slightly skeletal expansion. In cases of major skeletal cross it is better to use an expansion of the palate with a REP and then proceed with the functional appliances.

In the sagittal plane the Twin Block gives a greater mandibular advancement compared to Frankel and Bionator. The degree of mandibular advancement of these two devices is the same.

About the vertical effects, it is right to remember a study of HM Illing, DO Morris, Lee RT, "A prospective evaluation of Bass, Bionator and Twin Block appliances. Part I-The hard tissues "published in the European Journal of orthodontics in 1998 in which detects the significant vertical and sagittal skeletal effects more than in the Twin Block than in the Bionator.

Conclusions

The great result evidenced in our study is that the Twin block appliance determines a greater positive torque of the lower incisors togheter with the benefit of significant mandibular growth. Still today there are different opinions about the mandibular growth, some works in literature said that they are due with the advancement get by the use of these functional device, other says that the mandibular growth is link with the differential growth of the two jaws. However we have to remember that these devices are dependent on compliance and is difficult to compare dental and skeletal effects that have in individual patients.

References

1) McNamara JA Peterson JE Jr, Alexander RG. Three dimensional diagnosis and management of Class II malocclusion in the mixed dentition. See Orthodox 1995 Jun;2(2)144-137.

2) Paola Cozza, Fabiana Ballanti. Analisi Cefalometrica e diagnosi ortodontica.

3) Pavoni C, CozzaP. Rational choice of functional/orthopedic appliances for the correction of Class II Malocclusion. Mondo Ortodontico 2011;36(4):146-158.

4) Illing HM, Morris DO, Lee RT. A prospective evaluation of Bass, Bionator and Twin Block appliances. Part I--The hard tissues. Eur J Orthod. 1998 Oct;20(5):501-16.

5) Silvestrini-Biavati A, Alberti G, Silvestrini Biavati F, Signori A, Castaldo A, Migliorati M. Early functional treatment in Class II division 1 subjects with mandibular retrognathia using Fränkel II appliance. A prospective controlled study. Eur J Paediatr Dent. 2012 Dec;13(4):301-6.

6) Arreghini A, Trigila S, Lombardo L, Siciliani G. Objective assessment of compliance with intra- and extraoral removable appliances. Angle Orthod. 2016 Aug 10. [Epub ahead of print] PMID: 27508935

7) Enlow DH, Hans MG. Essentials of Facial Growth. Second Edition. Ann Arbor: Needham Press, Inc. 2008

8) Guilherme R. P. Janson, Jorge Luis Alegria Toruño, Décio Rodrigues Martins, José Fernando Castanha Henriques and Marcos Roberto de Freitas. Class II treatment effects of the Fränkel appliance. Department of Orthodontics, Bauru Dental School, University of São Paulo, Brazil. 2003 European Orthodontic Society

9) Fränkel C, Fränkel R. Der Funktionsregler in der orofazialen Orthopädie. Heidelberg: Hüthig 1992

10) Frankel, R.: The treatment of Class II, Division 1 malocclusion with functional correctors, AM. J. ORTHOD. 55: 265-275, 1969.

11) Frankel, R.: Guidance of eruption without extraction, Trans. Eur. Orthod. Sot. 47: 303-315, 1971.

12) Frankel, R.: Decrowding during eruption under the screening influence of vestibular shields, Am. J. Orthod. 65: 372-406, 1974.

13) Frankel, R.: The artificial translation of the mandible by function regulators. In Cook, J. T. (editor): Transactions of the Third International Orthodontic Congress, St. Louis, 1975, The C. V. Mosby Company. 1980.

14) Sammon, J. E.: Personal communication, 1980.

15)Dentofacial orthopedics with functional appliances – GRP

16) Removable orthodontic appliances –Graber & Neumann

17) Orthodontics and dentofacial orthopedics – James A Mc Namara

18) Contemporary orthodontics – William R Proffit 56

19) Clark W.J: La tecnica del Twin Block Ortho 01/2003 Edizione A2

20) Or-Tec Manuale di Tecnica Ortodontica Edizione Martina

21) Cicatiello M; Dispositivi con Piani Inclinati Dental Press 06/2004 Edizione Masson

22) Cicatiello M; Doppia placca di Sander Or-Tec 02/2007 Edizione Or.tec

23)Baccetti T, Franchi L: Trattamento con Twin Block Bollettino 66/2001.Edizione Leone.

24)Moss M. L. (1968). The primacy of functional matrices in profacial growth, Dent Pract 19:65-73

25) Graf. H. Occlusal forces during function. In proceedings of Symposium, ed N. H. Rowe. Ann Arbor, University of Michigan.

26) Objective assessment of compliance with intra- and extraoral removable appliances.Arreghini A, Trigila S, Lombardo L, Siciliani G.Angle Orthod. 2016 Aug.

27) Clark W.J. : European lournal of Ortodontics 4 - 1982

28)Comparative study of the Fränkel (FR-2) and bionator appliances in the treatment of Class II malocclusion. De Almeida MR, Henriques JF, Ursi W. Am J Orthod Dentofacial Orthop. 2002 May;121(5):458-66.

29) Skeletal and dentoalveolar effects of Twin-block and bionator appliances in the treatment of Class II malocclusion: a comparative study. Jena AK, Duggal R, Parkash H. Am J Orthod Dentofacial Orthop. 2006 Nov;130(5):594-602.

30) Stamenkovi? Z, Rai?kovi? V, Risti? V. Changes in soft tissue profile using functional appliances in the treatment of skeletal class II malocclusion.