Al-Azhar Journal of Dentistry

Volume 10 | Issue 1 Article 5

Pediatric dentistry and orthodontics Issue (Pediatric Dentistry, Orthodontics)

1-1-2023

Evaluation of Treatment Outcomes of Skeletal Class III Malocclusion Resulted from Dynaflex Appliance: A Clinical study

Noha Hassanein
Masters Degree Student, Faculty of Dental Medicine for Girls, Al-Azhar University, Cairo, Egypt, nohafayad1990@gmail.com

Samir Ibrahim
Professor of Orthodontic Department, Faculty of Dental Medicine for Girls, Al-Azhar University, Cairo, Egypt., drsamiribra@hotmail.com

Maha Ali
Lecturer of Orthodontic Department, Faculty of Dental Medicine for Girls, Al-Azhar University, Cairo, Egypt, mahaorthodontist2014@gmail.com

Fatma Abd El Samad
Professor of Orthodontic Department, Faculty of Dental Medicine for Girls, Al-Azhar University, Cairo, Egypt., fatmaaziz2004@gmail.com

How to Cite This Article

Hassanein, Noha; Ibrahim, Samir; Ali, Maha; and Abd El Samad, Fatma (2023) "Evaluation of Treatment Outcomes of Skeletal Class III Malocclusion Resulted from Dynaflex Appliance: A Clinical study," *Al-Azhar Journal of Dentistry*: Vol. 10: Iss. 1, Article 5.
DOI: https://doi.org/10.58675/2974-4164.1461

AL-AZHAR
Dental Journal
For Girls

The Official Publication of The Faculty of Dental Medicine For Girls, Al-Azhar University Cairo, Egypt.

Print ISSN 2537-0308 • Online ISSN 2537-0316

ADJ-for Girls, Vol. 10, No. 1, January (2023) — PP. 203:208

Evaluation of Treatment Outcomes of Skeletal Class III Malocclusion Resulted from Dynaflex Appliance: A Clinical study

Noha F. Hassanein[1*], Samir A. Ibrahim[2], Maha M. Ali[3], Fatma A. Abd el Samad[4]

Codex : 3-03/23.01

azhardentj@azhar.edu.eg

http://adjg.journals.ekb.eg

https://doi.org/10.58675/2974-4164.1461

Pediatric Dentistry & Orthodontics
(Pediatric Dentistry, Orthodontics)

ABSTRACT

Purpose: This clinical study was carried out to assess skeletal and dentoalveolar changes introduced by Dynaflex appliance on skeletal class III malocclusion treatment. **Materials and methods:** 8 patients (4 males & 4 females) aged 10-13 years old with skeletal class III discrepancy (-3 < ANB < 0) and dental class III malocclusion were treated using Dynaflex. Following leveling and alignment the appliance was positioned mesial to maxillary first molars and distal to mandibular canines. After reaching normal overbite and overjet with Class I molar and canine relationship, Dynaflex was removed. Lateral cephalometric radiographs were taken before treatment and after Dynaflex removal. Tracing for the two radiographs were done digitally using Webceph software. Skeletal, dental, and soft tissue changes were calculated by subtracting measurements taken before treatment from measurements taken after Dynaflex removal. **Results:** Positive overjet with class I molar and canine relationship was accomplished. Significant skeletal, dental, and soft tissue changes between pre and post treatment radiographs were detected. Forward movement of maxillary base by 1.9 mm and backward movement of mandibular base by 1.3 mm were seen with ANB improvements. Forward movement of maxillary incisors by 2.1 mm was found. Upper and lower lip showed significant protrusion and retrusion, respectively. **Conclusion:** Dynaflex appliance can be used to correct mild to moderate skeletal class III malocclusion (-3 < ANB < 0) with minimal patient compliance. Factors that contributed to overjet correction were anterior movement of maxilla, posterior and downward movement of mandible together with maxillary incisors proclination.

KEYWORDS

Class III malocclusion,
Dynaflex appliance,
Lateral cephalometric radiograph.

- Paper was extracted from Master Thesis titled "Evaluation of Treatment Outcomes of Class III Malocclusion Resulted from Dynaflex Appliance".

