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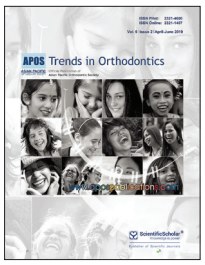

Case Report

Non-surgical correction of Class III adolescent patient with TADs and Damon system: A case report

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Received: 23 July 2021
Accepted: 20 January 2022
EPub Ahead of Print: 12 February 2022
Published: 05 August 2022

DOI
10.25259/APOS_101_2021

Quick Response Code:

ABSTRACT

Here is a case report of a 16 year old female patient with Class III malocclusion with Class III molar relation on both sides. The patient was diagnosed with normodivergent face pattern, proclined upper anterior, and crowded lower anterior, concave profile, potentially competent lips, reverse overjet and 0% overbite, and shallow mentolabial sulcus. The treatment was planned with a maxillary splint, mini-screws in mandible, and Class III elastics for Phase 1 and Phase 2 fixed appliance using the passive self-ligation system. The facial changes produced as a result of treatment were directly related to skeletal and dentoalveolar modifications that were designed as goals for patient treatment.

Keywords: Class III, Skeletal anchorage, Maxillary splint, Passive self-ligation

INTRODUCTION

Orthodontic science always strived hard to deliver the best possible, both the patient and practicing orthodontist. Orthodontics is a type of controlled pathology in which we include bone breakdown and bone formation at the same time.

Class III malocclusion is a very easy-to-see malocclusion but often difficult to treat. According to Angle, Class III molar relationship refers to a condition where the mesiobuccal cusp of the upper first molar occludes between the mandibular first and second molars. This condition represents a pre-normalcy where the mandible is in a mesial relation to the upper arch. Optimal skeletal Class III correction requires surgical procedures along with complicated orthodontic treatment.[1]

Several treatment options are available for these types of cases such as extraction (either only lower premolars or both upper and lower premolars),[2] extraoral tractions (horizontal traction of the mandibular arch or vertical traction in an open bite case), and distalization of lower molars with devices such as lip bumpers.[3-5] The use of an expansion device following a midline maxillary osteotomy has been recommended for crossbite treatment that is more common in younger Class III patients.[5]

With the advent of the skeletal anchorage system, the inter-radicular placement of the mini-implants or the miniplates appears to be the biomechanically feasible location when en masse retraction of the whole dentition is desired.[6] The passive self-ligation system provides the least friction compared to other brackets systems.[7]

This case report describes a case that was treated using a simple non-surgical method for skeletal Class 3 malocclusion. As the growth period for the patient was completed, orthopedic treatment with facemask therapy was no possible also the patient was reluctant to surgical procedure.

CASE REPORT

A pubertal female patient, aged 16 years, reported a chief complaint of forwardly placed lower front teeth and wanted to get them corrected.

The extraoral examination of the patient showed mesoprosopic facial form, mesocephalic head, potentially competent lips, and asymmetrical non-consonant smile, with 70% of incisal exposure during a smile. Facial asymmetry with mandible shifted to the right side. The patient was diagnosed with, concave profile, anterior divergence, average nasolabial angle, shallow mentolabial sulcus, and average malar and mandibular prominence [Figure 1a].

Intraoral examination revealed proclined upper anteriors and crowded lower anteriors, Angles Class III molar relations with normodivergent face pattern, reverse overjet of 0.5 mm, overbite of 0 mm 0%, rotated 13, 23, 35, and 45; erupting 15, retained 65, ovoid-shaped upper and lower arches, lower midline shifted to the right side. There was lateral open bite in premolar region on both sides. There were no signs of temporomandibular joint (TMJ) problems [Figure 1b].

The patient was subjected to radiographic examination. Panoramic radiograph revealed that TMJ of the patient was normal with bilaterally symmetrical condyles, mesioangular tilt in the upper 2nd premolars [Figure 2].

The lateral cephalometric analysis indicated a skeletal Class III skeletal pattern (ANB –2°, wits appraisal –7.5 mm)

Figure 1: (a) Pre-treatment extraoral photographs, (b) pre-treatment intraoral photographs.

with an average mandibular plane angle (SN-MP 30°). The maxillary incisors were proclined (U1-SN 115°; IMPA 91°), and the interincisal angle (121°) was decreased. The cervical vertebrae maturation index showed Stage IV (deceleration) referring to 10–25% of pubertal growth remaining [Figure 2].

