International Journal of Health Sciences and Research
Volume 14; Issue: 8; August 2024
Website: www.ijhsr.org
Case Report *ISSN: 2249-9571*

Three-Dimensional Correction of Class II Division 1 Malocclusion Using Headgear Activator Combination: A Case Report

Dr. Shubhangi Mani[1], Dr. Aishwarya Thorat[2], Retd. Col. Dr. Ravindra Manerikar[3], Dr. Vaishnavi Maniyar[4], Dr. Apoorva Tonde[5]

[1,2,3,4,5]Department of Orthodontics and Dentofacial Orthopaedics, Rural Dental College, Loni, Ahmednagar, India.

Corresponding Author: Dr. Aishwarya Thorat

DOI: https://doi.org/10.52403/ijhsr.20240835

ABSTRACT

Correction of Class II malocclusion in vertical growing patients poses particular challenges because vertical growth patterns can exacerbate the existing skeletal discrepancy between the upper and lower jaws. In such cases, orthodontic treatment often aims to address both the sagittal (front-to-back) and vertical dimensions of the malocclusion. This case report details the successful use of activator-headgear therapy for correction of Class II division 1 malocclusion in a vertically growing patient with a mandibular deficiency and a maxillary excess. The treatment caused correction in all three planes of space by improving the profile of the patient by sagittal correction, controlling the vertical growth pattern and correcting the transverse deficiency.

Keywords: growth modulation, activator-headgear, dentofacial orthopedics, Class II division 1 malocclusion, three-dimensional correction

INTRODUCTION

A mandibular deficiency, a maxillary excess, or a combination of the two may cause class II malocclusion. Improving the hard and soft-tissue profile, modifying the pattern of facial growth, and correcting the sagittal relationship are the goals of treatment for class II malocclusion. Most clinical studies acknowledge the beneficial role that functional appliances play in sagittal correction of the malocclusion, but they also concur that dentoalveolar changes are the main focus of treatment[1]. Functional jaw orthopedic appliances bring the mandible in a corrected forward posture, promoting adaptive skeletal growth. One of such functional appliances is the Andersen activator II[2] [3]. In hyperdivergent patients where the vertical dimensions need to be reduced or maintained, a high-pull face-bow linked to an activator is recommended. More cumulative skeletal growth is also provided by the combo appliance than by either device alone. Treating Class II division 1 malocclusion with a combination therapy of high-pull headgear and activator results in restraining the forward growth of the upper jaw, preventing forward and upward movement of the upper teeth, enhancing alignment of the lower back teeth, remodelling of the jaw joint and socket, and a positive shift in muscle activity patterns[4]. Correction of Class II division 1 malocclusion with high-pull

headgear activator combo therapy improves mandibular posterior teeth, condylar and glenoid fossa remodeling, muscle pattern, and inhibits forward maxillary development. It also keeps the maxillary teeth from moving mesially or vertically. [5 6]

CASE REPORT

A 12 year old female patient with CVMI stage 2 presented to the Department of Orthodontics and Dentofacial Orthopedics at Rural Dental College Loni. The clinical examination revealed a convex profile, an acute nasolabial angle, and a short upper lip length. She had inadequate lip coverage and a non-consonant smile as well as an increased interlabial gap and maxillary incisor show during resting or smiling. The visual treatment outcome (VTO) was favorable. (Figure 1)

Figure 1: Pre-treatment photographs

Intraorally, she had a Class II molar and canine relation with an 8 mm overjet and a 4 mm overbite. The patient exhibited a Bolton's discrepancy of 5.8 mm for maxillary anterior tooth material and 3.6 mm for maxillary total tooth material.

Based on the cephalometric analysis, the patient was diagnosed as a case of skeletal Class II malocclusion with a vertical growth pattern, prognathic maxilla with vertical excess and a retrognathic mandible. The patient showed no signs and symptoms of any temporomandibular disorders.

Prioritized Problem List:

- Skeletal Class II malocclusion
- Class II molar relation and canine relation
- Proclination of upper anterior teeth
- Increased overbite and overjet
- Vertical growth pattern
- Convex profile
- Incompetent lips

Treatment objectives:

- Correction of sagittal skeletal discrepancy and obtaining an aesthetically pleasing facial profile
- Elimination of aberrant musculature for achieving neuromuscular balance
- Achieving Class I canine and molar relationship bilaterally
- Achieving optimum overjet and overbite
- Vertical control
- Upper and lower arch alignment and levelling

- To achieve a consonant smile
- To correct Bolton's discrepancy.