1. Masters Degree Student, Faculty of Dental Medicine for Girls, Al-Azhar University, Cairo, Egypt.
2. Professor of Orthodontic Department, Faculty of Dental Medicine for Girls, Al-Azhar University, Cairo, Egypt.
3. Lecturer of Orthodontic Department, Faculty of Dental Medicine for Girls, Al-Azhar University, Cairo, Egypt.
4. Professor of Orthodontic Department, Faculty of Dental Medicine for Girls, Al-Azhar University, Cairo, Egypt.

* Corresponding author email: nohafayad1990@gmail.com

INTRODUCTION

One of the most difficult orthodontic treatments is skeletal class III malocclusion [1]. It is described by backward position and deficiency of maxilla, or by forward position and prognathism of mandible or both. Growth modification [2], orthodontic camouflage, or orthognathic surgery [3] can accomplish normal occlusion and improve smile esthetics of skeletal class III malocclusion. Proper treatment choice will be determined by patient's age and chief complaint, malocclusion severity, clinical examination, and cephalometric analysis [4].

The incidence of skeletal class III malocclusion greatly varies within different races, ethnic groups and geographic areas studied. A global incidence of Angle Class III malocclusion was reported for different populations within the range of 0%-26.7%[5].

Functional appliances, chin cup therapy, protraction facemask and bone-anchored appliances can be used in developing class III malocclusion to accomplish growth modification [6]. Patient cooperation is mandatory in most of these appliances or treatment failure will occur.

Fixed force module usage has reduced patient compliance. The usage of appliances like Jasper Jumper or Herbst is quite common in class II anomalies, while in class III anomalies, their usage is rare [7].

A fixed inter-arch spring-loaded module (Dynaflex appliance) has been used for class III correction. The inter-arch closed coil NiTi spring is the main component of this appliance which is used as class III elastics. It requires minimal patient compliance [8].

If the appliance effect is simply dentoalveolar (tooth tipping and alveolar remodeling) relapse is more likely. However, when an appliance can provide orthopedic change (basal bone remodeling) the results tend to be more stable.

So, this study was carried out to assess skeletal and dentoalveolar changes taking place in skeletal class III malocclusion after treatment with the Dynaflex appliance.

MATERIAL AND METHODS

The present study was done on 10 patients (5 males & 5 females) according to sample size power test aged 10-13 years old. The final sample size consisted of 8 patients (4 males & 4 females) because of 2 dropped out patients due to pandemic covid-19. The patients were selected from those seeking orthodontic treatment at the orthodontic clinic, Faculty of Dental Medicine for Girls, Al-Azhar University. This study obtained the approval from the committee of ethics of the Faculty of Dental Medicine of Al-Azhar University, Cairo, Egypt. (REC 17-073) After detailed explanation of the treatment steps to all patients, written informed consent was obtained from their parents.

Selected patients fulfilled the following criteria, Patients with Angle Class III molar relationship, mild to moderate skeletal Class III discrepancy ($-3 < ANB < 0$), growing patients in the permanent dentition (Patient selection was done according to the cervical vertebrae maturation index which was defined by lateral cephalometric radiograph), non-extraction orthodontic treatment, no history of previous orthodontic treatment, none of them has any craniofacial deformity in the craniofacial area, absence of any systemic disease that might affect bone, good oral hygiene and highly motivation and cooperation.

At first, leveling and alignment was done by direct bonding Atlas Mini brackets (Dynaflex, USA) with 0.022-in slot Roth. Arch wire escalated from 0.012-in Nickel Titanium up to Stainless Steel wire 0.016 x 0.022-in in diameter. All patients received oral hygiene instructions before orthodontic appliances placement. Teeth were then ligated in figure 8 pattern.

Dynaflex appliance insertion procedure: A rectangular Stainless-Steel wire of 0.016 x 0.022-in was used in both arches during the use of the Dynaflex. Two pivots were placed on the lower archwire, pivots were positioned distal to the lower canines, archwire was inserted and ligated. Outside the mouth, two springs, screws and pivots combinations were assembled. To guarantee pivot will slide onto archwire, screw at this point shouldn't be overtightened. Assembled components were placed onto the upper arch wire, the pivots were positioned mesial to the upper first molars. Screw was tightened as needed. Using a hemostat, spring eyelet was stretched onto the lower pivot and secured in place with a screw. Cinch back was done in both arch wires.