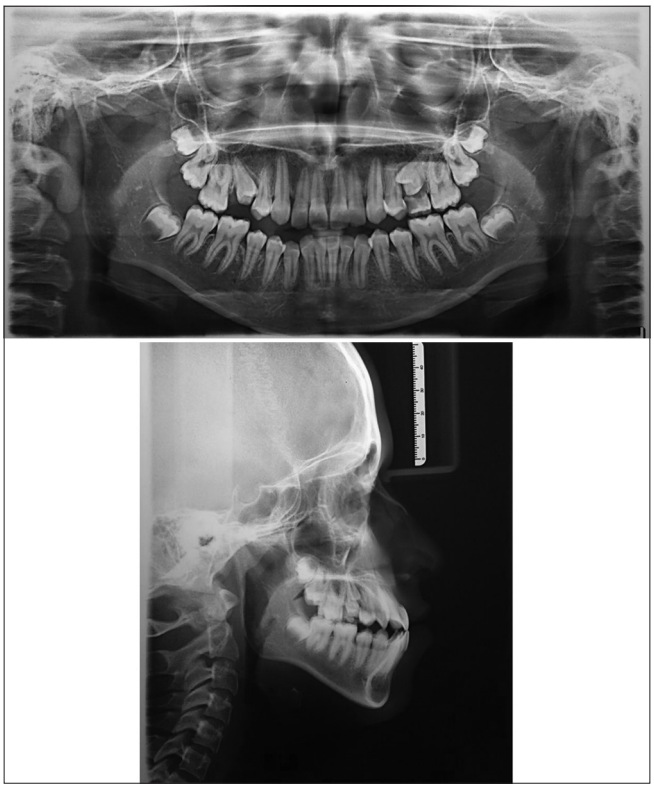

Figure 2: Pre-treatment radiographs.

Diagnosis

The female patient aged 16 years was diagnosed as a case of skeletal Class III malocclusion with Angles Class III molar relation with normodivergent face pattern, proclined upper anteriors, and crowded lower anteriors, reverse overjet of –0.5 mm, overbite of 0 mm 0%, rotated 13, 23, 35, and 45; convex profile, potentially competent lips, shallow mentolabial sulcus, average nasolabial angle, and anterior facial divergence.

Treatment objectives

Treatment objectives were (1) to improve the esthetics appearance of the profile, (2) to address skeletal Class III face pattern, (3) to achieve Angles Class I molar and canine relation, (4) to achieve ideal overjet and overbite, correction of midline shift, (5) derotation of rotated 13, 23, 35, and 45; and (6) to correct the smile esthetics.

Treatment plan

The treatment plan decided was maxillary splint, mini-screws in mandible, and Class III elastics. Maxillary splint with

Figure 3: Maxillary splint with temporary anchorage devices in lower arch.

Table 1: Cephalometric variables.

Variables	Norms	Pre-treatment	Post-functional	Post-treatment
SNA	82°	87°	88°	88°
SNB	80°	89°	86°	85.5°
ANB	2°	–2°	2°	2.5°
SN–OP	14°	19°	15°	17°
SN-GoGn	32°	31°	30°	30°
PP-MP	25°	24°	19.5°	20°
U1-SN	102±2°	115°	117°	115°
IMPA	90±3°	91°	94°	92°
Overjet	2 mm	–0.5 mm	1.5 mm	2 mm
Overbite	2 mm	0 mm	2 mm	2 mm
Interincisal angle	135°	121°	113°	122.5°
Nasolabial angle	90–110°	90°	88°	89°
Upper lip to E-line	–1 mm	–2 mm	–1 mm	0 mm
Lower lip to E-line	0 mm	1.5 mm	1.5 mm	1 mm

Figure 4: (a) Post-Stage 1 extraoral photographs, (b) Post-Stage 1 intraoral photographs.

Figure 5: Post-Stage 1 lateral cephalogram.

hooks in the 1st molar region was constructed and bonded to the maxillary dentition. Two mini-screws, 1.6 × 8 mm in size, were placed between mandibular 1st premolars and canines on both sides. They were kept at an angulation of 70° to the long axis of the teeth [Figure 3].

