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Literature Review

Biological Mechanism of Orthodontic Movement in The Treatment of Skeletal Class II Malocclusion Using Twin Block

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Functional appliance, growing age, skeletal class II malocclusion, twin block

ABSTRACT

Introduction: Patients of growing age with dentoskeletal class II malocclusion are often found in the clinic, to avoid further severity it is recommended to use functional appliance in cases involving skeletal.

Review: Functional appliances have been widely used since activators were introduced by Andersen, but the use of activators has many disadvantages such as the shape that blends between the maxilla and mandible making it difficult for patients to open their mouths, speak and eat, then the large shape makes patients uncomfortable and causes facial changes. Clark developed the twin block to answer the previous shortcomings, which is a simple and separate design between the mandible and maxilla causing patients to be more comfortable in speaking and eating so that it is comfortable to use for a long time. Twin block is a functional appliance used to reposition the mandible forward in cases of class II malocclusion with retrognathic mandible.

Conclusion: This paper describes the design and use of twin block and its effectiveness in skeletal correction. In addition, its use was found to improve facial shape, reduce overjet and overbite, corrected molar relationships and alleviated patient complaints.

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INTRODUCTION

Class II skeletal maloclusion is defined as a facial deformity characterized by a mandible position that is more backward than the maxilla. This condition can be caused by underdeveloped mandible growth, normal maxilla growth, or a combination of both. The maxilla and mandible change during the prepubertal, pubertal, and postpubertal periods. Therefore, treatment of class II skeletal malocclusion begins early before puberty (preadolescence) so that growth can be directed. When the patient has passed the growth period, the only orthodontic treatment that can be done is camouflage treatment to improve aesthetics and function.[1-2] Class II skeletal malocclusion can be caused by three abnormal relationships between the maxilla and the mandible, i.e., the prognatic maxilla and the normal mandible, the retrognatic mandible and the normal maxilla, or both. In patients with grade II malocclusion in the growth phase, growth modifications can be performed. Growth modification is a treatment that optimizes a person's growth potential to direct growth so that it is more harmonious. Proffit's use of "re-direction of growth" is meant to change the direction of growth that is considered more appropriate than to inhibit or stimulate growth. The appliance used for the treatment of growth modification in skeletal malocclusion of class II is a functional appliance, which is the most widely used option to correct the skeletal discrepancy so that it has a natural growth potential.[3-4] Correction of class II skeletal malocclusion in patients of growing age is a major challenge in achieving treatment success. The use of functional appliance such as twin blocks in orthodontic care, introduced in 1977 by William Clark, has significantly improved treatment results in patients with class II dentoskeletal malocclusion. Various functional appliances have previously been used to correct class II maloclusion, such as activators, functional regulators, twin blocks, and others. Unlike other appliances, patients can adjust quickly in speech and other functions; they can be used for difficult cases; and patients can immediately notice changes when using appliances that act as positive reinforcements. Compared to other appliances, twin blocks seem to be more useful for cases that cause sagittal and vertical changes.[5-6]

REVIEW

In class II skeletal maloclusion, generally having retrognatic jaw relations, i.e., the mandible position located further behind the maxilla, may be due to a lower growth of the maxilla, excess growth of a normal maxilla, or a combination of both. [4.7] In patients of growing age, the treatment of malocclusion class II can be carried out in two stages. The first stage is treatment that utilizes the growth factor of the patient, known as growth modification treatment, and the second stage is dental treatment of patients using orthodontic instruments (which is performed in the postpubertal period or the completion of the post-pubertal period). There are times growth modification treatment is carried out in conjunction with the dental care of patients because the age of patients is close to completing their growth or passing the peak of growth, even though growth still exists.[7,8]

Treatment of skeletal malocclusion of the second grade at the growth stage (first stage) has the following objectives: 1. Prevent progressive and irregular changes in soft tissue and bone. 2. Repair skeletal abnormalities and provide a more favorable environment for the jaw to grow normally. 3. improve interdigitation (occlusal function); 4. reduce the duration of comprehensive treatment in stage two and reduce the likelihood of doing orthognatic surgery; 5. improve facial aesthetics for the psychosocial development of the patient.[8-9] The appliances used for the treatment of growth modification in class II skeletal malocclusion are activators, Frankel, bionators, twin blocks.[9-1]

