Effectiveness of Twin Block Device as Upper Airway Correctionin Pediatric Patients with Class II Malocclusion and Its Relationship with Muscle Contraction: A Systematic Review

Harun Achmad[1]*, Rini Sitanaya[2], Hans Lesmana[3], Arni Irawaty Djais[4] , Rosdiana Agustin[5]

1. Pediatric Dentistry Department, Faculty of Dentistry, Hasanuddin University, Makassar, Indonesia.
2. Dental Nurse Department Health of Polytechnic, Makassar, Indonesia.
3. Oral biology Department, Faculty of Dentistry, Airlangga University, Surabaya, Indonesia.
4. Department of Periodontology, Faculty of Dentistry Hasanuddin University, Makassar, Indonesia.
5. PPDGS Pediatric Dentistry Student, Faculty of Dentistry, Hasanuddin University, Indonesia.

Abstract

Abnormalities that occur in the upper respiratory tract can result in malocclusion, or otherwise malocclusion that occurs in a child can result in upper airway abnormalities. This abnormality turns out to result in contraction of the muscles involved during jaw movement. In several studies, it is stated that the use of functional equipment can correct malocclusion so that it can reduce muscle contractions that occur and have an impact on increasing upper respiratory tract repair for a child.

To systematically review the benefits of using Twin Block functional equipment in correcting malocclusions with muscle contractions that are caused and are the cause of upper respiratory tract disorders.

Data collection was carried out by searching literature on article search sites, namely PubMed, Cochrane, Wiley, Google Scholar and Science direct which were published from 2010 to 2021, the search was carried out in March - April 2021. Data search is carried out systematically using keywords twin block, upper airway, class II malocclusion, and muscle tension

After eliminating duplicate articles, the title and abstract of each article were analyzed in 164 articles which excluded 142 articles. Article full text the remaining 22 articles were re-analyzed and 12 articles were excluded. The text of journal articles that are complete and meet the eligibility are 10 articles.

The current literature shows that the use of twin block device in patients with Class II malocclusion can correct dental abnormalities and improve the airway and reduce muscle contractions that occur.

Review (J Int Dent Med Res 2022; 15(2): 873-884)

Keywords: Class II malocclusion, upper airway, twin block, muscle contraction.

Received date: 06 March 2022 **Accept date:** 05 May 2022

Introduction

Breathing disorders during sleep (RSD) in childhood, ranging from snoring to clinical manifestations of sleep apnea – hypopnea syndrome (SAHS).[1] is a common problem. Although the first clinical features of SAHS date back to in 1892, Guilleminault reported that in children diagnosed with SAHS by polysomonography, which is currently the diagnostic technique of choice, the treatment of these patients does not always respond satisfactorily to treatment[2,3]

From a dental perspective, the upper airway (UA) has received increasing attention in pediatric orthodontic treatment. The anatomy and function of the nasopharyngeal airway is directly related to craniofacial development. Because of this close relationship, a reciprocal interaction is expected between pharyngeal structure and dentofacial patterns, validating the growing interest among the orthodontic community[1,4].

Indications for treating the cause of the obstruction should be determined by the pediatrician, ENT specialist, allergist, although orthodontics and dentofacial orthopedics can also correct the obstruction. Interdisciplinary coordination is essential. Malocclusion and other dentofacial abnormalities, can also cause

Corresponding author:
Prof. DR. Harun Achmad
Pediatric Dentistry Department, Faculty of Dentistry,
Hasanuddin University,Makassar, Indonesia
E-mail: harunachmader@gmail.com

SAHS, mandibular retrognathism as one of the most important risks in children[1].

Airway narrowing and adaptation to soft palatal tissues are common in subjects with retrognathic mandibles. Among subjects with sleep-disordered breathing (SDB), the position of the mandible is often retrognathic in relation to the cranial base. As a result, the space between the cervical column and the mandibular body is reduced to the posterior tongue and soft palate, increasing the likelihood of impaired daytime respiratory function and possibly causing nocturnal problems such as snoring, upper airway resistance syndrome, and obstructive sleep apnea syndrome (OSA)[5,6].

Sleep-disordered breathing (SDB) is a diagnostic category of disease that includes obstructive phenomena including primary snoring, upper airway resistance syndrome, and obstructive sleep apnea (OSA), along with the associated entities of central sleep apnea and sleep-associated hypoventilation[7,8]. This disorder is the most common respiratory disease that interferes with normal ventilation, oxygenation, and sleep quality associated with several associated clinical symptoms[9].

Mandibular deficiency causes a decrease in the airway space between the mandibular bone and the cervical column and this can lead to incorrect and posterior tongue and soft palate postures.[10] As long as this attitude remains unchanged, nocturnal breathing problems such as snoring, upper airway resistance syndrome (UARS), and obstructive sleep apnea syndrome (OSAS) may occur[11].

Class II malocclusion is considered one of the most common craniofacial disorders. Class II malocclusion may be the result of a sagittal mandibular deficiency, maxillary excess or a combination of both[12].

