

MANAGEMENT OF CLASS II MALOCCLUSION IN SIBLINGS

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Abstract

This case report discusses management of skeletal class II siblings with different treatment modalities. Both the sisters presented with convex profile, posterior divergence, class II molar relationship, increased overjet and overbite. Cephalometrically the sibling presented with an ANB value of 8° and 5° respectively. Taking into consideration the clinical and cephalometric values one case was managed with single arch extraction along with a TAD assisted double keyhole loop and the other with fixed functional appliance (Powerscope).

Key words Sibling, Class II malocclusion, TAD assisted double keyhole loop, Powerscope.

Introduction

Class II malocclusions have been of significance to the clinicians since they comprise a considerable percentage of the cases that they treat.¹ In 1899, Edward Angle contributed to the orthodontic society by famously categorizing all the possible malocclusions into three classes, simply and solely by the relative position of the first molar in the dental occlusion and jaw relationship.² The individuals presenting with a normal class I occlusion and skeletal relationship, display a synchronizing amount of maxillary and mandibular growth which results in a well-balanced and esthetically pleasing profile. While on the other hand the individuals with Class II malocclusions present an anteroposterior discrepancy between the maxillary and mandibular dentitions, which may or may not be associated with a skeletal discrepancy.¹

This class of malocclusion has been recognized to present with a triad of 1) deep overbite 2) proclined/retroclined maxillary incisors 3) posteriorly positioned mandibular dental arch.² There have been various documentations that hold genetics and familial trend responsible for its general etiology.³

There are three possible approaches to the treatment of skeletal and dental Class II malocclusion:

- (1) Growth modulation to reduce or eliminate the jaw discrepancy
- (2) Camouflage treatment option where the treatment goal is to camouflage the skeletal problem rather than correcting it. Here the tooth movement is done to compensate for the jaw discrepancy, i.e., retraction of the upper incisors or proclination of the lower incisors.
- (3) Surgical treatment option which involves repositioning of the jaws. This almost always involves advancement of the lower jaw since severe Class II malocclusions are considerably due to mandibular deficiency.

Taking into account the extent to which growth modification is possible, it is the ideal treatment plan. However, when significant growth is no longer possible as in cases of late adolescents and adults, camouflage and surgery becomes the treatment options. Furthermore, when comparing various alternative treatment procedures, it becomes important to assess the treatment

efficacy, where one needs to assess to what extent the treatment meets its goal of improving the dental relationship along with the dentofacial esthetics. Although not much literature has been published regarding efficacy, it seems wise to compute in terms of the goals of modern orthodontic, that is to attain a normal occlusion, satisfactory skeletal and soft tissue proportions, and a pleasing dentofacial esthetics. Additionally, an acceptably stable result, decent cost-benefit and risk-benefit ratios. In contrary to the highly established specific criteria and methods utilized to assess the dental occlusion and dentofacial proportions, the assessment of dentofacial esthetics is still unstandardized. The established standard cephalometric soft tissue criteria correlate with esthetic judgments but are not adequate alone for a comprehensive evaluation of the dentofacial esthetics.⁴

This article presents and discusses two case reports of class II malocclusion in siblings presenting with class II division 1 malocclusion.

Case report 1

History

A 15 years female patient came to our department with the complaint of forwardly placed upper front teeth. The patient gave no relevant medical or habit history and attained menarche a year before.

Diagnosis-

Extraoral assessment

The patient presented with a facial pattern typical to a class II malocclusion, i.e. a posterior divergent profile, positive visual treatment objective and mandibular retrognathism (**Fig.1**). The patient displayed a mesocephalic head type and mesoprosopic facial form with no gross facial asymmetry. Also presented with normal vertical proportions and deep mentolabial sulcus.

Intraoral assessment-

Intraoral examination revealed all permanent dentition with Angle Class II Division 1 malocclusion, proclined upper incisors which contributed to an acute nasolabial angle. Occlusal features revealed U shaped maxillary and mandibular arch. The lower midline was found to be shifted 2 mm towards left side with respect to the upper midline. Spacing was seen between 14 -13, 13-12, 22-23

and 23-24. The smile assessment revealed 8mm incisal display at rest and full display on smiling with no gingival exposure. The oral hygiene status was average. The right and left excursive movements were normal. Maximum mouth opening was 42 mm.



Figure 1- pretreatment records.

Radiographic assessment

On examination of OPG optimum bone support was observed (Fig 1). tooth missing 18, 38, 48 and erupting 28. TMJ space revealed normal size, shape and position of the condylar heads.

On cephalometric assessment the pretreatment ANB angle was found to be 8° and MPA was 29° pointing to a Class II skeletal base and a hypodivergent growth pattern (Table 1). As clinical examination already revealed proclined upper and lower incisors hence the 1/NA, 1/NB and IMPA angulations were found to be increased i.e. 24°, 32° and 102° respectively.