Treatment alternatives:

1) Orthognathic surgical treatment will be initiated after the patient's growth had been finished. This strategy has the disadvantage of forcing the patient to wait a few more years.
2) Camouflage treatment for Class II, Division 1 malocclusion by extraction of maxillary first premolars. However, the patient's facial (frontal or profile) features would not support this treatment outcome.
3) Expansion activator with high pull activator as part of phase 1 therapy controlling the vertical maxillary excess and backward rotation of the mandible, followed by fixed mechanotherapy using pre-adjusted edgewise appliance for alignment and settling.[7 8]

The patient agreed with the third treatment option.

Treatment progress:

Diagnostic casts and working models were taken of the patient. A construction bite was obtained horizontally 3 mm short of maximum protrusion, ensuring there to be no lateral displacement and vertically exceeding the freeway space by 2–3 mm. The activator was incorporated with an expansion screw for transverse expansion of the arches. (Figure 2) The acrylic was trimmed lingual to the mandibular incisors so that only the upper arch expanded would expand without causing any unwanted effects in the lower arch as a consequence of the expansion screw.

After a week of usage, the headgear was secured to the tubes in the activator's acrylic blocks at the premolar-molar area. For 11 months, a high-pull force of 400 g on each side was applied for 12–16 hours per day. The extraoral force and outer bow were altered so that the force travelled through the centre of maxilla, roughly between the first and second premolar roots.

Figure 2: The activator appliance fabrication and placement of headgear in the patient.

The appliance was selectively trimmed to maintain contact with the maxillary posterior teeth; and the mandibular posterior teeth were allowed to erupt by trimming the acrylic on the occlusal and lingual aspect. The patient was followed up to 13 months and selective trimming of the appliance was done to accommodate the eruption of premolars bilaterally (Figure: 3)

Figure 3: Intra-oral placement of the appliance

After correction of jaw relation, the patient was shifted to fixed appliance therapy using MBT 0.22" slot prescription for alignment and levelling as part of the phase II treatment.

Aligning and levelling was performed using 0.014 nickel-titanium archwire, progressively shifting to heavier archwires. After coordination of upper and lower arches, rigid stainless steel archwires with crimpable retraction hooks were placed for space closure and for appropriate expression tip and torque. (Figure: 4)

Figure 4: Post Orthodontic correction photographs

Retention phase:[9 10] (Figure:5)

As part of retention phase the patient was provided with a removable activator as a retainer to be worn after debonding.

Figure 5: A removable activator appliance given as a retainer

Treatment objectives achieved:

- Skeletal sagittal correction achieved
- Angle's Class I molar and canine relation bilaterally
- Optimum overjet and overbite
- Levelling of curve of spee
- Control of vertical dimensions
- Lip seal achieved
- A pleasing soft tissue profile achieved

RESULT

The use of activator headgear successfully decreased the severity of Class II malocclusion through a combination of dental and skeletal changes. The overjet, SNB, and ANB angles greatly improved. The addition of an expansion screw in the appliance enabled for transverse expansion of the arches.

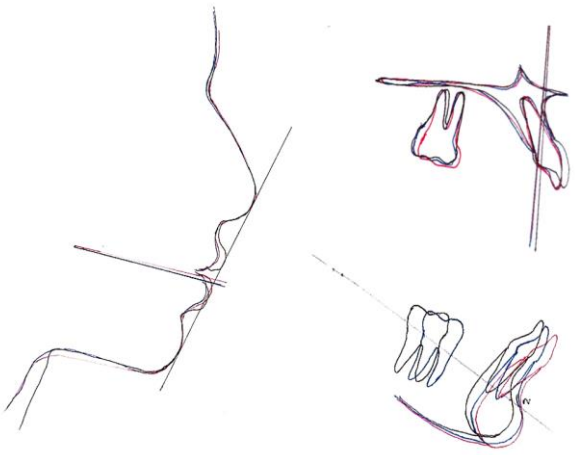
Six degrees of retroclination was achieved in the maxillary incisors with activator and headgear combination therapy.

The lower incisors did procline by 5° towards the end of the treatment, which was inevitable with the functional therapy as seen in several studies throughout the literature. (Ahlgren and Laurin, 1976[11]; Pancherz, 1984[12]; Nelson *et al.*, 1993).

The vertical dimensions were maintained by the end of the treatment. (Figure: 6)

Figure 6: Comparison of pre and post treatment soft tissue changes.