The ideal criteria for treatment using functional appliance are: prepubertal, mesofacial to brachyfacial shapes; class II with normal overbite to deep overbite ; maxilla and upper incisor protrusion; underdeveloped mandible with lower incisor are retroclined; teeth located either in jaw curves or minimal space discrepancies. The right time to use the twin block is during peak growth velocity. Optimal results relate to the treatment time, where the skeletal role in improving the molar

relationship, the addition of the mandible length and height of the lobe, and the growth of the cones more to the posterior.[5-6,11] A twin block is a functional appliance used to push the mandible forward to be parallel to the maxilla. It is called a "twin block" because this appliance is separated between the maxilla and the mandible. On a separate plate, there is a block in the occlusal area of the posterior tooth. When biting, the block will adjust as well as the mandible position forward. As time passes, the mandible will be permanently in that position. [5-6,11] A twin block is a functional appliance used to push the mandible forward to be parallel to the maxilla. It is called a "twin block" because this appliance is separated between the maxilla and the mandible. On a separate plate, there is a block in the occlusal area of the posterior tooth. When biting, the block will adjust as well as the mandible position forward. As time passes, the mandible will be permanently in that position.[12-13]

The benefit of the twin block, the patient uses for 24 hours a day, and can eat comfortably without removing the appliance from the mouth. Twin blocks can be designed without an anterior wire, without losing efficiency in correcting jaw curves. Little interference was found with normal function because the mandible can move freely in the anterior and lateral without being restricted by the size of too large instruments. Twin block discharge can be used permanently in the mouth for the first week or 10 days of treatment to ensure that the patient can fully adapt during 24-hour use. Patients can re-learn to speak normally using twin blocks, compared to using other functional appliances. One of the advantages of using a twin block is that it can be removed. The appliance is recommended to be worn for at least 18 hours a day and always in bedtime. In growing children, growth hormones are released mainly at night. Therefore, orthopedic patients are advised to use their growth modifier more often at night than during the day. This condition will allow the results of the treatment to have effective progress. Since this appliance is an exhaust, it's easy to clean; even very simple, enough to be cleaned using a regular toothbrush every day. The appliance can also be immediately cleaned by rinse after a meal.[5-7,11-13]

Work bite. In class II malocclusion, the skeletal bite is made by advancing the mandible to reduce overjet and distal occlusion by 5–10 mm, with an interincisal space of 2 mm, a premolar space of 5–6 mm, and an intermolar space of 2 mm growth in the vertical direction.[5-6] Twin block of maxilla. The maxilla and twin blocks consist of separate palatals with one or two midline screws (6 mm expansion screws). The rear part consists of two bite blocks that cover the medial part of the posterior teeth. The lateral part is not closed, so the appliance can be adjusted during the treatment (Figure 1). The anterior part is composed of a bite block in the form of an inclined plane, and this bite block forms a 70^0 towards the occlusal plane. [5-6] Twin block of mandible. The horse-shaped design is made of acrylic that covers the premolar teeth of both mandible. The lingual part of the mandible molar teeth is not covered (Figure 1), thus allowing for an eruption of the molar tooth during treatment. [5-6]

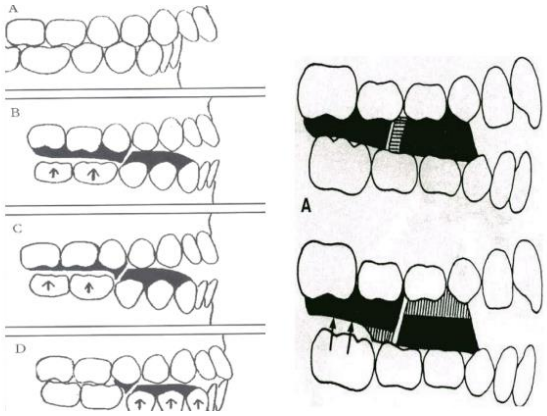

Figure 1. Twin block on lateral side [6]