Breathing through the mouth is the habit that most often causes abnormalities in facial structure and occlusion of the teeth. The habit of breathing through the mouth during the growth and development period, it can affect dentocraniofacial growth. Chronic mouth breathing causes abnormalities in the muscles around the mouth, which can spur the development of malocclusion[13].

Mouth breathing has long been recognized as one of the causes of facial growth irregularities. These deviations arise due to an imbalance in the activity of the orofacial muscles[14]. Vargervik, et al and Babicc stated that during mouth breathing there is a change in the activity of the orofacial muscles. Rubin stated that abnormal function of the oral cavity will cause changes in muscle pressure acting on craniofacial bones, resulting in changes in craniofacial morphology. Vig formulated a series of biological pathways for craniofacial growth aberrations due to mouth breathing[13].

Facial esthetics plays an important role in the perception of beauty and is also the main reason for patients with skeletal Class II malocclusion to seek orthodontic treatment[8]. When normal function is established, craniofacial morphological adaptations will follow. Growth modification is attempted to alter the Class II skeletal relationships that develop in children, especially during the growth phase by modifying the residual growth of the patient's face to a suitable jaw size or position using functional appliances[15]. Severe mandibular deficiency has been associated with decreased oropharyngeal airway dimensions which increases the likelihood of impaired respiratory function and may lead to problems such as snoring, and obstructive sleep apnea-hypo apnea syndrome (SAHS)[15].

Patients with skeletal Class II malocclusion caused by *retrognathic mandible,* the reduced space between the cervical column and the mandible can lead to a posterior position of the tongue and soft palate tissue causing airway obstruction.[16] Obstruction of the nasal airways can also cause changes in the physiological position of the mandible rest[15].

In children with decreased anterior facial height, mandibular retrognathism and a steep mandibular plane, narrowing occurs in the nasopharynx. Furthermore, airway obstruction can lead to various developmental abnormalities such as "long face syndrome", anterior and posterior open bites, and temporomandibular joint problems[15].

When the mandible is repositioned forward with the aid of a functional apparatus, an indirect increase in airway space occurs. Further, along with as the size and shape of the nasopharyngeal space increases, due to the use of functional equipment, the effectiveness of this equipment also tends to increase at the same time, which automatically results in increased respiration. Several studies have revealed that children with Class II malocclusion tend to keep their heads in an upright and forward position and that there is a significant correlation between malocclusion and cervical lordosis[12,17].

The muscles around the upper respiratory tract, such as the genioglossus, masseter, mylohyoid, and orbicularis oris muscles, have a variety of important functions. The orbicularis oris muscle is a muscle that is attached to the main part of the lips and functions in moving the lips, nostrils, cheeks, and chin skin, while the mylohyoid muscle is a muscle that functions to lift the floor of the mouth and tongue when swallowing, also lowers the lower jaw and raises the tongue bone. The mylohyoid muscle is one of the suprahyoid muscles which is triangular in shape and forms the floor of the mouth[13,18].

Twin Block devices is a functional device used for the early treatment of children with class II malocclusion by advancing the jaw and stimulating jaw growth (Burhan & Nawaya, 2015).[19] It was developed by William J Clark in 1970 in Scotland and is currently one of the most common and most popular functional tools due to its effectiveness in correcting Class II skeletal malocclusions (Abdeikarim 2012; Al-Anez 2011). This tool is well received by patients and can produce rapid changes[1].

The device must be used 24 hours a day, but even if the device is used for approximately 14-18 hours per day it also produces a positive effect after 12-18 months of treatment. However, treatment should be started ideally before or during peak growth for better efficacy[1].

The upper pharynx (nasopharynx) is defined as the area between the most posterior part of the soft palate and the closest point on the posterior pharyngeal wall, reflecting the diameter of the nasopharynx. A larger upper pharynx allows for greater ventilation, whereas a smaller upper pharynx exhibit narrowing and a less patent airway[20].

The lower pharynx (oropharynx) is defined as the area between the junction of the posterior border of the tongue, the lower edge of the jaw and the point closest to the posterior pharyngeal wall, reflecting the diameter of the oropharynx. A larger lower pharynx indicates greater patency, whereas a smaller lower pharynx indicates poorer constriction and ventilation[1].

Since airway problems have a major negative impact on craniofacial growth and development, examination of the airway should be an integral part of the diagnosis and treatment of cases of skeletal Class II malocclusion with retrognathic mandible. These cases also tend to develop into future systemic and respiratory complaints, such as Sleep Disordered Breathing (SDB) due to the compromised airway dimensions[21].

Retrognathic mandible can be associated with upper airway narrowing and has been identified as a risk factor for childhood obstructive sleep apnea (OSA). Because functional appliances have long been used to treat children with mandibular retrognathism, they are potentially useful for children with OSA[22].

Functional appliances that position the mandible forward for the treatment of childhood OSA can also be considered as mandibular advancement devices (MADs). MAD is often used for the treatment of adult OSA because, by positioning the mandible forward, it can enlarge the upper airway and improve respiratory function[22].