Class III elastics were used daily for full-time wear except during meals. The initial force of 6 oz was given initially for the 1st month. After the 1st month, the force increased gradually to 8 oz thereafter.[8] The Stage 1 treatment took 8 months where the positive overjet was achieved and the molar relation was corrected [Figures 4a, b, and 5].

Damon passive self-ligating bracket system was chosen which features arch flow mechanics that describes both the flow mechanics of the self-ligating brackets (SLBs) along the archwire and the distal drift of the initial archwire itself. The upper and lower canines were bracketed with high torque and the upper incisors were low torque to correct the proclination and also the Class III elastics tend to procline the upper incisors. The lower incisors had acceptable inclination so low torque brackets were preferred.[5]

The profile was improved after the completion of the Stage 1 treatment. In Stage 2, treatment was continued with fixed appliances using Damon System, Damon Q™ System (Ormco, Orange, Calif) passive SLB in conjugation with thermally activated CuNiTi wires. The bonding was done according to modification[6] of the Smile Arc Protection protocol [Figure 6].[7] Along with that short Class III elastics, 2 oz U6-L4 was given from the start of fixed treatment.

Elastics were worn full time except during meal till 14 × 25 CuNiTi stage, that is, for 5 months [Figure 6]. After that, the elastic wear was reduced to night-time wear only. From the 18 × 25 CuNiTi stages, the elastic force was increased to 3.5 oz. In the 19 × 25 SS stage, triangular elastics were prescribed for night-time wear in U6-U3-L3 fashion [Figure 6]. Finally, in the finishing stage, the settling in the premolar region was done with 2 oz elastics in a continuous Class 3 fashion. The ideal overjet and overbite along with Class I canine and molar relations were achieved [Figure 7].