Using the appliance will cause changes in the neuromuscular proprioceptive response. According to Clark, that bone will provide a remodeling response to a certain style in its functions to the skeletal, tooth, and neuromuscular.[5,14-16] Orthopedic effect twin block: 1). average growth/reposition of the anterior mandible of 2.4 mm (Ar-Pog); 2). inhibits growth of the maxilla to the anterior 3). stimulus growth of the condyle 4). remodeling of the glenoid fossa down and forward; 5). changes in the height of the lower anterior face. Twin block orthodontic effect: 1). reduction of bite distance; 2). change of incisor

inclination; 3) change in bite swing; and 4). interdigitation correction (lower molars an erupts anterior and superior)

Rabie found that VEGF is a powerful regulator of neovascularization that is expressed during long bone endochondral ossification as well as the mandible condyle. Chondrocytes in the mandible condyle stimulate VEGF, which stimulates neovascularization and marks the onset of endochondral bone formation. VEGF expression in the mandible condyle increases at the position of the frontal mandible, with a pattern of expression that is closely related to the formation of new bones. Mechanical pressure is an important regulator of chondrocyte metabolism and is necessary to maintain the characteristics of the cartilage matrix. Degree or frequency changes significantly affect the production of matrix molecules such as type II collagen and proteoglycan. Advancing the mandible with bite jumping appliance causes an increase in VEGF by chondrocytes, which are regulators of the recruitment process of new blood vessels into the hypertrophic cartilage matrix of the condyle. The newly recruited blood vessels deliver the mesenchymal cells needed to replace the size of the osteoprogenitor cells required for differentiation into bone-building cells to substitute for the hypertrophic cartilage matrix in the condyle with the bone. The invasion of new blood vessels into the hypertrophic cartilage matrix marks the beginning of endochondral ossification.[19]Rabie examined the cellular response after advancing the mandible with a bite jumping appliance in a Sprague-Dawley rat and found the number of bone formations in the anterior, middle, and posterior glenoid fossa areas. The highest rate of new bone deposition occurred in the posterior region of the fossa. In the fibrous layer, fibroblasts are found parallel to the articular surface on the 3rd day and become increasingly apparent in the direction of attraction by the disc fibers from the 7th day and beyond. [20]

CONCLUSION

Recently, the integration of orthodontic and orthopedic techniques has offered new initiatives in treating facial balance for patients who show differences in bone growth. Skeletal and dentoalveolar changes after treatment with twin block appliance are caused by bone and tooth changes. Twin block appliances are the most widely for repairing class II malocclusion cases because twin blocks have advantages such as being more comfortable, more adaptive, flexibility, efficiency, and ease of mandible progression without instrument correction.

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REFERENCE

1. Bahreman A. Early-age orthodontic treatment. 1st edition New York: Quintessence Publishing; 2013. p. 533-543, 549.
2. Karad A. Clinical orthodontics: current concepts, goals and mechanics. 2nd edition India: Reed Elsevier India Pvt. Ltd; 2015. p. 68-80.
3. Nanda R. Esthetics and biomechanics in orthodontics. 2nd edition . India: Elsevier Inc.; 2015. p. 197-203.
4. Bennett JC. Orthodontic management of uncrowded class II division one malocclusion in children. 1st edition . New York: Elsevier Ltd; 2006. p. 310-315.
5. Clark WJ. Twin block functional therapy. 2nd edition. New York: Elsevier Science Limited; 2002. p. 5-23, 55, 85-95, 101.
6. Clark W. Design and management of twin blocks: reflections after 30 years of clinical use. Journal of Orthodontics. 2010; 37(3), 209–216.
7. Premkumar S.Textbook of orthodontics. 1st edition India: Reed Elsevier India Pvt. Ltd; 2015. p. 542-544.
8. Singaraju GS, Vannala V, Ankisetti SA, Mandava P, Ganugapanta VR, Unnam D. Evaluation of sagittal changes in class II div 2 patients with decelerating phase of growth by powerscope appliance: a retrospective cephalometric investigation. J Pharm Bioallied Sci 2019; 11(Suppl 2): S208-S215. Doi: https://doi.org/10.4103/jpbs.jpbs_299_18