Materials and methods

Data source

Data collection was carried out by searching literature on article search sites, namely Google search, PubMed, Cochrane, Wiley, Google Scholar and Science direct which were published from 2010 to 2021, the search was carried out in March – April 2021. Data search is carried out systematically using keywords *twin block, upper airway, class II malocclusion and muscle contractions.*

Research Criteria

A. Inclusion criteria
1. Published articles from 2010-2021
2. Articles in English
3. Published scientific articles available online
4. An article that examines skeletal class II malocclusion with upper respiratory distress corrected using a device *Twin Block*

B. Exclusion criteria

1. Articles included in systematic reviews, literature reviews, case reports, andeditorials
2. Articles that cannot be accessed for free.

Data collection

The data that will be used in this research is secondary data. The data is obtained from the articles searched in the article database which will then be reviewed according to the research criteria set by the researcher.

Results

After eliminating published articles, the title and abstract of each article were analyzed in 164 articles which excluded 142 articles. Article *full text* the remaining 22 articles were re-analyzed and 12 articles were excluded. The complete text of the journal article and meets the eligibility of 10 articles will be reviewed and entered into the synthesis table.

Literature searches were carried out on online databases, namely Google, PubMed and Science direct using the keywords, namely twin block, upper airway, class II malocclusion which found 164 articles (Figure 1).

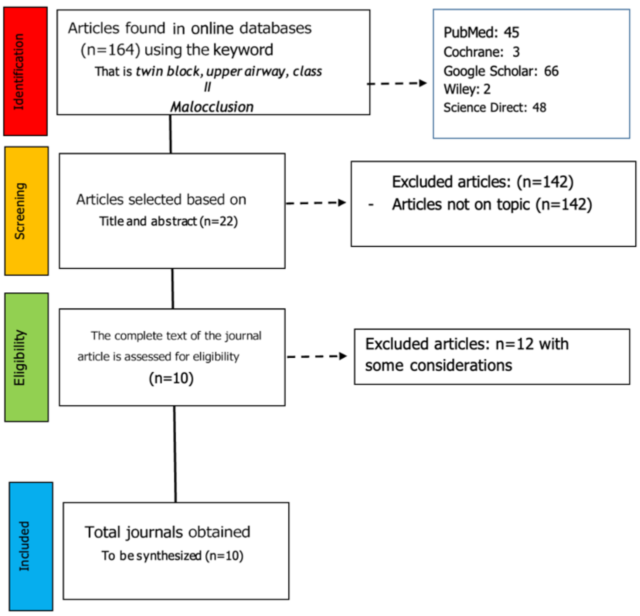

Figure 1. Diagram showing the selection of articles for review.

Study Characteristics and Study Quality

Data are available from 2010 to 2021. Of the 10 studies included in the review, 8 were prospective studies (3 with controls and 2 without controls). 2 studies were retrospective studies with controls (Table 1). The number of study participants ranged from 12 to 60 (total n = 383), with a mean of 38.3. In all included studies, a lateral cephalogram was used to analyze upper airway changes. The mean duration of active treatment ranged from 4 months to 18 months (Table 2).

Discussion

Dentocraniofacial growth is influenced by genetic and environmental factors, among others. Breathing pattern is one of the environmental factors that can affect dentocraniofacial growth. Breathing can be done normally through the nose, or through the mouth if there is a blockage in the nose. Breathing through the nose, in addition to playing a role in maintaining general health, also functions in maintaining normal dentocraniofacial growth[23].

Mouth breathing pattern causes less active lips, reduced tone and shortened. Hellsing concluded that mouth breathing causes pressure on the upper lip to decrease, but pressure on the lower lip to increase. The position of the lower lip, which is between the maxillary and mandibular anterior teeth, is a driving factor for the labial maxillary anterior teeth. Strong thrust from the lower lip without any resistance on the anterior side of the upper lip, resulting in protrusive teeth. The above mechanism results in an Angle Class II division 1 type of malocclusion[24].

The use of functional appliances in the treatment of Class II malocclusion patients with retrognathic mandibles can retract the mandible forward, prevent posterior relocation of the tongue, and improve the upper airway. This systematic review was designed to assess and evaluate changes in the upper airway and muscle movement that occur after repair of malocclusion using the Twin Block apparatus[24]. All studies included in this systematic review showed significant improvement in correcting Class II malocclusions using the Twin Block apparatus compared to the different treated controls[25].

The function of the functional apparatus is through downward and forward displacement of the mandible, causing appropriate stretching of the orofacial soft tissues and muscles, or myotatic reflexes. Myotatic reflexes can be defined as active muscle contractions combined with the viscoelastic properties of muscles, which may be responsible for the tension exerted on teeth and bone structures during treatment. This muscle action produces the desired orthodontic or orthopedic force, which is directly or indirectly transmitted to the underlying dentoskeletal tissue, which is expected to correctthe malocclusion[26].

In a research study conducted by Andrew T, et al in 2020, which compared the use of the Twin Block device with the Dynamix device in adolescent patients with Class II malocclusion, it was found that the Twin-block device was more effective in reducing overjet in children with Class II malocclusion. There seem to be several reasons for this; first, it was clear that patients in the Dynamax group had more problems, e.g., trauma compared to patients with Twin Block. In this case, dropout in the Twin-block group occurred immediately after treatment was started, whereas with the Dynamax device, dropout occurred 3 to 6 months after the device was installed[27].

