Avicenna J Dent Res. 2018 June;10(2):63-66

AJDR
Avicenna Journal of Dental Research

doi 10.34172/ajdr.2018.14

Original Article

The Effect of Anterior Bite Plate on Deep Bite Correction During Early Mixed Dentition

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Abstract

Background: Deep bite is one of the main common occlusal discrepancies of mixed dentition period and anterior bite plate is recommended in early mixed dentition to correct the trait and prevent the future malocclusion. The aim of this study was to assess the effect of anterior bite plate on the correction of deep bite in early mixed dentition.

Methods: This retrospective semi-experimental clinical trial was conducted on 16 patients (8 males, 8 females) with deep bite and class II malocclusion in early mixed dentition. Cephalometric radiographs were obtained from patients' records before and after the application of anterior bite plate. Changes in 11 various angular, ratio and distance measures were evaluated by tracing the cephalograms. Collected data were then analyzed using paired t-test.

Results: Statistical differences were evaluated before and after the use of anterior bite plate appliance. Change in overbite, overjet, ANB angulation, anterior facial height, posterior facial height and Jarabak index were calculated with results indicative of significant changes ($P<0.017$, $P<0.041$, $P<0.001$, $P<0.0001$, $P<0.0001$, $P<0.012$). However, no significant difference in the degree of SNA, SNB, Go.Gn.SN, Y-axis and incisor to the mandibular plane angle (IMPA) was noted following the application of the appliance ($P>0.914$, $P>0.219$, $P>0.753$, $P>0.276$, $P>0.062$).

Conclusions: Treatment with the anterior bite plate was shown to be effective in correction of the deep bite in cases with class II malocclusion with little need for complex fixed appliance therapy.

Citation: Ansari G, Showkatbakhsh R, Malekshah S, Dashti M, Simaei L. The effect of anterior bite plate on deep bite correction during early mixed dentition. Avicenna J Dent Res. 2018;10(2):63-66. doi: 10.34172/ajdr.2018.14.

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Keywords: Deep bite, Anterior bite plate, Mixed dentition

Received March 7, 2018
Accepted May 10, 2018
ePublished June 15 2018

Background

Anterior deep overbite is defined as an increase in vertical overlap of maxillary incisors over their corresponding mandibular teeth, more than the normal average of 30%-40%. The inclination of maxillary and mandibular incisors can also have an impact on the actual amount of the overbite. Deep bite is a common malocclusion in various racial and ethnic entities. The frequency of this condition has been reported to be higher during mixed dentition and might be associated with other malocclusions too. It is thought to be one of the most detrimental malocclusions for future occlusion (1-5).

A simple deep bite is limited to the dentition and its alveolar process. Usually, dental deep bites are due to the over-eruption of anterior teeth following the loss of incisal contact or infra-occlusion of molars. A characteristic feature of such deep bite is the absence of any skeletal problem. In contrast, severe forms of deep overbite occur when lower anterior segment impinge behind the maxillary incisors causing trauma to the palatal mucosa. In certain cases, this may even lead to the loss of upper incisors. Severe forms of deep bite are usually seen in class II division II malocclusion; some cases of deep bite have been seen in patients with class I and class III malocclusion too. The most common characteristics seen in such malocclusion include short anterior lower face height, flat mandibular plane angle, acute gonial angle, parallel maxillary and mandibular occlusal plane and deep mandibular curve of Spee (6).

Treatment of the deep bite is considered as a challenging procedure as untreated patients may further suffer from anterior crowding, upper incisors flaring, periodontal problems, and temporomandibular disorders (7).

Various outcomes are expected when correcting deep bite which include aesthetic, occlusal plane, lip competency, vertical skeletal dimension, skeletal convexity, stability of final occlusion and patients' growth potentials (8,9).

Highlights

- A significant decrease in degree of overjet after the use of anterior bite plate with jack screw
- A significant decrease in degree of overbite after the use of anterior bite plate with jack screw
- A significant decrease in ANB angle after the use of anterior bite plate with jack screw
- A significant increase in PFH and AFH after the use of anterior bite plate with jack screw
- A significant increase in jarabak index after the use of anterior bite plate with jack screw

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It has been confirmed that arch leveling techniques and intrusion mechanics can give desired results in cases of simple dental deep bites with normal inter-occlusal distances in the mandibular postural position. Absolute intrusion is needed along with segmented arch mechanics in cases with no sign of growth (6).

