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Role of Activator and Bionator in class II malocclusion correction- A review

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Abstract

Functional appliances are passive appliances, which make use of the natural forces generated by the orofacial & masticatory muscles and the forces of occlusion to bring about changes in dento alveolar & craniofacial structures. These appliances alter neuromuscular environment of orofacial region to improve occlusal development and craniofacial skeletal growth. In this article we will discuss effects of two functional appliances that are activator and bionator.

Keywords: Activator, Bionator, Maxillary protrusion.

Introduction

Class II malocclusion is one of the most common orthodontic problem and it occurs in about one third of population.[1-3] Class II malocclusion can result from many contributing factors, both dental and skeletal. Although both maxillary protrusion and mandibular retrusion are causative factors, it has been reported that the most common component in a class II sample population is mandibular retrusion.[4] For Class II patients in whom the mandible is retrognathic, the ideal treatment is alteration of amount and direction of growth of mandible. The primary treatment for this is functional appliance therapy.[5] Functional appliances include removable and fixed devices that are designed to alter the position of the mandible, both sagitally and vertically and to induce supplementary lengthening of the mandible by stimulating growth of condylar cartilage.[6,7]

Functional appliances have been used since 1930s. Despite this long history, there is much controversy regarding their use, method of action, and effectiveness.[7]

Bjork[8] and Pancherz[9] demonstrated only small changes in mandibular growth with functional appliance therapy. Butmany other researchers reported that functional appliances significantly affect mandibular growth.[10,11,12]

Activator

The original monobloc designed by Robin in 1902 and it was a one-piece removable appliance.[13] This appliance positioned the mandible forward in patients with severe mandibular retrognathism. Viggow Andresen in 1908 developed a mobile, loose fitting appliance that transferred functioning muscle stimuli to the jaws, teeth, and supporting tissues and this appliance was called biomechanic working retainer. Later, Andersen and Haupal called their appliance activator because of its ability to activate the muscle force.

According to Andersen and Haupal, the activator makes use of the interrelationship between function and changes in internal bone structure for malocclusion correction. Activator induces musculoskeletal adaptation by introducing a new pattern of mandibular closure and these adaptations in functional pattern caused by activator also affect condyles. Condylar adaptations include growth in an upward and backward direction to maintain the integrity of temporomandibular joint structures.[14] The appliance advances the mandible and generate a biomechanical force as the muscles attempt to return the mandible to its normal position.[15]

Skeletal effects of activator

Activator inhibits the horizontal growth of the maxilla,[9,16] also results in increased growth of the mandible and causes anterior relocation of the glenoid fossa.[17] Barbel Kahl-Nieke[18] found that activator appliance therapy in hemifacial microsomia patients showed improvement of function, occlusion and facial asymmetry was also reduced. Construction bite in such cases is taken by keeping mandible in slightly forward and overcompensated position that changes muscle activity which can lead to enhanced bone apposition and optimal growth of the condyle. Horizontal activator results in increase in SNB angle, mandibular plane angle, reduction in SNA angle, ANB angle, and increase in mandibular length.[19,20]Mehta and patel[21] reported activator corrects class II malocclusion by increasing condylar growth and mandibular base length. According to Luder's Hypothesis, a great interocclusal height of an activator would lead to improvement in mandibular retrognathism, no change in maxillary prognathism, clockwise rotation of occlusal plane and low construction bite results in reduction in maxillary prognathism, clockwise mandibular rotation, anterior tipping of mandibular anterior teeth. Some clinical studies found no significant increase in mandibular length with the use of this device[9] but other authors

reported significant increase in the mandibular length or protrusion of mandible using the activator.[22,23,24,25]

Dental effects

Calvert,[26]and Pancherz,[9] observed significant dentoalveolar changes with activator. Class I occlusion is achieved through distal tipping of the maxillary teeth, mesial and vertical movement of the mandibular dentition. Overjet reduction also occurs mainly due to dentoalveolar changes that are retroclination of maxillary incisors and proclination of mandibular incisors.[9,20] Pancherz[9] found that more than 70% of the overjet corrected by incisor tipping. Harvold & Vargervik[17] found that activator results in inhibition of mesial migration of maxillary teeth, inhibition of increase in maxillary alveolar height and also causes extrusion of mandibular molars,[12] mesial movement of mandibular teeth**.** Appliance achieved Class I occlusion by inhibiting maxillary dentoalveolar vertical development, while encouraging mandibular dentoalveolar mesial and vertical development.[21] Activator with headgear combination resulted in upper incisor retrusion, upper molar distalization, and mesial movement of lower molars.[16,27,28]

Bionator

Balters developed the original appliance in early 1950s.It is the prototype of a less bulky appliance. Its lower portion is narrow and upper part has only lateral extensions, with a cross palatal stabilizing bar. The palate is free for proprioceptive contact with tongue and the buccinator wire loops hold away the potentially deforming musculature.