Class II individual treatment with Twin Block equipment reduces masseter muscle thickness. Treatment with functional appliances can cause mild atrophy of the muscles of mastication, possibly due to decreased functional activity. Our findings may be related to the findings of Freeland[1], which detected decreased muscle activity during swallowing and mastication in patients undergoing activator treatment. In contrast to the children treated with functional appliances, our findings revealed that the untreated children, in the control group, showed an increase in masseter muscle thickness during this period, which is in line with the findings of Raadsheer, et al[27].

Furthermore, a study conducted by Asli Baysal, et al in 2013 which also compared the conditions after therapy using different tools namely Twin Block and active Herbst, the support phase was carried out to achieve interdigitation and good occlusal resolution. In this way, mandibular positioning resulted in greater advancement of mandibular soft tissue with the use of a twin block device than the Herbst and control groups. Soft tissue changes reflect good treatment effect on hard tissue[28].

In the Twin Block group, mandibular progress was greater than in the control and Herbst groups. The forward position of the soft tissue pogonion results in a concurrent forward position of the plane. Although Herbst appliance treatment did not result in a statistically significant increase in soft tissue pogonion with respect to VRL measurements, an increase in nasal projection would occur with the retude position of the upper lip relative to the plane[28].

In order to assess the effect of muscle function on dentofacial development in a biologically accurate manner, it must be considered in conjunction with the central nervous system, which regulates and controls muscle function. According to a study by Oudet Petrovic and Stutzmann, states that the effective wear time of equipment varies by design and argues that equipment such as hyperpropulsors, Twin Blocks, and Frankel Functional Regulators should be worn full time (FT)[29].

In contrast to a study conducted by Min GU et al in 2019 regarding the comparison of the use of the Herbst and Twin Block devices, which reported that both devices were effective in the treatment of childhood OSA, the Twin Block device increased facial height more than the Herbst device. However, the present study showed that this effect did not result in differences in the upper airway. This study determined the effect of the Herbst and TB equipment on PSQ scores and did not show a significant difference in the increase in SRBD between the two devices[22].

Furthermore, a study conducted by Swapnil Godke in 2014 explained that the small dimensions of the PAP and the anatomical adaptation of the soft palate are common features in subjects with retrognathic mandibles. Correction of mandibular retrognathism with the Twin Block functional apparatus can increase the dimensions of the upper airway. Although the lateral cephalogram is not yet ideal for airway analysis[5].

In the class II malocclusion group, the changes in PAP dimensions were minimal, but there was a significant increase in the depth of the oropharynx and hypo pharynx, and inclination of the soft palate after correction of mandibular retrusion. The back position of the tongue in subjects with retrognathic mandibles pushes the posterior soft palate and decreases the dimensions of the upper airway. When the

mandible is moved anteriorly by the Twin Block apparatus, it affects the position of the hyoid bone and the position of the tongue thereby improving the morphology of the upper airway[5].
In a study conducted by Dalia Smailiene in 2017, it was stated that the period of using the Twin block device was standardized to 10-14 months based on the results of a study evaluating the treatment effect produced by the Twin block tool. This period of time is sufficient to ensure bone change and reduction[17].

The short-term effects of treatment with the twin block device evaluated in this study are similar to those of other studies. The main effects are an increase in mandibular position (increase in SNB angle and Ar-B distance), consequent correction of the sagittal skeleton jaw discrepancy (decrease in ANB angle), and increase in facial height (increase inAFH and LFH values). Statistically significant dentoalveolar effects on incisors were not observed, but there was a significant increase in oropharynx and deep pharyngeal airway width. There is a change in body posture that can be associated with an increase in the oropharynx and airway width during treatment with twin block functional appliances[17].

Furthermore, a study conducted by Inmaculada Entrenas in 2019 showed that correction of mandibular retrognathism with a Twin Block device in patients the growth spurt not only improves the facial profile and intermaxillary relationship but also increases the dimensions of the UA thereby reducing the risk of future respiratory problems and represents a suitable oral appliance for treating children with SAHS. However, several studies have demonstrated the long-term effectiveness of using Twin Blok equipment; therefore, its permanence remains to be determined[1].

Another study on airway improvement in class II malocclusion patients using functional appliances conducted by Merve Goymen, et al in 2019 revealed that the effect of the type of treatment on the airway problems experienced, especially in severe class II cases led to an increase in the detected airway. Proportional to growth in both the individuals receiving the different treatment and in the untreated individuals[30].

The difference between the values before treatment and after treatment was not significant in the group for SNB, while it was only significant in the Twin Block group for theme a surement of SNA. Functional treatment in this study can improve the sagittal measurement of the oropharyngeal and hypo pharyngeal airways in accordance with previous studies[30].