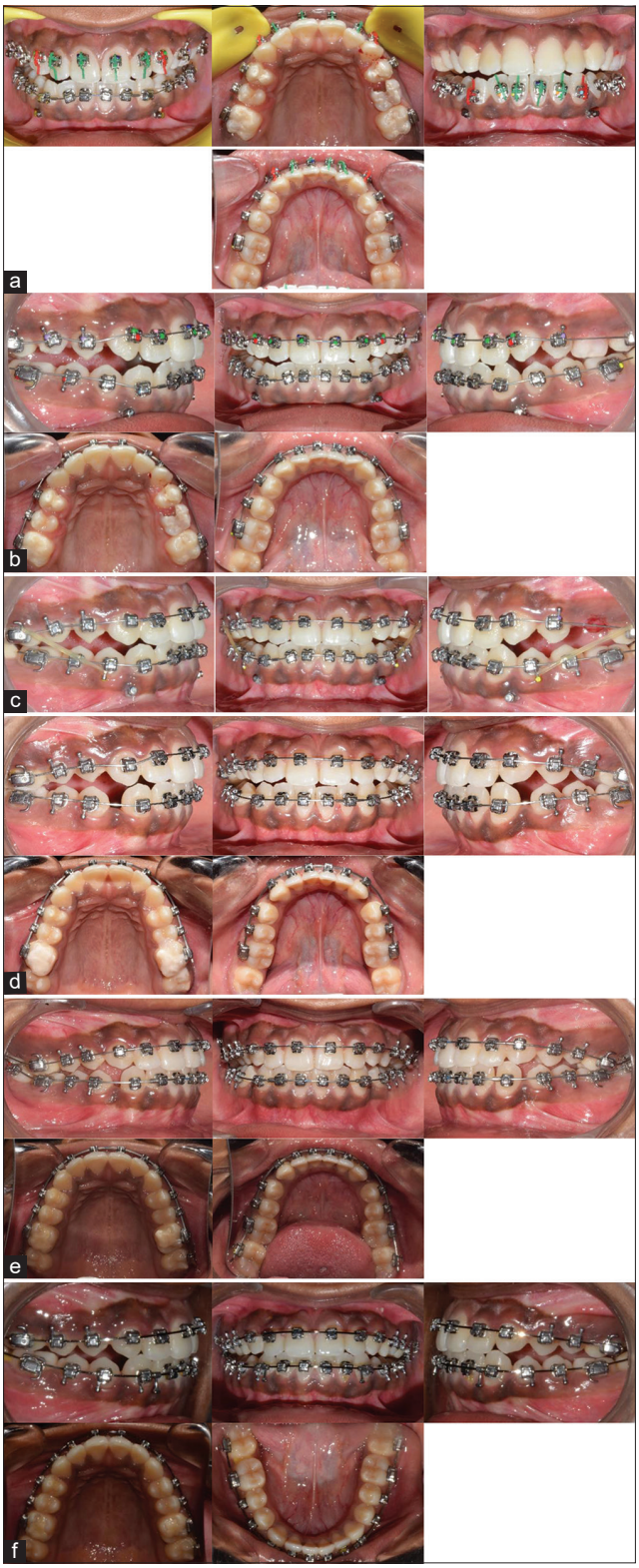

Figure 6: (a) Initial bonding, (b) 0.014" CuNiTi initial light round wire phase, (c) 0.014" CuNiTi with class elastics U6-L4, (d) 0.014×0.025" CuNiTi high-technology edgewise phase, (e) 0.018×0.025" CuNiTi high-technology edgewise phase, (f) 0.019×0.025" SS major mechanics phase.

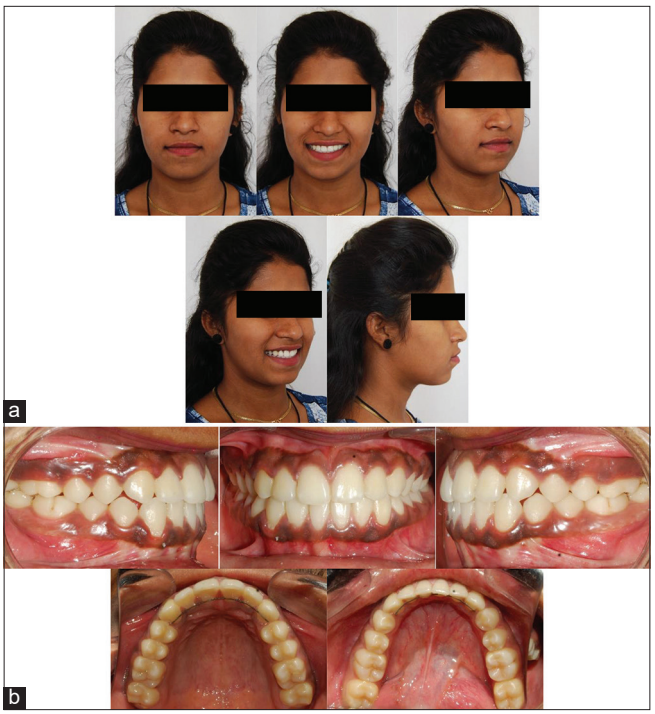

Figure 7: (a) Post-treatment extraoral photographs, (b) post-treatment intraoral photographs.

Treatment progress

There was a slight intrusion of the mandibular molars because of the occlusal splint, which is necessary for the Class III correction by changing the occlusal plane and distally positioning of the mandible for better functional and esthetic relationship. To a certain degree, this appliance altered the relationship between the maxilla and the mandible by bringing the posterior occlusal plane into a better functional position and thus balancing the face. Class I molar and canine relationships were established, with a 2 mm overjet and 2 mm overbite [Figure 7].

Cephalometric superimposition showed that there was steep distal reposturing of the mandible at the level of the temporomandibular space. The upper molars were extruded and also migrated mesially, resulting in Class I dental occlusion. The final profile showed a retrusion of the lower lip and protrusion of the upper lip, with both coming in the normal range of E-line. There was a counterclockwise rotation of the occlusal plane the interlabial gap and incisal display at rest was closed. Appropriate nasolabial, labiomental sulcus, and interincisal angles were achieved [Tables 1 and 2 and Figures 8 and 9]. The PAR score assessment showed a 97.2% change in PAR score post-treatment indicating a greatly improved outcome [Table 3]. Follow-up after 12 months and 20 months revealed that the occlusion was stable with satisfactory facial esthetics [Figure 10].

Table 2: Treatment timeline.