Principles of Bionator

According to Balters, the equilibrium between tongue and circumoral muscles is responsible for shape of dental arches and intercuspation. The functional space for tongue is essential for normal development of orofacial system. Discoordination in its functions can lead to abnormal growth and actual deformation. Bionator establishes good coordination and eliminates these deforming and growth restricting factors.

The principle of Bionator is not to activate the muscles but to modulate muscle activity, thereby enhancing normal development of inherent growth pattern and eliminating abnormal and potentially deforming environmental factors.

During bite registration, the bite cannot be opened and must be positioned in an edge to edge relationship because a high construction bite can impair tongue function and the patient can actually acquire a tongue thrust habit as the mandible dropped open and the tongue instinctively moved forward to maintain an open airway.[14]

The popularity of this appliance is due to a number of favorable characteristics such as relative ease in the construction and clinical handling of appliance and the high level of comfort for the patient, who usually shows positive acceptance and compliance.

Skeletal effects of Bionator

Many studies reported that bionator appliance therapy improvedmaxillomandibular relationship in class II patients as it increases mandibular length[29,30,31,32,33] and has slight restrictive effect on anterioposterior dimension of maxilla[33] butsome other studies found no significant restriction of maxillary growth with this appliance.[29,31,32,34,35] Freeman et al reported that use of bionator and high-pull facebow combination followed by fixed appliance therapy in patients with hyperdivergent facial patterns, resulted in increase in mandibular plane angle and larger inclination of Frankfort horizontal plane to occlusal plane in treated group than controls. So they did not recommend this combination for growing patients with hyperdivergent facial patterns.[36] Bionator therapy resulted in increased anterior facial height[29] and posterior facial height,[32,34] forward movement of point B and increased SNB angle.[37] Bionator when used during pubertal growth spurt, results in elongation of mandible, increase in mandibular ramus height and significantly more backward direction of condylar growth.[38] Some studies also reported increase in posterior maxillary base width with Bionator appliance.[39,40]

Dental effects of Bionator

Bionator appliance corrects molar relationship and overjet of class II patients mostly by dentoalveolar changes. Bionator treatment resulted in reduced overjet, labial tipping of lower incisors and lingual inclination of upper incisors.[29,32,34,35] butanother study showed that bionator therapy results in proclination of lower incisors and insignificant increase in inclination of upper incisors.[41] Class II molar relation is corrected by mesial movement of mandibular molars and distal movement of maxillary molars.[31,35] Almeida, Henriques and Ursi concluded that bionator results in labial tipping and linear protrusion of the lower incisors and a lingual inclination and retrusion of the upper incisors, significant increase in mandibular posterior dentoalveolar height.[30] Bionator produced no extrusion of the upper molars.[30,34] However open bite Bionator resulted in reduced overjet, eruption of maxillary molars,[23,42] less increase in facial height and no change in eruption of lower molars,[42] but other studies showed extrusion of mandibular molars occurred with open bite Bionator.[36,43]

Summary and Conclusion

Both skeletal and dentoalveolar changes can be achieved in activator functional appliance therapy. Depending on timing and trimming of appliance, significant facial and occlusal changes can be achieved. In addition to the elimination of abnormal perioral muscle function, growth guidance is the major

contribution of functional appliance therapy. Activator therapy also has some limitations such as it is less effective in treating maxillary prognathism and vertical growth patterns, inappropriate for extensive bodily movement, torque, rotation and intrusion of teeth. It also interferes with speech and lateral jaw movements. It is single block appliance so cannot be used in subjects with nasal obstruction.[18]

Bionatorre establishes a muscular equilibrium between forces of tongue and outer neuromuscular envelope which influence the form and shape of dental arches. It is useful in class II malocclusion with mandibular retrognathism, some open bite and class III cases. The main advantage of Bionatoris its reduced size, so it can be worn day and night time. Constant wear makes its action faster than activator and also results in more rapid sagittal adjustment of musculature to forward mandibular posture. Bionator is effective in treating functional type retrusions with relatively normal skeletal potential and sufficient growth increments.

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