In a research study conducted by Andrew T, et al in 2020, which compared the use of the Twin Block device with the Dynamix device in adolescent patients with Class II malocclusion, it was found that the Twin Block device was more effective in reducing overjet in children with Class II malocclusion of Dynamax tool. There seem to be several reasons for this; first, it was clear that patients in the Dynamax group had more problems, e.g., trauma compared to patients with Twin Block. In this case, dropout in the Twin-block group occurred immediately after treatment was started, whereas with the Dynamax device, dropout occurred 3 to 6 months after the device was installed[27]

It is different with the study conducted by Jia-Nan Zhang et al in 2020 in the treatment of class II scalable malocclusion by comparing the use of RME and Twin Block devices which suggested that RME treatment followed by a fixed device is better for vertical control, because clockwise rotation of the mandible is avoided. .In contrast, Twin-Block treatment followed by a fixed appliance significantly increased the mandibular plane angle and caused an unfavorable clockwise rotation of the mandible, causing the mandible to grow downward and forward. Phase I treatment period with RME therapy was shorter than with Twin Block therap[31].

Research conducted by Vivek Kumar Thakur in 2021, validated the significant positive effect of the Twin Block device on airway dimensions as an increase in the minimum upper airway area and an increase in airway area. The area of maximum narrowing may be more clinically significant, in terms of airway improvement, which is directly correlated with improved quality of life in patients with Class II skeletal malocclusion; visible changes are evident in individuals with clinical improvement characterized by facial features and bright eyes. The dull ness and lethargy disappeared probably due to the attainment of deep sleep due to better oxygenation and better airway dimensions.

Twin Block therapy may be one of the most efficient treatment modality available for repair in the upper airway for growing patients with skeletal Class II malocclusion[10].

The same thing was also said by Neel Dedhiya et al in their study in 2021 which showed a significant increase in UPW, MPW after twin block device treatment in Class II subjects with retrognathic mandible. The Fixed Twin Block device was more effective in correcting skeletal class II malocclusions and therefore, marked improvement in oropharyngeal airway dimensions (UPW, MPW)and hyoid bone displacement (anterior and superior)[32].

All included studies showed significant improvement in airway improvement after Twin Block treatment compared with controls using other devices. The expansion of the maxillary arch, along with the forward growth of the mandible, causes forward relocation of the tongue, thereby increasing the posterior tongue space. The study by Verma, et al.[13] demonstrated a significant improvement in the upper airway among individuals with Class II skeletal malocclusion after treatment with a Twin Block device. However, there were no significant changes in the lower pharynx. This can be attributed to the fact that the Twin Block appliance causes the mandible to advance and the tongue to position forward, which in turn reduces stress on the muscles and soft palate, this results in an increase in upper oropharyngeal dimensions and an increase in airway permeability. The growth of the oropharyngeal muscles caused by the forward movement of the mandible increases the upper airway[33].

Conclusions

The results of the explicitly selected studies included in this systematic review, it can be concluded that the use of the Twin Block device for correction of Class II skeletal malocclusions resulted in significantly greater upper airway improvement. The twin block functional device is proven to be very good at treating Class II division I malocclusion, this tool is better than other functional devices.

Treatment of class II relationship of teeth with functional equipment, namely the Twin Blok device reduces the thickness of the masseter muscle. This treatment may cause mild atrophy of the masseter muscle, possibly due to a decrease in its functional activity. This functional apparatus therapy is associated with the adaptation of masticatory muscles. The initial condition of the masticatory muscle is represented by the thickness of the masseter muscle, which can be one of the factors that affect the results treatment. Individuals with thinner pretreatment masseter muscles showed greater proclination of the mandibular incisors, distalization of the maxillary molars, and displacement of the cephalometric point A posteriorly during treatment. Individuals with thicker muscles showed greater increases in posterior facial height, condyle- ramus height, and mandibular unit length during treatment.

Recent literature has shown that the use of Twin Block devices in pediatricpatients with Class II malocclusion can correct dental abnormalities and improve the airway by reducing muscle contractions that occur. The Twin Block Device is a simple device that not only provides bone and tooth correction for Class II malocclusions, but is more accurate as an exercise tool that leads to neuromuscular changes by facilitating muscle adaptation and activating different brain regions.

Declaration of Interest

The authors report no conflict of interest.