Vertical growth can spontaneously compensate for the extrusion of the buccal segment and relative intrusion of incisors in growing patients along with the development of other teeth in the face, resulting in the correction of deep bite in the late mixed or early permanent dentition. Phase 2 treatment is usually accomplished due to the significant incisors protrusion (6). Intrusive force needs to be near the center of resistance in order to achieve intrusion without proclination. Such move is best achieved using osseointegrated implants as a temporary anchorage device (6).

Removable appliances are proved to be useful when they are equipped with anterior bite plate in order to correct the deep bite. In such circumstances, posterior dentoalveolar segment will grow and a slight intrusion in mandibular incisors may occur (10).

Acrylic extension of appliance in anterior segment will play the role of a stop on mandibular incisors allowing posterior teeth to further erupt. This posterior disocclusion promotes further eruption of posterior teeth to reach the new occlusal plane and correct the anterior deep bite. In this device, the Jackscrew, by palatal expansion and creating preloaded contacts while closing, causes the mandible to move forward, which helps to correct class II malocclusion (10).

This study was aimed to assess the role of an anterior bite plate with or without jackscrew in treating deep bites in early mixed dentition stage.

Methods

This retrospective semi-experimental clinical trial was carried out on a group of 16 patients, all in the age range of 6-10 years (early mixed dentition stage) with moderate class II malocclusion (The mesiobuccal cusp of the maxillary first permanent molar occludes with the buccal groove of the mandibular first permanent molar) combined with deep bite in early mixed dentition stage. Patients were selected from those referred for an orthodontic private practice in Tehran in 2010.

Data were collected through analysis and recording of measures in lateral cephalograms. Pre and post treatment cephalograms were obtained and analyzed. The sample size was calculated using the following equation:

$$n = \frac{(Z_\alpha + Z_\beta)^2 \times sd^2}{(X_1 - X_2)^2}$$

Z_α: 1.96, Z_β: 0.84, sd: 1.88, X_1: 4, X_1: 1.6

The result of this calculation revealed a minimum sample size of 10. However, due to the availability, the number of cases was 16 (8 females and 8 males), with a mean age of 8.5 ±1.09 years (range: 6-10 years of age).

The inclusion criteria were: (1) Moderate skeletal and class II malocclusion with deep overbite, (2) Early mixed dentition period. All patients were treated by an anterior bite plate for 12 months. The wires of appliance were made of 026 wire manufactured by Dentarum company, Germany. The acrylic base plate was manufactured by Dentarum Company, Germany, too (Figure 1).

This anterior bite plate provided 1-2 mm space between the posterior teeth in both sides of the jaws. Tracing was carried out on all pre and post treatment radiographs of each patient by an independent examiner. In order to assess the magnitude of the method error, all cephalograms were traced and measured again by another independent examiner in a 4-week period. The method error did not exceed 0.1 mm and 0.75° for the linear and angular measurements, respectively.

Data were analyzed by defining central scattering parameters (mean and standard deviation) of 11 angular and distance variables, before and after treatment.

Statistical comparison of changes was made based on cephalometric indices after treatment with anterior bite plate using paired *t* test at 0.05 significance level.

Angular measurements used include SNA, SNB, Go.Gn to SN, Y-axis and long axis of mandibular incisor to the mandibular plane angle (IMPA).

Linear measurements used include overbite, overjet, anterior facial height, posterior facial height and Jarabak index. Individuals were evaluated for their problems with three independent orthodontists and this treatment strategy was defined as indicated before inclusion in the study. Paired *t* test was conducted to further analyze the data.

Results

Based on the findings of this investigation, the mean overbite value was 4.25±1.57 before treatment with a clear decrease to 3.125±1.543 after treatment using anterior bite plate appliance. Paired *t* test showed a significant difference in overbite before and after treatment (mean

Figure 1. Anterior Bite Plate with Jackscrew.

decrease of 1.67 mm, $P<0.017$).

A statistically significant difference was observed in the degree of overjet before and after treatment following the use of anterior bite plate appliance (mean decrease of 1.789 mm and $P<0.041$). The mean decreased value of ANB angle was 1.062 mm ($P<0.001$). Posterior facial height was also measured with the mean increase of 5.352 mm ($P<0.0001$). Mean anterior facial height was increased to 6.255 mm with a highly significant difference ($P<0.0001$). Jarabak index measurement also showed a significant difference before and after the URA was applied (mean increase 2.019%, $P=0.012$). However, no significant differences in the changes of SNA, SNB, Go.Gn.SN, Y-axis and IMPA angles following the use of this appliance design were noted ($P>0.914$, $P>0.219$, $P>0.753$, $P>0.276$, $P>0.062$) (Table 1). There was no significant difference between genders.