Model analysis

Arch perimeter analysis concluded 1mm of maxillary tooth material excess and Carey's analysis showed 3 mm mandibular tooth material excess. Bolton's analysis revealed a mandibular anterior tooth material excess of 0.91 mm while overall mandibular tooth material excess was 1.26 mm.

	CEPHALOMETRIC DATA		
	NO RM	PRE-TREATMENT	POST TREATMENT
SNA	82°	82°	81°
SNB	80°	74°	75°
ANB	2°	8°	6°
MPA	32°	29°	29°

1/NA	22°	24°	21°
1-NA	4.0 mm	5 mm	1 mm
1/NB	25°	32°	30°
1-NB	4.0 mm	8 mm	7 mm
IMP A	90°	102°	101°
1/1	131°	128°	135°

Table 1-cephalometric reading of patient lateral cephalogram tracing(case 1)

Treatment objectives and plan

Treatment objectives were to

- 1) correct class II skeletal relationship,
- 2) to maintain class II molar relation,
- 3) Achieve ideal overjet and overbite
- 4) To reduce the facial convexity and attain an esthetically pleasing soft-tissue profile.

We decided upon two treatment plans first being a surgical treatment option i.e. BSSO advancement and second was camouflage treatment plan. The surgical approach required upper second premolar extraction and lower first premolar extraction bilaterally for decompensation and BSSO advancement along with genioplasty. Even though the patient at the start of treatment was 14 years of age, by the time decompensation would have been completed she would be old enough for surgery. This treatment option was discarded as the patient sought orthodontic treatment only in form of a conservative approach.

The second treatment approach was more conservative which was masking the skeletal as well as dental discrepancy by camouflage. This required extraction of only upper first premolars, retraction of the upper incisors and attain a more satisfying profile.

Treatment Progress And Results

Full fixed preadjusted Edgewise appliance MBT of 0.022" (3M Unitek™ Gemini Metal Brackets) prescription was placed to level and align both arches. Patient was referred for extraction of upper first premolars before commencing leveling and aligning. On banding and bonding the upper second molar was also banded and a TPA was placed for anchorage. Leveling aligning was commenced on 0.012 NiTi (3M Unitek Nitinol Super elastic wire) and gradually reached a thicker gauge wire till 0.017X0.025 SS in the upper arch in a period of five months. In the next visit a "TAD assisted double keyhole loop" was made on 0.019x0.025 SS and placed having a Beta bend of 25° and an Alpha bend of 10° (Fig.2). The Beta bend was given more to further more to enhance the anchorage in the upper arch. A TAD (S.K Surgical mini implant) of 1.2x6mm dimension was placed in the midline i.e. between the upper central incisors at the mucogingival junction to aid in the vertical control and intrusion. This was followed by lower arch bonding along with placement of 0.012

NiTi and routine activation of the double keyhole loop in every 8 weeks. The lower arch wire was also gradually increased to a thicker gauge wire on NiTi. Once the lower arch wire reached 0.016 SS, interproximal stripping was done in relation to 42,41,31,32 (2mm) to correct the tooth material discrepancy.

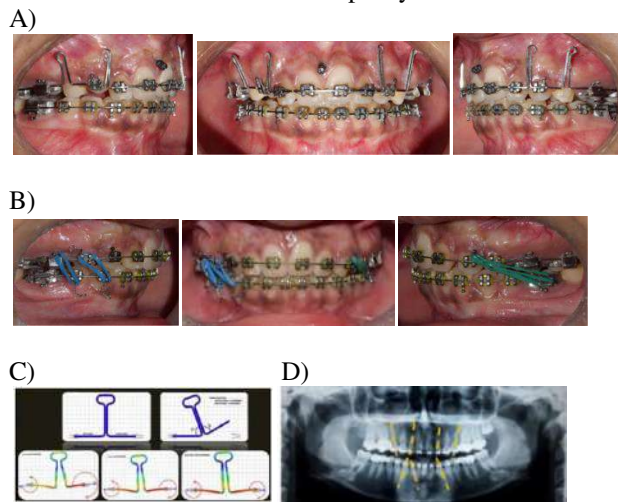


Figure 2- Mid treatment records(a- TAD assisted double key hole loop, b-settling elastics, c- computer simulation of key hole loop, d-OPG)

As soon as the space was closed in the upper arch owing to the retraction of the upper anteriors, the wire is replaced by 0.016x0.022 SS in upper arch and 0.017x0.025 SS along with 15° lingual crown torque with respect to 42,41,31,32 in lower arch to compensate for the lower incisor fanning. Next the patient was referred for a mid-treatment OPG which revealed requirement of root paralleling with respect to 15,12,22,25,33,42,43 (Fig.2). The concerned tooth brackets were repositioned on a thinner gauge NiTi wire. As 0.016 NiTi wire was once again reached, interproximal stripping was done in relation to 45,44 (1mm) and the patient was asked to begin with short class III settling elastics on right side and class II settling elastics on left side for the settling of the occlusion. The purpose of inter proximal stripping specifically on the right side was to avail space for the midline shift seen towards the left side.