Table 1. Study descriptive data included

NO	Author/Year	Title	Study Design	Criteria Mal occlusion	Type of Intervention	Analysis Statistics	Study Conclusion
1	Original Baysal, et all 2013	Soft Tissue Effects of Twin Block and Herbs appliances in Patients with Class II Division 1 Mandibular Retrognathy	prospective	Class Malocclusion II Division I	Sample group first research use Herbst equipment Sample group second research using Twin Block In group control :no given treatment	"t" test independent	Twin Block and Herbst tools can significantly provide network changes software, on the software profile, with progress greater in patients using twin block devices
2	Swapnil Ghodke,,et all 2014	Effect of Twin Block Appliance on The Anatomy of Pharyngeal Airway Passage (PAP) in Class II Malocclusion Subject	prospective longitudinal	Malocclusion Skeletal Class II with sample Mandible Retrognathic	In group research sample, use twin block equipment In group control, sample don't get treatment using tools anything	Shapiro Test- Wilk	sagittal oropharynx and hypo pharynx, soft palate thickness, and inclination improved but not significant effect to thickness Posterior pharyngeal wall
3	Dalia Smailiene, et all 2017	Effect of Treatment with Twin-Block Appliances on Boy Posture in Class II Malocclusion Subjects : A Prospective Clinical Study	Prospective	Class II malocclusion with the Mandible Retrognathic	in the group the research sample, le using dan twin block equipment modification In group control, sample is a patient not using tools anything because no cooperative in care	't' test independent in pairs Test Man Whitney U	Analysis of changes in posture body show profile enforcement back and the reduction statistically significant of all measurements during treatment with a Twin-block device. Changes in body posture Is an expression of physiological growth rather than response to occlusion repair?
4	Inmaculada Entrenas, et all 2019	Evaluation of changes in the upper airway after Twin Block treatment in patients with class II malocclusion	prospective case control	Class II mal occlusion with pattern growth Jaw malofacial and brachyfacial	in the group research samples, sample use twin block equipment In group control, sample don't get treatment using tools anything	Student "t" test	Increase in road size significant upper airway in the nasopharynx and opharynx after use of Twin Block in patients with Class II malocclusion Mandible. Treatment effectiveness shown to the patient by showing better breathing quality

5	Min Gu, et all 2019	Research Article Upper Airway Changes Functional follow Treatment with the Headgear Herbst or Headgear Twin Block Appliance Assessed on Lateral Cephalograms and Magnetic Resonance Imaging	prospective	Class II Mal occlusion with t over jet (>5mm)	Research samples randomly given treatment different Sample group first research use tool equipment Herbst Headgear Sample group second research using Twin Block Headgear	"t" test in pairs and Test Man Whitney U	Both Herbst and equipment Twin Block has reported to be effective in the treatment of obstruction sleep apnea (OSA) in childhood
6	Merve Goymen, et all 2019	Evaluation of Airway Measurements in Class II Patient Following Functional Treatment	Retrospective	Class II Mal occlusion Division 1	Sample group first research with equipment Twin Block tool Sample group second research with Forsus Fatigue	ANOVA testone way and Test	Class II malocclusion can be treated effectively with FRD. Treatment and TWB, equipment this functional causes an increase in the dimensions of the Resistant Device (FRD): In group no control given treatment anything
7	Andrew T. DiBiase, Luisa Lucchesi, et all 2020	Post-treatment cephalometric changes in adolescent patients with Class II malocclusion treated using two different functional appliance systems for an extended time period: a randomized clinical trial	randomized clinical trial retrospective	patients with a Class II malocclusion	Sample patients completed the trial, Twin Block andDynamax	SPSS (versi 16,0)	Treatment resulted in greater mandibular growth with the Twin Block than the Dynamax. In the follow-up period, there was less growth in the Twin Block group compared to the Dynamax
8	Jia Nan Zhang, et all 2020	Comparison of the Effectof Rapid Maxillary Expansion versus Twin Block Appliance on Mandibular Growth in Skeletal Class II Patients	Retrospective	Malocclusion Skeletal Class II	Sample group class II Skeletal with equipment Rapid Maxillary Expansion (RME)Sample group second research with Twin Block tool	SPSS (vers. 20.0)	Good care with RME or Twin-Block Phase I is followed by Phase II treatment with fixed equipment with four tooth extraction premolars reach increased growth of the sagittal mandible significant and clear facial profile repair In skeletal Class II patients.

9	Vivek Kumar Thakur, et all 2021	Evaluation and quantification of airway changes in Class II division 1 patients undergoing myofunctional therapy using twin block appliance	prospective	Skeletal Class II division I with retrognathy mandible	All sample Search Twin Blocks tools No group control	"t" test in pairs	Significant upper airway improvement in Skeletal Class II division 1 subjects with therapy myofunctional Twin Block with functional change achievement positive, aesthetic, and healthier quality of life
10	Neel Dedhiya, et all 2021	Assessments of Airway and Hyoid Bone Position in Class II Patient Treated with Fixed Twin Block and Forsus Fatigue Resistant Device – A Retrospective Cephalometric Study	prospective	Class II malocclusion with the Mandible Retrognathic	Sample group study using Fixed equipment Twin Block Sample group second research Use Forsus Fatigue Resistant Device (FRD) In group no control given treatment anything	Test 't" and Test ANOVA	More FTB tools effective in correcting class II malocclusions skeletal compared to the Forsus FRD apparatus and real improvement on channel dimensions breath oropharyngeal (UPW, MPW) and displacement hyoid bone (anterior and superior) seen with FTB as comparison to Forsus FRD