Discussion

A significant increase in the incidence of deep bite during the primary and mixed dentition stages was reported, which highlights the need for an interceptive orthodontic treatment in early mixed dentition stage. This will even prevent the case from entering a traumatic deep bite pattern. Various treatment strategies have been introduced in the literature to tackle such problem including removable appliances with anterior bite plates. The anterior bite plate will unlock the mandible by disoccluding the posterior segment and freeing the mandible through the removal of the barrier of mandibular growth (11).

According to the findings of this study, the use of anterior bite plate with jackscrew can change many cephalometric parameters related to deep overbite during mixed dentition. These parameters included the decrease in overbite, overjet, ABA angle and increase in PFH, AFH and Jarabak index. It was also shown that no significant increase can be found in SNA angle after the application of the appliance. This could be partly explained by anterior movement of maxilla during the treatment period. The evaluation of the data obtained from IMPA measurements revealed a decrease related to the contact of the incisal edges of mandibular incisors with acrylic plate, with no statistically significant difference ($P=0.062$). Dake and Sinclair (12), Parker et al (13) and Ball and Hunt (14) also showed significant overbite decrease in their studies.

Table 1. Cephalometric Index Before and After Treatment with Anterior Bite Plate

Variable	Before Treatment (Average)	After Treatment (Average)	SD	*P* Value
Overbite	4.25	3.125	1.67	0.017[a]
Overjet	3.688	2.688	1.789	0.041[a]
SNA	78.875	78.938	2.265	0.914
SNB	74.25	75.125	2.729	0.219
ANB	4.875	3.813	1.062	0.001[a]
Go.Gn.SN	34.375	34.188	2.344	0.753
Y-axis	69.625	69.188	1.547	0.276
IMPA	94.563	92.188	4.703	0.062
P.F.H	70.875	77.25	5.352	0.0001[a]
A.F.H	111.75	119	6.255	0.0001[a]
Jarabak	63.429	64.869	2.019	0.012[a]

Findings of this investigation also show significant differences in values of AFH and PFH before and after treatment. These changes can be due to the posterior teeth extrusion during treatment with jackscrew and downward movements of the maxilla during growth, which is similar to the results of a study done by Parker et al (13). However, Dake and Sinclair (12) reported that these parameters had a very small decrease with almost similar setups.

In earlier studies, an increase in IMPA during treatment of deep bite with anterior bite plate has been reported while nothing was detected in the current study (12,13).

Lindauer et al showed the efficacy of both bite plate and arch intrusion in the reduction of the deep bite. Overbite measures were reported with a decrease of 3.3 mm when bite plate was used which is comparable to the findings of the current study showing 1.67 mm reduction (11).

Keski-Nisula et al believed that interceptive treatment in society leads to less orthodontic treatment needs (15).

Bassarelli et al used a modified jasper jumper (JJ) and anterior bite plane and showed a significant increase in mandibular length and decrease in overbite and overjet. A significant improvement in sagital relationship and the proinclination of lower incisors were also reported while the mandibular first molars showed decrease of mesial movement. It appears that the use of JJ and anterior bite plane is an effective protocol for class II malocclusion with great skeletal rather than dentoalveolar effects (16).

Ciavarella et al compared the efficacy of anterior bite plane functional appliance (ABPFA) with untreated patients and reported reduced overjet and overbite (dental parameters) in ABPFA group but no significant differences in skeletal measurements ($P=0.000$, $P=0.9588$) (17).

Overall, intervention in early mixed dentition acts as a highly effective tool to reduce the need for more complicated orthodontic approaches in the future. Proper retention can lead to desired results with little to no relapse. However, the long-term effectiveness of this treatment modality should be assessed only after the retention period and follow-up (18).

Conclusions

The use of a removable appliance with a jackscrew and anterior bite plate was shown to be beneficial in the correction of deep bite for those with class II division II malocclusion during early mixed dentition. Decreased overbite is achieved along with reduced overjet but increased AFH, PFH and Jarabak index.

Authors' Contribution

GA and RS designed and handled the study. SM and MD performed the experiments and analyzed data. LS wrote the manuscript with input from all authors.