After 22 months of active treatment class II molar relation was maintained, upper incisors were retracted and retroclined along with well aligned lower arch. The patient's soft tissue profile appeared more esthetically pleasing (Fig.3). Following this debonding was done and post treatment records were taken. The cephalometric measurements produced by treatment are displayed in Table.1 The patient was very much satisfied and pleased with her treatment and her soft tissue profile. Fixed retainers were placed in both the arches.

Result

The post treatment cephalometric analysis reveals no changes in ANB i.e. 8° as we followed a conservative treatment approach only masking the skeletal discrepancy and not correcting it (Table 1). Camouflage

required retroclination of upper incisor hence contributing to a decreased I/NA than normal which is 21° and slight retroclination of lower incisors from the previous value hence presents with a reduced IMPA and I/NB i.e. 101° and 30° respectively.



Figure 3-Post treatment records.

Pretreatment and post-treatment photographs and radiographs confirmed certain amount of soft tissue growth in the chin region. Retraction of upper incisors by 4mm with retroclination of lower incisors (table 1). Fig. 4 shows one year follow up photographs and radiographs.

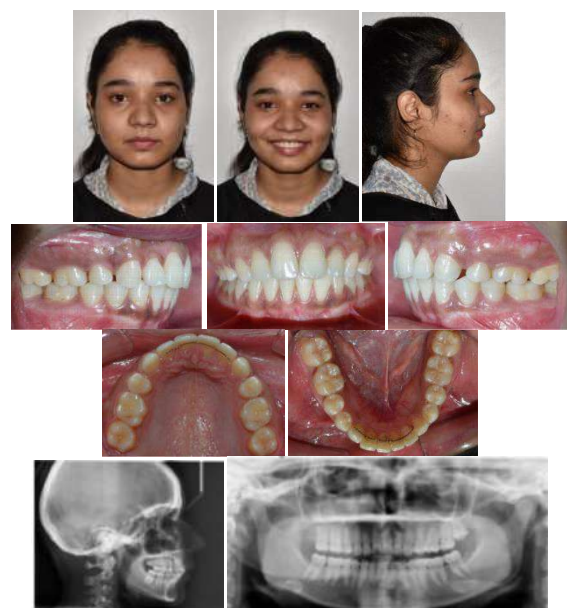


Figure 4- One year follow up

Case Report 2

History

14 Year old female patient reported to our department with forwardly placed teeth. She presented with no relevant medical and habit history.

Diagnosis And Treatment Plan

Extraoral assessment

Extraoral examination (Fig. 5) of the case revealed mesocephalic, mesoprosopic, convex facial form with no gross asymmetry. Patient presented with incompetent lips and a typical class 2 malocclusion div 1 feature i.e. an acute nasolabial angle.

On examination of TMJ did not show any pain or clicking sound during opening and closing. Maximum mouth opening was 39 mm.

Intraoral assessment

Intraoral examination revealed a U shaped upper and lower arch with matching skeletal and dental midlines. She had a Class II div 1 molar relationship with increased overjet and overbite. Mesioangular rotation was noted in relation to 15, 25 while scissor bite was noted in relation to 35, 45. Spacing was also seen in relation to 13 -14 and 23-24.

	NOR M	PRE- TREATMEN T	POST TREATMEN T
SNA	82°	88°	87°
SNB	80°	83°	85°
ANB	2°	5°	2°
MPA	32°	29°	25°
1/NA	22°	25°	24°
1-NA	4.0mm	5 mm	3 mm
1/NB	25°	25°	28°
1-NB	4.0mm	2 mm	3 mm
IMP A	90°	95°	97°
1/1	131°	128°	122°

Table 2-cephalometric reading of patient lateral cephalogram tracing(case 2)

Radiographic examination

On examination of OPG optimum bone support was observed. Erupting tooth irt 18, 28, 38, 48. TMJ space appeared with normal size, shape and position of the condylar heads.

Lateral cephalometric assessment (Fig. 5 and Table 2) suggested a Class II skeletal base with hypodivergent jaw bases as the ANB is 5° and MPA is 29°. As clinical examination already revealed proclined upper and lower incisors hence the 1/NA, 1/NB and IMPA angulations were found to be increased i.e. 25°, 25° and 95° respectively. It also revealed CVMI stage IV growth status. Both the maxillary and mandibular base length parameters were within normal range.