Phase	Archwire sequence	Duration	Total duration
Stage 1			
Maxillary splint with lower TADs	-	8 months	8 months
Stage 2 (fixed mechanotherapy)			
Phase I	0.014" CuNiTi	3 months	11 months
Initial light round wire phase			
Phase 2	0.014×0.025" CuNiTi	2 months	13 months
High-technology edgewise phase	0.018×0.025"CuNiTi	1 month	14 months
Phase 3	0.019×0.025" SS	3 months	17 months
Major mechanics phase			
Phase 4	0.019×0.025" SS	2 months	19 months
Finishing			
Retention phase	Permanent lingual retainer+begg wrap around retainer	20+months	39+months

TADs: Temporary anchorage devices

Table 3: PAR scoring sheet.

Pre-treatment

PAR components	Right								Left		Unweighed total	Weighed total
Upper anterior component	3-2	1	2-1	0	1-1	0	1-2	0	2-3	1	2	X1
Lower anterior component	3-2	1	2-1	2	1-1	0	1-2	1	2-3	2	6	X1
Buccal occlusion	Anteroposterior					Right 2			Left 2		4	X1
	Transverse					Right 0			Left 0		0	X1
	Vertical					Right 1			Left 1		2	X1
Overjet	Positive			0		Negative			3		3	X6
Overbite	Overbite			0		Open bite			0		0	X2
Center line					1						1	X4
Total											18	36

Post-treatment

PAR components	Right								Left		Unweighed total	Weighed total
Upper anterior component	3-2	0	2-1	0	1-1	0	1-2	0	2-3	0	0	X1
Lower anterior component	3-2	0	2-1	0	1-1	0	1-2	0	2-3	1	1	X1
Buccal occlusion	Anteroposterior					Right 0			Left 0		0	X1
	Transverse					Right 0			Left 0		0	X1
	Vertical					Right 0			Left 0		0	X1
Overjet	Positive			0		Negative			0		0	X6
Overbite	Overbite			0		Open bite			0		0	X2
Center line					0						0	X4
Total											1	1

Assessment of outcome

PAR score		Improvement	
Change in PAR score	35	Greatly improved	←
% change in PAR score	97.2%	Improved	
		Worse or no different	

Greatly improved: A reduction 22 points or more (a case with a pre-treatment score of 22 PAR points or less cannot be classed as "greatly improved" as it was not sufficiently severe before treatment), improved: A reduction of at least 30%, worse or no different: A reduction of<30%

Critical appraisal

In the Stage 1 treatment of maxillary splint and lower temporary anchorage devices (TADs), instead of the maxillary occlusal splint, a bonded rapid maxillary expansion or a miniscrew-assisted rapid palatal expansion could have been a better option to get more skeletal protraction.

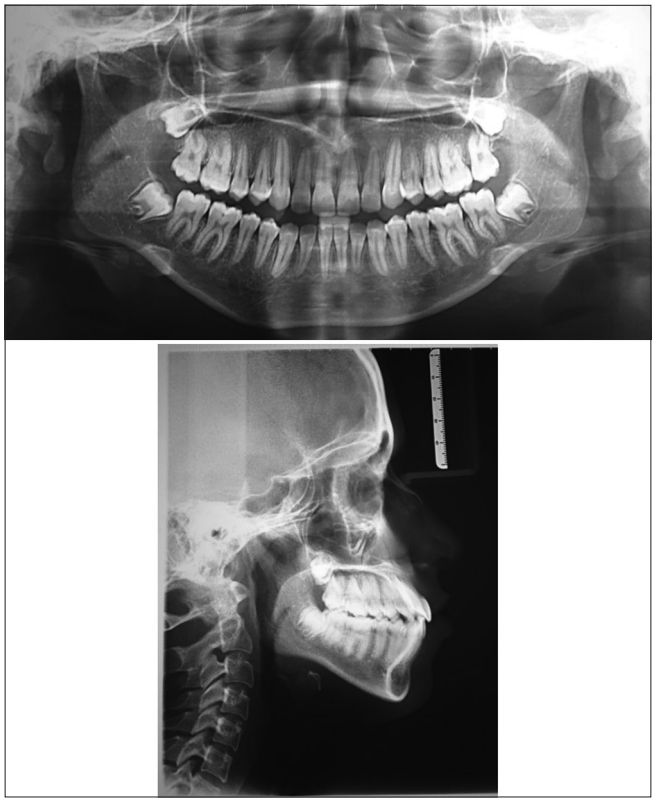

Figure 8: Post-treatment radiograph.