Ethical Statement

All parents were requested to read and sign an informed consent form provided prior to the commencement of the orthodontic treatment.

Conflict of Interest Disclosures

The authors declare that they have no conflict of interests.

References

1. Baratam S. Deep overbite—A review (Deep bite, Deep overbite, Excessive overbite). Ann Essences Dent. 2009;1(1):8–25. doi: 10.5368/aedj.2009.1.1.8-25
2. Feldner J A, Bantleon PH. Intrusion vs. Extrusion as Different Treatment Methods to Correct Deep Bite. Inf Orthod Kieferorthop 2017;49(1):24-28.
3. Naumann SA1, Behrents RG, Buschang PH. Vertical components of overbite change: a mathematical model. Am J Orthod Dentofacial Orthop. 2000;117:486–95.
4. Calloway DM, Anton MA, Jacobs JS. Changing concepts and controversies in the management of mandibular fractures. Clin Plast Surg. 1992;19(1):59-69.
5. Stahl F, Grabowski R. Orthodontic findings in the deciduous and early mixed dentition--inferences for a preventive strategy. J Orofac Orthop. 2003;64(6):401-16. doi: 10.1007/s00056-003-0313-8
6. Ghafari JG, Macari AT. Component analysis of predominantly vertical occlusal problems. Semin Orthod. 2013;19:227–238. Doi:10.1053/j.sodo.2013.07.006.
7. Kale Varlik S, Onur Alpakan Ö, Türköz Ç. Deepbite correction with incisor intrusion in adults: a long-term cephalometric study. Am J Orthod Dentofacial Orthop. 2013;144(3):414-9. doi: 10.1016/j.ajodo.2013.04.014
8. Ng J, Major PW, Heo G, Flores-Mir C. True incisor intrusion attained during orthodontic treatment: a systematic review and meta-analysis. Am J Orthod Dentofacial Orthop. 2005;128(2):212-9. doi: 10.1016/j.ajodo.2004.04.025
9. Chen Y, Yao C, Chang H. Non-surgical correction of skeletal deep overbite and class II division 2 malocclusion in an adult patient. Am J Orthod and Dentofacial Orthoped. 2004;126(3):371-378.
10. Simon M, Keilig L, Schwarze J, Jung B.A, Bourauel C. Forces and moments generated by removable thermoplastic aligners: incisor torque, premolar derotation, and molar distalization. Am J Orthod Dentofacial Orthop. 2014;145(6):728-36. doi: 10.1016/j.ajodo.2014.03.015
11. Lindauer SJ, Lewsi SM, Shroff B. Overbite correction and smile aesthetics. Semin Orthod. 2005;11:62-66. doi:10.1053/j.sodo.2005.02.003.
12. Dake ML, Sinclair PM. Comparison of the Ricketts and Tweed-type arch leveling incisors. Am J Orthod Dentofac Orthop. 1985;2:3-8
13. Parker CD, Nanda RS, Currier GF. Skeletal and dental changes associated with the treatment of deep bite malocclusions. Am J Orthod Dentofacial Orthop. 1995;107:382-393.
14. Ball JV, Hunt NP. The effect of Andresen, Harvold, and Begg treatment on overbite and molar eruption. Eur J Orthod 1991;13:53-58 .
15. Keski-Nisula K, Hernesniemi R, Heiskanen M, Keski-Nisula L, Varrela J. Orthodontic intervention in the early mixed dentition: a prospective, controlled study on the effects of the eruption guidance appliance. Am J Orthod Dentofacial Orthop. 2008;133:254-260. doi: 10.1016/j.ajodo.2006.05.039
16. Bassarelli T, Franchi L, Defraia E, Melsen B. Dentoskeletal effects produced by a Jasper Jumper with an anterior bite plane. Angle Orthod. 2016;86(5):775-81. doi: 10.2319/110115-737.1
17. Ciavarella D, Laurenziello M, Guida L, Montaruli G, Gallo C, Tepedino M, et al. Dentoskeletal modifications in Class II deep bite malocclusion treatment with anterior bite plane functional appliance. J Clin Exp Dent. 2017;9(8):e1029-34. doi: 10.4317/jced.54092
18. Keski-Nisula K, Keski-Nisula L, Salo H, Voipio K, Varrela J. Dentofacialchanges after orthodontic intervention with eruption guidance appliance in the early mixed dentition. Angle Orthod. 2008 Mar;78(2):324-31. doi: 10.2319/012607-37.1