There was a significant improvement in the soft tissue profile of the patient with the gained lip competency and mandibular advancement. (Figure: 7)



Parameter	Average	Pretreatment	Post-myofunctional	Posttreatment
SNA (°)	82	83	84	84
SNB (°)	80	78	82	82
ANB (°)	2	5	2	2
FMA (°)	25	25	26	26
SN-GoGn (°)	32	26.5	26.5	26.5
U1-NA (angle)	22	32	26	27
U1-NA (linear)	4	7	5	6
U1-SN (°)	102	115	111	112
L1-NB (angle)	25	27	27	30
L1-NB (linear)	4	5	4	6.5
IMPA (°)	90	93	91	95
Holdaway ratio	1:1	5:2	4:2.5	2:1
Nasolabial angle (°)	102	107	110	112

Figure 7: Comparison of pre and post treatment cephalometric records

DISCUSSION

Several studies have investigated at the outcomes of treating patients with extraoral force and functional appliances, emphasizing the variety of responses and the significance of controlling the posterior vertical dimension.(Williams and Melsen, 1982[13]; Altuğ *et al.*, 1989[14]; Jacobsson and Paulin, 1990[15]; Dermaut *et al.*, 1992[16]; Öztürk and Tankuter, 1994[17]; Başçiftçi *et al.*, 2003[18])

The high-pull headgear and activator combination in Class II division 1 malocclusion limits maxilla forward growth, inhibits maxillary tooth mesial and vertical displacement, improves mandibular posterior teeth, condylar and glenoid fossa remodelling, and improves muscle pattern. [19]

The alteration and anterior displacement of the glenoid fossa may have played a role in correcting the skeletal Class II malocclusion.

Although the patient did not have any particular complaints regarding the airway[20] [21], the treatment did help improve significantly with the mandibular advancement and the maxillary transverse expansion.

In accordance with studies conducted by Isono et al[22], Horihata et al[23], where the activator therapy led to an increase in the anteroposterior width and total dimension of the upper airway. The anterior positioning of mandible causes anterior displacement of the base of the tongue, whereas the transverse expansion promotes widening of the nasal floor to reduce the resistance to airflow, and have a positive influence on nasopharynx function[24].

CONCLUSION

This case study provided further details on the application of activator headgear combination therapy to reduce upper incisor proclination and treat severe skeletal Class II. In phase 2, the patient underwent fixed appliance therapy to address the dental alignment after achieving the desired alterations to their face. As a result, the facial features showed a noticeable improvement, and the dental disharmony was corrected.

Declaration of patient consent:

The authors certify that all required patient consent paperwork is in their possession. The patient or patients have given their written authorization for the journal to publish their images and other clinical data. The patients understand that while all efforts would be taken to conceal their identity, including not publishing their names or initials, anonymity cannot be guaranteed.

Declaration by Authors
Ethical Approval: Not required
Acknowledgement: None
Source of Funding: None
Conflict of Interest: The authors declare no conflict of interest.

REFERENCES

1. Vargervik K, Harvold EP. Response to activator treatment in Class II malocclusions, American Journal of Orthodontics, 1985, vol. 88 (pg. 242-251)
2. Ivorra-Carbonell L, Montiel-Company JM, Almerich-Silla JM, Paredes-Gallardo V, Bellot-Arcís C. Impact of functional mandibular advancement appliances on the temporomandibular joint - a systematic review. Med Oral Patol Oral Cir Bucal. 2016 Sep 1;21(5):e565-72. doi: 10.4317/medoral.21180. PMID: 27475694; PMCID: PMC5005093.
3. Xie, Jiye & Huang, Chunrong & Yin, Kang & Park, Juyoung & Xu, Yanhua. (2021). Effects of orthodontic treatment with activator appliance on patients with skeletal Class II malocclusion: a systematic review and meta-analysis. Annals of Palliative Medicine. 10. 10.21037/apm-21-3205.
4. Wieslander L, LagerströmI. The effect of activator treatment on Class II malocclusions, *American Journal of Orthodontics*, 1979, vol. 75 (pg. 20-26)
5. Gülnaz Marşan, Effects of activator and high-pull headgear combination therapy: skeletal, dentoalveolar, and soft tissue profile changes, *European Journal of Orthodontics*, Volume 29, Issue 2, April 2007, Pages 140–148, https://doi.org/10.1093/ejo/cjm003
6. R.I. Levin (1985). Activator headgear therapy, 87(2), 0–109. doi:10.1016/0002-9416(85)90019-3
7. Stjepan Spalj, Kate Mroz Tranesen, Kari Birkeland, Visnja Katic, Andrej Pavlic, Vaska Vandevska-Radunovic, "Comparison of Activator-Headgear and Twin Block Treatment Approaches in Class II Division 1 Malocclusion", BioMed Research International, vol. 2017, Article ID 4861924, 9 pages, 2017. https://doi.org/10.1155/2017/4861924
8. Lima, Karina & Henriques, José & Janson, Guilherme & Pereira, Suelen & Neves, Leniana & Cançado, Rodrigo. (2013). Dentoskeletal changes induced by the Jasper jumper and the activator-headgear combination appliances followed by fixed orthodontic treatment. American Journal of Orthodontics and Dentofacial Orthopedics. 143.
9. Herrera-Sanches, Francyle Simões; Henriques, José Fernando Castanha; Janson, Guilherme; Neves, Leniana Santos; Lima, Karina Jerônimo Rodrigues Santiago de; Henriques, Rafael Pinelli; Pieri, Lucelma Vilela (2013). Class II malocclusion treatment using Jasper Jumper appliance associated to intermaxillary elastics: a case report. Dental Press Journal of Orthodontics, 18(2), 22–29. doi:10.1590/S2176-94512013000200010
10. Spahl TJ. The bionator/OCI as a retainer. Funct Orthod. 1997 Aug-Oct;14(4):5-8, 10-5. PMID: 9610287.
11. Ahlgren J, Laurin C. Late results of activator-treatment: a cephalometric study. Br J Orthod. 1976 Jul;3(3):181-7. doi: 10.1179/bjo.3.3.181. PMID: 1067871.
12. Pancherz H. A cephalometric analysis of skeletal and dental changes contributing to Class II correction in activator treatment. Am J Orthod. 1984 Feb;85(2):125-34. doi: 10.1016/0002-9416(84)90004-6. PMID: 6594053.
13. The postnatal development of the palatomaxillary region studied on human autopsy material Melsen, Birte et al. American Journal of Orthodontics, Volume 82, Issue 4, 329 - 342
14. Gögen, Hakan, and Şebnem Parlar. *The Evaluatıon Of Facıal Profile Changes In Indıvıduals Wıth Skeletal Class Iı Anomaly Treated Wıth Actıvator And Actıvator + Occıpıtal Headgear*. Galenos Yayinevi, 1989.
15. Jakobsson SO, Paulin G. The influence of activator treatment on skeletal growth in Angle Class II: 1 cases. A roentgenocephalometric study. Eur J Orthod. 1990 May;12(2):174-84. doi: 10.1093/ejo/12.2.174. PMID: 2351202.
16. Dermaut LR, van den Eynde F, de Pauw G. Skeletal and dento-alveolar changes as a result of headgear activator therapy related to different vertical growth patterns. Eur J Orthod. 1992 Apr;14(2):140-6. doi: 10.1093/ejo/14.2.140. PMID: 1582458.