Table 2. Study descriptive data included

NO	Author	Number of Samples	Measurement technique	Mean duration of active treatment
1	Original Baysal, et all2013	Research group of 40 children 20 Herbs pediatric patients 12-14 years 11 P and 9 L 20 TB patients: 11-14 years 10 P and 10 L 20 control patients (11 L,	Measurement using lateral cephalometric	All the time 10-18 months
2	Swapnil Ghodke, et all 2014	9 P) Study Group 20 patients using TB devices : 8-12 year 18control patients : 8-12 yaer	Measurement using lateral cephalometric	24 hours a day6 months
3	Dalia Smailiene, et all2017	The initial research group consisted of 42 children aged 10-15 years, who wanted 23 children to use the device (13 L, 10 P), 19 were excluded because they were uncooperative, and The 14 of them were used as the control group.	Measurement using standard cephalometric	16-18 hours a day10-14 months
4	Inmaculada Entrenas, et all 2019	Study sample group was 40 patients (20P, 20L).)8-12 years old	Measurement using Lateral teleradiography	14-18 hours per day 12-18 months
5	Min Gu, et all 2019	The research group consisted of 28 children (11 L, 17 P) M age : 12-17 yrs. P : 10-15 year	MRI and cephalometry	10-12 hours per day 6-10 months

6	Merve Goymen, et all 2019	Study group 30 children 15 patients TWB : 11-13 year 15 FRD patients : 13-15 year control patients : 10-16 year	Measurement using 2D cephalometry	Unknown
7	Andrew T. DiBiase, Luisa Lucchesi, et all 2020	The research group consisted of 100 adeloscent females aged 11–13 and males 12–14; 52 using Twin Block and 48 Dynamax	cephalometry	th full-time wear for the period of 15 months
8	Jia Nan Zhang, et all 2020	Study group 29 patients 14 RME patients (4 L, 10 P) 15 TB patients (9 L, 6 P)	Measurement using lateral cephalometric	24 hours a day 3-6 months
9	Vivek Kumar Thakur, et all 2021	Study group 12 patients (5 L, 7 P) age = 13 years cephalometry, MRI and SD	Measurement using Cone Bean	10-12 hours per day 6-10 months
10	Neel Dedhiya, et all2021	Study Group 40 patients 20 Forsus patients (11 L, 9 P) 20 FTB patients (11 L, 9 P) 20 control patients (11 L, 9 P)	Measurement using 2D cephalometry	Unknown