9. Tripathi T, Sigh N, Rai P, Gupta P. Comparison of dentoskeletal changes, esthetic, and functional efficacy of conventional and novel esthetic twin block appliances among class II growing patients: a pilot study. Turk J Orthod 2020; 33(2): 77-84. Doi: https://doi.org/10.5152/TurkJOrthod.2020.19030
10. Pankaj P, Utreja AK,Sigh SP,Aggarwal A,Jena AK. Effects of twin block appliance treatment on pulmonary functions in class ii malocclusion subjects with retrognathic mandibles. Journal of Orthodontics and Endodontics 2015; 1(1): 1-5.
11. Santhana. Cephalomteric changes in airway dimensions with twin block therapy in growing Class II patients. J Pharm Bioallied Sci 2013 ;5(Suppl1): S25-S29. Doi: https://doi.org/10.4103/0975-7406.113288
12. Zhang C, Shen G, Ning Y-J, Liu H, Zhao Y, Liu D-X. Effects of twin-block vs sagittal-guidance twin-block appliance on alveolar bone around mandible incisors in growing patients with class II division 1 malocclusion. American Journal of Orthodontics and Dentofacial Orthopedics 2020; 157(3): 329-339. Doi: https://doi.org/10.1016/j.ajodo.2019.04.029
13. Ehsani S, Nebbe B, Normando D, Lagravere MO, Flores-Mir C. Short-term treatment effects produces by the Twin-block appliance: a systematic review and meta-analysis. Eur J Orthod 2015; 37: 170-6. Doi: https://doi.org/10.1093/ejo/cju030
14. Saikoski LZ, Cancado RH, Valarelli FP, de Freitas KM. Dentoskeletal effects of Class II malocclusion treatment with the Twin-block appliance in a Brazilian sample: a prospective study. Dent Press J Orthod 2014; 19(1): 36-45. Doi: https://doi.org/10.1590/2176-9451.19.1.036-045.oar
15. Jankare S,Parchake P,Katole S. Response to twin block treatment. International journal of current research 2020; 12(10): 14358-14362. Doi: http://journalcra.com/article/response-twin-block-treatment-literature-review
16. Ersin Yildirim. Condylar response to functional therapy with Twin-Block as shown by cone-beam computed tomography. Angle Orthod 2014; 84(6): 1018-1025. Doi: https://doi.org/10.2319/112713-869.1
17. Koretsi V, Zymperdikas V, Papageorgiou SN,Papadopoulos MA. Treatment effects of removable functional appliances in patients with Class II malocclusion: a systematic review and meta-analysis. European Journal of Orthodontics 2014; 37(4): 418-434. Doi: https://doi.org/10.1093/ejo/cju071
18. Chaudhary et al. Comparative evaluation of soft tissue changes one year posttreatment in Twin Block and FORSUS FRD treated patients. Medica Journal of Armed Forces 2016; 72(4): 362-366. Doi: https://doi.org/10.1016/j.mjafi.2015.09.015
19. Rabie AB, Shum L, Chayanupatkul A . VEGF and bone formation in the glenoid fossa during forward mandible positioning American Journal of Orthodontics and Dentofacial Orthopedics 2002; 122(2): 202-209. Doi: https://doi.org/10.1067/mod.2002.125991
20. Rabie AB,Shen ZZ, Hägg EU, Dr O, Robinson W. Osteogenesis in the glenoid fossa in response to mandibler advancement American Journal of Orthodontics and Dentofacial Orthopedics 2001; 119 (4): 390-400. Doi: https://doi.org/10.1067/mod.2001.112875