DISCUSSION

Class III treatment requires that decisions be based not only on the morphological types that present them as orthodontic problems but also on those who authorize consideration for their potential psychological impact and quality of life. This last consideration when making medical recommendations is a specialized service provided by the orthodontist. Each person should be treated based on his or her expectations, including professional advice and human understanding.

The three main approaches for the treatment of Class III malocclusion include camouflage by dental occlusion correction, growth modification, and surgical correction. Facemask is the most commonly used protocol for this anomaly. The treatment effects show a combination of dental and skeletal changes of both maxilla and mandible.[5]

Another problem encountered in the extraoral appliance is the requirement of patient compliance as well as parental support.[9] The appliance being bulky still has to be worn for at least 14–16 h/day. Furthermore, the heavy forces applied cause irritation on the chin area skin.

Conservative treatment of Class III skeletal malocclusion is popular with patients but challenging for orthodontists. Bone-anchored maxillary protraction (BAMP) to treat

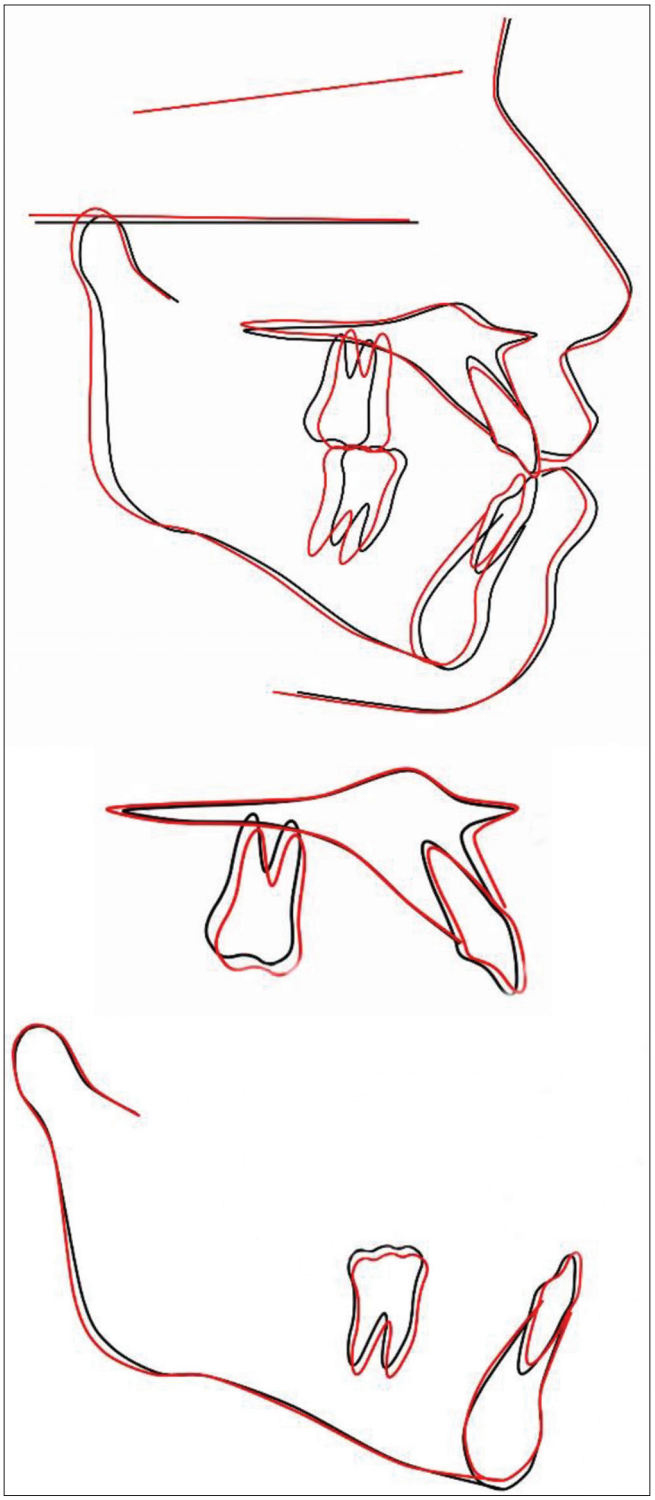

Figure 9: Cephalometric superimposition.