At subsequent visits, the springs were changed from 10 mm to 7 mm for further activation. Progress was evaluated every 3 weeks. After reaching normal overbite and overjet with Class I molar and canine relationship, Dynaflex was removed. After Dynaflex removal, to avoid relapse and stabilize the results teeth were retained with 3/16-in class III elastics. (Fig. 1)

Cephalometric Analysis: All patients under this study were submitted for lateral cephalometric radiographs before treatment and immediately after Dynaflex appliance removal. Using Webceph software, tracings were done for the two radiographs, all angular and linear measurements were recorded for the treatment outcomes comparison. The analysis included a combination of the variables described by McNamara, Downs, Steiner and Jarabak.

Statistical Analysis: Data was explored for normality using Kolmogorov-Smirnov and Shapiro-Wilk tests in addition to checking data distribution using histogram. All data showed normal (parametric) distribution except for ANB°, overjet, overbite, Ls-E line, and Li-E line measurements which showed non-normal (non-parametric) distribution. Numerical data was presented as mean and standard deviation (SD) values. For parametric data, pre- and post-treatment measurements were compared using paired t-test. For non-parametric data, they were compared using Wilcoxon signed-rank test. Significance level was set at $P \leq 0.05$. Statistical analysis was performed with IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY:IBM Corp.

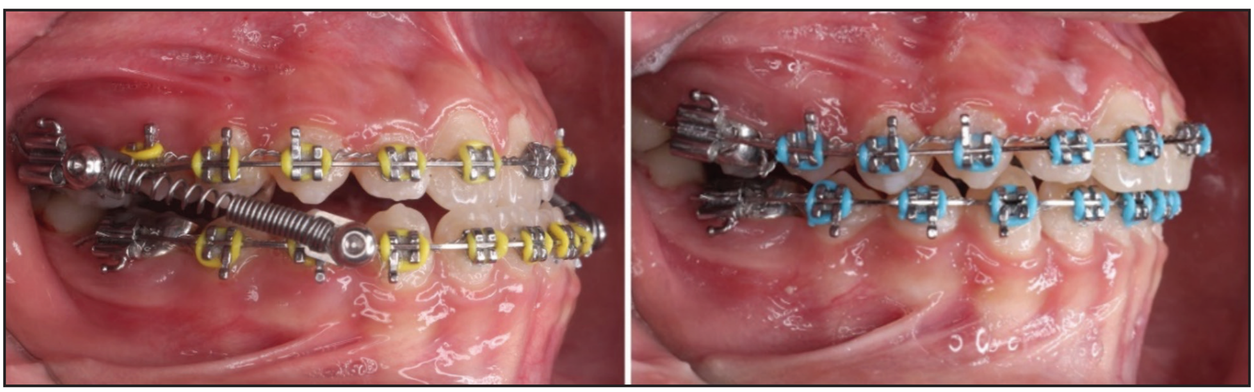

Figure (1) Intra-oral photos during loading and after removal of Dynaflex.

RESULTS

Skeletal measurements: Statistically significant increase in mean SNA°, ANB° and LAFH measurements post-treatment was found. No statistically significant change in mean SNB° post-treatment was found. (Table 1)

Dental measurements: Statistically significant increase in mean U1/NA°, U1-NA, L1/NB°, L1-NB, overjet and overbite measurements post-treatment was found. Statistically significant decrease in mean U6-NA and L6-NB measurements post-treatment was found. (Table 2)

Soft-tissue measurements: Statistically significant increase in mean H-angle and Li-E line measurements post-treatment was found. Statistically significant decrease in mean Ls-E line post-treatment was found. (Table 3)

Table (1) *Comparison between skeletal measurements pre- and post-treatment*

Skeletal measurements	Pre-treatment (n=8)		Post-treatment (n=8)		Change		P-value	Effect Size (d)
	Mean	SD	Mean	SD	Mean	SD		
SNA°	79.8	3.12	81.7	3.97	1.9	1.2	0.001*	0.376
SNB°	81.5	3.14	80.2	3.88	-1.3	2.16	0.090	0.349
ANB°	-1.7	0.95	1.5	0.53	3.2	1.4	0.004*	4.144
LAFH	66	10.59	74.4	9.06	8.7	2.58	<0.001*	0.706