17. Oztürk Y, Tankuter N. Class II: a comparison of activator and activator headgear combination appliances. Eur J Orthod. 1994 Apr;16(2):149-57. doi: 10.1093/ejo/16.2.149. PMID: 8005202.
18. Basciftci FA, Uysal T, Büyükerkmen A, Sari Z. The effects of activator treatment on the craniofacial structures of Class II division 1 patients. Eur J Orthod. 2003 Feb;25(1):87-93. doi: 10.1093/ejo/25.1.87. PMID: 12608728.
19. Wieslander L, Lagerström L. The effect of activator treatment on class II malocclusions. Am J Orthod. 1979 Jan;75(1):20-6. doi: 10.1016/0002-9416(79)90136-2. PMID: 283692.
20. Rita Catia Brás Bariani, Renato Bigliazzi, Mario Cappellette Junior, Gustavo Moreira, Reginaldo Raimundo Fujita, Effectiveness of functional orthodontic appliances in obstructive sleep apnea treatment in children: literature review, Brazilian Journal of Otorhinolaryngology, Volume 88, Issue 2, 2022, Pages 263-278, ISSN 1808-8694, https://doi.org/10.1016/j.bjorl.2021.02.010.
21. Vargervik K, Harvold EP. Response to activator treatment in Class II malocclusions. Am J Orthod. 1985 Sep;88(3):242-51. doi: 10.1016/s0002-9416(85)90219-2. PMID: 3862347.
22. Isono S, Tanaka A, Tagaito Y, Sho Y, Nishino T. Pharyngeal patency in response to advancement of the mandible in obese anesthetized persons. *Anesthesiology*. 1997. Nov;87(5):1055–62. 10.1097/00000542-199711000-00008
23. Horihata A, Ueda H, Koh M, Watanabe G, Tanne K. Enhanced increase in pharyngeal airway size in Japanese class II children following a 1-year treatment with an activator appliance. *Int J Orthod Milwaukee*. 2013;24(4):35–40.
24. Ramires T, Maia RA, Barone JR. Nasal cavity changes and the respiratory standard after maxillary expansion. Braz J Otorhinolaryngol. 2008 Sep-Oct;74(5):763-769. doi: 10.1016/S1808-8694(15)31388-4. PMID: 19082360; PMCID: PMC9445931.

How to cite this article: Shubhangi Mani, Aishwarya Thorat, Ravindra Manerikar, Vaishnavi Maniyar, Apoorva Tonde. Three-Dimensional correction of class II division 1 malocclusion using headgear activator combination: a case report. *Int J Health Sci Res.* 2024; 14(8):309-316.
DOI: *https://doi.org/10.52403/ijhsr.20240835*

******