Class III bone marrow deformities has gained popularity with facemasks. The best advantage is that it is possible for 24 h/day intraoral tractions without an external facemask, which requires little patient compliance.

Figure 10: (a) One year retention phase, (b) 20 months post-treatment follow-up extraoral photographs, (c) 20 months post-treatment follow-up intraoral photographs.

The present case describes a Class III malocclusion in the pubertal deceleration stage. The maxillary protraction was carried out by applying the Class III elastics to the mini-screws in the lower anteriors to the maxillary splint. This technique was simple and less invasive and provided good compliance from the patient.[10] The elastic force was 6 oz initially for a month and then increased gradually to 8 oz till the end of the Class I canine relationship was achieved at the end of the protraction stage. The facial changes produced as a result of treatment were directly related to skeletal and dentoalveolar modifications that were designed as goals for the patient treatment. During the protraction stage, point A moved forward (SNA 88°) ANB (2°) increased and SNB (86°) decreased significantly which led to the Class 1 skeletal relationship in 8 months. In the study by De Clerck *et al*.,[11] maxilla was protracted through Class III elastics between miniplates on both maxilla and mandible, which was called BAMP protocol. The authors reported a 4 mm forward progression of point A at 12 months, a longer duration that required greater patient cooperation. The mandibular plane rotated posteriorly during protraction and the B point was carried backward, decreasing the projection of the mandible.

This result occurred due to the chin cup effect of the facemask and anterior rotation of the maxilla. There was slight proclination of upper incisors, which was mainly due to two factors which were the counterclockwise rotation of the upper occlusal plane due to force vector and the use of a tooth-borne occlusal splint. Interestingly, there was mild proclination in the lower incisors similar to that reported in the study by De Clerck *et al*.[12] The lower incisor proclination could be due to the new posture of the tongue acting on the lower incisors.

The passive self-ligating Damon system provided a minimal friction environment.[13] The low torque brackets in the upper anteriors were beneficial for avoiding the proclination due to the usage of the Class 3 elastics.[14] The passive self-ligation method produces a more accurate force system for malocclusion, with fewer unwanted forces and moments compared with elastic conventional ligation.[15] The Damon system mechanics demonstrates the lip bumper effect, similar to using lip bumper appliances due to the pressure from the orbicularis muscle that can move the teeth distally.[6] There is 9° play between 19 × 25 stainless steel archwires and the Damon bracket slot creates the Multiloop Edgewise Archwire effect which is effective in treating open bites, severe Class IIs, and Class IIIs, and asymmetry patients, without bending complicated loops.[16]

The use of early elastics of light force along with the passive self-ligation increases the efficiency of the treatment by maximizing the wanted tooth movements in all dimensions and minimizing or mitigating the unwanted tooth movement during the tipping or early torsional phase of treatment.[17] According to the suggested treatment protocol for the correction of Class III malocclusion with Damon System, in the initial light wire stage, short Class III elastics 2oz 3/16" from U6-L4 or U5-L3 are given to start A-P and vertical correction. In the high-tech wire stage, sling elastics U6-L3-U4 5/16" 2 oz are given for the A-P correction. In the major mechanics' stage, the force level is increased to 4.5 oz sling and Class III is overcorrected. The diligent use of early light elastics may shorten or eliminate the major mechanics' phase.

Ideal overjet and overbite were achieved with ideal incisal inclination in both the arches. The patient was pleased with her dental and facial esthetics and was more confident at her 12th and 20th-month follow-up visits.

CONCLUSION

This case report demonstrates simplified mechanics for the correction of Class III malocclusion with TADs and passive self-ligation bracket system, instead of treatment with extraoral traction or orthognathic surgery, for the correction of the same. A pleasant attractive smile, passive lip seal, and a balanced facial profile were achieved. The treatment results were stable at 20 months after the treatment completion.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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How to cite this article: Shaikh AA, Kumar GA, Ramesh GC, Chinthan G, Indra S. Non-surgical correction of Class III adolescent patient with TADs and Damon system: A case report. APOS Trends Orthod 2022;12:139-48.