**: Significant at P ≤ 0.05, †: Wilcoxon signed-rank test.*

Table (2) *Comparison between dental measurements pre- and post-treatment*

Dental measurements	Pre-treatment (n=8)		Post-treatment (n=8)		Change		P-value	Effect size (d)
	Mean	SD	Mean	SD	Mean	SD		
U1/NA°	26.9	3.31	31.6	4.12	4.7	2.87	0.001*	1.221
U1-NA	6.9	3.63	9	4.5	2.1	1.85	0.006*	0.459
U6-NA	20.25	1.69	16.05	1.77	-4.2	0.79	<0.001*	2.417
L1/NB°	26.5	5.64	29	4.88	2.5	3.14	0.033*	0.462
L1-NB	7.4	2.22	9.1	2.73	1.7	1.25	0.002*	0.631
L6-NB	18.6	4.14	15	1.76	-3.6	3.86	0.016*	1.05
Overjet	-1.55	1.12	1.5	0.71	3.05	0.83	0.005*	3.976
Overbite	-1.75	0.98	1.35	0.88	3.10	0.88	0.004*	4.384

**: Significant at P ≤ 0.05, †: Wilcoxon signed-rank test.*

Table (3) *Comparison between soft tissue measurements pre- and post-treatment*

Soft tissue measurements	Pre-treatment (n=8)		Post-treatment (n=8)		Change		P-value	Effect size (d)
	Mean	SD	Mean	SD	Mean	SD		
H-angle	12.3	3.06	14.9	1.1	2.6	3.06	0.025*	1.091
Ls-E line	4.55	2.07	2.8	1.75	-1.75	1.21	0.004*	4.8
Li-E line	-1.95	2.47	-1.25	2.11	0.7	0.63	0.023*	2.064

**: Significant at P ≤ 0.05, †: Wilcoxon signed-rank test*

DISCUSSION

In the literature, the use of Dynaflex appliance to treat skeletal class III malocclusion has been mentioned only once. However, starting from protraction facemask [9], to removable appliances such as Frankel III, Bionator III [10], modified tandem traction bow [11] and Class III Twin Block were different treatment options that have been reported to correct skeletal class III malocclusion. More treatment options will be available with the appearance of skeletal anchorage devices such as miniplates and miniscrews.

This study consisted of 8 patients meeting the inclusion and exclusion criteria presented earlier. Class I dental arch relationship or overcorrection to a Class I or II dental arch relationship with positive overjet and overbite was achieved in all patients.

Between pre- and post-treatment radiographs significant skeletal, dental, and soft tissue changes were seen. One of the most significant skeletal results in this study, as well as other class III protraction studies [8,12,13], is the maxillary base forward movement (A point).

The maxillary base moved forward significantly. The maxilla (A point) moved anteriorly by 1.9 mm. In a study with miniscrew-anchored inverted Forsus FRD, A point moved anteriorly by 1.73 mm [12]. In another study comparing the Modified Jasper Jumper to the Face Mask, the maxillary base moved forward by 2.28 mm and 3.22 mm, respectively [13]. The Dynaflex acts 24 h per day on the maxilla with a force magnitude (150 g per side) which is lower than that of facemask (450 g per side). While the Dynaflex appliance correction is low in comparison to facemask therapy, it remains a fixed appliance and factors out compliance issues.

Lower anterior facial height (ANS-Me) change by 8.7 $\pm$ 2.58 mm explained the mandible rotation in a downward and backward direction contributing to mandibular base posterior movement by 1.3 mm. However, Anteroposterior mandibular changes were non-significant like other fixed appliances studies [8,12,13]. Thus, usage of Dynaflex appliance in skeletal class III malocclusion due to mandibular prognathism may not be a proper treatment choice.

The overjet was improved significantly by 3.05$\pm$0.83 mm. However, this is lower than those reported using Modified Jasper Jumper, Face Mask and Forsus FRD [12,13]. Most of the change was attributed to maxilla anterior movement together with mandible posterior movement. The rest was contributed by maxillary incisor forward movement (2.1$\pm$1.85 mm). This is beneficial for skeletal class III correction stability to increase skeletal changes and decrease dental changes.

Most of studies reported lower incisors backward movement [8]. While in this study, their forward movement by 1.7$\pm$1.25 mm showed that the Dynaflex appliance usage could minimize the unfavorable effect of the lower incisors proclination.