References

1. Enternas I, Chamorro EG, Alvarez-Abad C, Muriel J, Menndez-Diaz I, Cobo T. Evaluation Of Changes In The Upper Airway After Twin Block Treatment In Patients With Class II Malocclusion. Clin Exp Dent Res 2019; 5(3): 259–268.
2. Albajalan OB, Alazzawi NO, Mukti NA, AR Samsudin. Effectiveness of Treatment with Reverse Twin-Block and Reverse Pull Face Mask on Dental Arches of Class III Malocclusion: A Randomized Clinical Trial. Journal of International Dental and Medical Research 2020; 13(2): 708-713.
3. Murakami A, Kawanabe H, Hosoya H, Fukui K. Effect of sleep-disturbed Breathing on Maxillofacial Growth And Development In Schoolaged Children. Orthodontic Waves 2021; 80(2): 87–95.
4. Elfeky HY, Fayed MMS. Three-Dimensional Effects of Twin Block Therapyon Pharyngeal Airway Parameters In Class II Malocclusion Patients. Journal of the World Federation of Orthodontists 2015; 4(3): 114–119.
5. Unuvar YA, Zortuk FB, Ozer T, Beycan K. The Pharyngeal Airways of Patients with Class II Malocclusion: A Cone-Beam Computed Tomography Analysis. Makara J Health Res 2021; 25(2): 113−121.
6. Thapa VB, Shrestha A, Sherchan P, Poudel P, Joshi L. Twin block appliance: Effect on pharyngeal airway. Journal of Kathmandu Medical College 2018; 7(4), Issue 26: 147-152.
7. Behrents RG, Shelgikar AV, Conley RS, et al. White Paper: Obstructive Sleep Apnea and Orthodontics: An American Association of Orthodontists White Paper. Am J Orthod Dentofacial Orthop 2019; 156: 13-28.
8. Padmanaban S. Effect of Functional Appliance on the Airway in Class II Malocclusions. Journal of the World Federation of Orthodontists 2020; 9(3): 527-530.
9. Corso R, Russotto V, Gregoretti C, Cattano D. Perioperative Management Of Obstructive Sleep Apnea: A Systematic Review. Minerva Anesthesiologica 2018; 84(1): 81-93.
10. Achmad H, et al. An Overjet Reduction of Class II, Division 1 Malocclusion in Twin Block Dentofacial Orthopedic and Fixed Orthodontic Treatment: Case Report. Journal of International Dental and Medical Research 2017; 10(3); 1010-1016.
11. Cortese M, et al. Evaluation of the Oropharyngeal Airway Space in Class II Malocclusion Treated with Mandibular Activator: A Retrospective Study. The Journal of Contemporary Dental Practice 2020; 21(6): 666-672.
12. Ajami S, Morovvat A, et al. Dentoskeletal Effects Of Class II Malocclusion treatment With The Modified Twin Block Appliance. J Clin Exp Dent 2019; 11(12): 1093-1098.
13. Habar EH, Erwansyah E, Bakri K. Mouth Breathing Habit As An Etiological Factor Of Malocclusion: Literature Review. Makassar Dental Journal 2021; 10(3): 256-259
14. Grippaudo C, Paolantonio EG, Antonini G, Saulle R, G Torre La, Del R. Association Between Oral Habits, Mouth Breathing And Malocclusion. Acta Otorhinolaryngologica Italica 2016; 36: 386-394.
15. Kannan A, Sathyanarayana HP, Padmanabhan S. Effect of Functional Appliances on The Airway Dimensions in Patients with Skeletal Class II Malocclusion: A systematic review. Journal of Orthodontic Science 2017; 6(2).
16. Achmad H, Mutmainnah N, Ramadhany YF. A Systematic Review of Oral Myofunctional Therapy, Methods and Development of Class II Skeletal Malocclusion Treatment in Children. Sys Rev Pharm 2020; 11(6): 511- 521.
17. Smailiene D, Intiene A, et al. Effect of Treatment with Twin-Block Appliances on Body Posture in Class II Malocclusion Subject : Prospective Clinical Study. Med SciMonit 2017; 23: 343-352.
18. Achmad H, Faizah N. Effect of Orthodontic Facemask as a Treatment for Children in Growth and Development Period: A Systematic Review. Annals of R.S.C.B. 2021; 25(1): 4620 – 4631.
19. Burhan AS, Nawaya FR. Dentoskeletal Effects of the Bite Jumping Appliance and the Twin-Block Appliance in the Treatment of Skeletal Class II Malocclusion: A Randomized Controlled Trial. European Journal of Orthodontics 2015; 37(3): 330–337.
20. Melleiro CM, Antonio GF, Aparecida BM, Magro GO, et al. Cephalometric Evaluation Of The Predictability Of Bimaxillary Surgical-Orthodontic Treatment Outcomes In Long Face Pattern Patients: A Retrospective Study. Dental Press J Orthod 2013; 18(5):53-58.
21. Thakur VK, Londhe SM, et al. Evaluation and Quantification of Airway Changes in Class II Division 1 Patients Undergoing Myofunctional Therapy Using Twin Block Appliance. Medical Journal Armed Forces India 2021; 77: 28-31.
22. Gu M, Savoldi F, et al. Upper Airway Changes following Functional Treatment with the Headgear Herbst or Headgear Twin Block Appliance Assessed on Lateral Cephalograms and Magnetic Resonance Imaging. The Scientific World Journal 2019; (2019).
23. Achmad H. Mouth Breathing in Children Due to Upper Respiratory Tract Obstruction. PDGI Journal 2015; 478-483.
24. Feroza NA, et al. The Relationship Between Bad Mouth Breathing Habits and the Severity of Malocclusion at SMPN 4 Banjarbaru and SMAN 4 Banjarbaru. Dentino (Journal of Dentistry) 2017; 2 (1): 39-43.
25. Pawinru AS. Twin Blocks. Makassar Dent J 2016; 5(3): 87-90.
26. Gregory SA, Kiliaridis S. Predictive Value Of Masseter Muscle Thickness And Bite Force On Class II Functional Appliance Treatment: A Prospective Controlled Study. European Journal of Orthodontics 2015; 37(6): 570–577
27. Andrew T, Lucchesi L, Qureshi U, Lee RT. Post-Treatment Cephalometric Changes In Adolescent Patients With Class II Malocclusion Treated Using Two Different Functional Appliance Systems For An Extended Time Period: A Randomized Clinical Trial. European Journal of Orthodontics 2020; 42(2): 135–143.
28. Ng Hui Lin, Soemantri ES, Gayatri G. Changes in Soft Tissue Facial Profile of Class II Skeletal Malocclusion Patients With Retrognathic Mandible Treated With Twin Block Appliance. Padjadjaran Journal Dentistry 2019; 31(1): 32-37.
29. Ozdiler O, Orhan K, Cesur E, Koklu A, Algin O. Evaluation of Temporomandibular Joint, Masticatory Muscle, and Brain Cortex Activity in Patients Treated by Removable Functional Appliances: A Respective FMRI Study. Dentomaxillofacial Radiology 2019; 48(7).
30. Goymen M, Mourad D, Gulec A. Evaluation of Airway Measurements in Class II Patients Following Functional Treatment. Turk J Orthod 2019; 32(1): 6-10.
31. Zhang JN, Chen S, Huang CY et al. Comparison of The Effect of Rapid Maxillary Expansion versus TwinBlok Appliance on Mandibular Growth in Skeletal Class II. BMC Oral Health 2020; 350(2020).
32. Dedhiya N, Pradhan T, Sethia A. Assessment of Airway Dimensions and Hyoid Bone Position in Class II Patients Treated with Fixed Twin Block and Forsus Fatigue Resistant Device A Retrospective Cephalometric Study. Journal of Orofacial Sciences Published by Wolters Kluwer – Medknow 2020; 12(2): 131-138.
33. Mohamed RN, Basha S, Al-Thomali Y. Changes in Upper Airway Dimensions Following Orthodontic Treatment of Skeletal Class II Malocclusion with Twin Block Appliance: A Systematic Review. Turk J Orthod 2020; 33(1): 59-64.