Skeletal change was the main reason for molar relationship correction. Forward movement of maxillary molars by 4.2$\pm$0.79 mm contributed for the rest. This was seen also with the Modified Jasper Jumper, Facemask and Forsus FRD by 1.57$\pm$2.03mm, 1.03$\pm$2.21 mm, and 0.77$\pm$0.66 mm, respectively [12,13]. The earlier Dynaflex study also reported 1.2mm forward movement. Similarly, the lower molars in the present study moved forward instead of backward as mentioned by other studies[12,13].

Lower lip to E plane relationship changes lead to significant lower lip retrusion by 0.7 $\pm$ 0.63 mm. Significant upper lip protrusion was contributed by forward maxillary growth and movement of maxillary teeth mesially by 1.75 $\pm$ 1.21 mm. The facial profile was improved significantly. The upper lip showed significant protrusion by 1.56 $\pm$ 0.73 mm, while the lower lip showed significant retrusion by 0.95 $\pm$ 0.74 mm when Forsus (FRD) was used [12].

CONCLUSION

Dynaflex appliance can be used to correct mild to moderate skeletal class III malocclusion (-3< ANB < 0) with minimal patient compliance. Overjet correction occurred because of anterior movement of the maxilla, posterior and downward movement of the mandible together with maxillary incisors proclination.

RECOMMENDATIONS

Long-term follow-up studies are essential to monitor the stability of the skeletal and dental corrections achieved.

Conflict Of Interest

No conflict of interest

Funding

No funding was received for this study

REFERENCES

1. Manuel GC , Gina JF , Luciane M , Livia KF , José AM , Cátia CA. Management of the Vertical Dimension in the Camouflage Treatment of an Adult Skeletal Class III Malocclusion. Case Rep Dent. 2020; 2020:1-12.
2. Jamilian A, Cannnavale R, Piancino MG, Eslami s, Perillo L. Methodological quality and outcome of systematic reviews reporting om orthopedic tretment for class III malocclusion: overview of systematic reviews. J Orthod. 2016; 43:102-20.
3. Amal EA, Sara EK, Sanaa A, Driss T, Zakaria B. Surgically assisted maxillary expansion, about a clinical case. Tunis Med. 2020; 98:246-253.
4. Heena S, Ritu N, Swati G, Natasha S, Parul S. Treatment Modalities for Early Management of Class III Skeletal Malocclusion: A Case Series. Contemp Clin Dent. 2020; 11:91-96.
5. Hardy D. Prevalence of angle class III malocclusion: A systematic review and meta analysis. Open J Epidemiol. 2012; 02:75–82.
6. Zere E, Chaudhari PK, Sharan J, Dhingra K, Tiwari N. Developing Class III malocclusions: challenges and solutions. Clin Cosmet Investig Dent. 2018; 10:99–116.
7. Fuly CDM, Oliveira AGD UW. Correction of Class III Malocclusion with Jasper Jumper. J Clin Orthod. 2000; 34:41–6.
8. Vanlaecken R, Williams M, Razmus T, Gunel E, Martin C, Ngan P. Class III correction using an inter-arch spring-loaded module. Prog Orthod. 2014; 15-32.
9. Adobes M, Lipani E, Alvarado A , Bernes L, Aiuto R , Dioguardi M , et al. The effect of maxillary protraction, with or without rapid palatal expansion, on airway dimensions: A systematic review and meta-analysis. Eur J Paediatr Dent. 2020; 21:262-270.
10. Pottanaik S, Mohammad N, Parida S SS. Treatment Modalities for Skeletal Class III Malocclusion: Early to Late Treatment. IJSS Case Reports Rev. 2016; 2:28–33.
11. Husson AH, Burhan AS, Salma FB, Nawaya FR. Dentoskeletal Effects of the Modified Tandem Appliance vs the Facemask Appliance in the Treatment of Skeletal Class III Malocclusion: A Single-center, Randomized Controlled Trial. J Contemp Dent Pract. 2016; 17:522–9.
12. Eissa O, ElShennawy M, Gaballah S, ElMehy G, El-Bialy T. Treatment of Class III malocclusion using miniscrew-anchored inverted Forsus FRD: Controlled clinical trial. Angle Orthod. 2018; 88:692–701.
13. Kılıçoğlu H, Öğütlü NY, Uludağ CA. Evaluation of Skeletal and Dental Effects of Modified Jasper Jumper Appliance and Delaire Face Mask with Pancherz Analysis. Turkish J Orthod. 2017; 30:6–14.