Model analysis

Arch perimeter analysis suggested 1mm of maxillary tooth material excess and Carey's analysis showed 2 mm mandibular tooth material excess. Pont's index revealed arch expansion is required at premolar (1.5 mm) and molar region (1.8 mm). Bolton's analysis indicated mandibular anterior tooth material excess of 1.26 mm while overall mandibular tooth material excess was 1.54 mm.



Figure 5- Pretreatment records.

Treatment objectives and plan

Treatment goals were to correct the patient's class II skeletal and dental relationships along with correction of rotations, proclination and spacing among the teeth and achieve an esthetically pleasing soft-tissue profile. Four treatment modalities were proposed. The first treatment modality required extraction of all first premolars, the second option, required extraction of upper first premolars and lower second premolars bilaterally allowing us to finish the case in an ideal Class I molar and canine relationship. Third modality followed extraction of maxillary third molars and distalizing the upper arch. Fourth and last, involved the use of fixed functional appliance to address the skeletal problem and best utilize the remaining growth potential of the patient for a much more esthetic profile. The first three treatment options were discarded as the patient sought orthodontic treatment only in form of a conservative approach and was not willing for extraction; if an option of non-extraction was available.

Treatment Progress And Results

Full fixed preadjusted Edgewise appliance MBT 0.022" (3M Unitek™ Gemini Metal Brackets) prescription was placed to level and align both arches starting from 0.012 NiTi along with placement of transpalatal arch for anchorage reinforcement. After achieving leveling and alignment of both the arches in seven months, 0.019" × 0.025" stainless steel archwire was inserted subsequent to consolidation. A fixed functional Class II corrector appliance Powerscope (American Orthodontics), was placed with equal activation on both side to correct the mandibular retrognathism and achieve Class I molar and canine relation (Fig. 6). To compensate for the lower incisor flaring, a 10° of lingual crown torque with respect to 41,42,31,32 was incorporated in lower arch wire. A sequential activation (2mm) of powerscope was done at an interval of 3 months and 6 months.

After nine months, the Powerscope appliance was removed and a lighter gauge wire i.e. a 0.016" stainless steel archwires were inserted in both the arches.

After 22 months of active treatment, skeletal and dental Class I relationships was achieved. (Fig. 7). The patient's facial profile changed from convex to straight due to favorable growth of mandible. Following the end of settling phase (0.014 NiTi) of treatment, debonding was done. The patient presented with good intercuspation except between 16 and 46 as the patient was eager to have the treatment completed along with her sister. The patient presented with a very much pleasing profile.



Figure 6- Mid treatment intraoral photograph (placement of Powerscope).

The post treatment assessment results achieved by the Powerscope are shown in Table 3. The changes seen are as follows: ANB angle was reduced from 5° to 2°, a 2° increase



Figure 7- Post treatment records.

is observed in IMPA, 1° reduction in I/NA and a slight reduction in inter incisor angulation.

Post treatment photographs and radiographs illustrates and indicates significant condylar growth owing to the fixed functional appliance (Fig. 7). Fig 8 shows one year follow up photographs and radiographs.

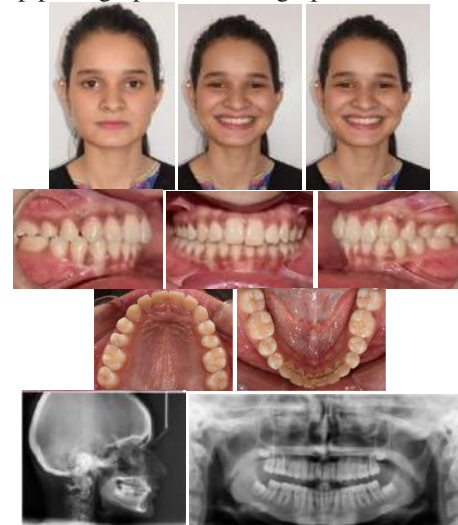


Figure 8- One year follow up

Discussion

Successful treatment of any case can only be achieved if (1) the diagnosis is based on a logical understanding of the physiologic dimensions of the presenting dental state, and (2) understanding the system of treatment mechanics employed which allows the operator to precisely arrange the teeth so that they are in a continual state of harmony with their environment.⁵

Even though the post cephalometric readings discussed in case report 1, do not lay within the standard norms of cephalometry the patient presents with a complete class 2 molar relationship and good intercuspation.

According to a published article cephalometric analysis are available to assist and guide us in treatment planning and in assessing changes that take place naturally and as a result of treatment. It expresses problems so that they can easily be observed at an early phase and therefore understood. It helps us to make decisions such as when to extract and when not to extract, and it gives an indication of what to extract. It helps to evaluate the results of different types of treatment.⁶ Therefore it becomes important for the clinician to assess the best choice for a specific case.

The case report 1 discussed in our article presented with well-developed nose and chin which support the camouflage treatment plan in masking the skeletal class 2 pattern. We decided to follow the frictionless mechanism (TAD assisted double keyhole loop) for retraction in this

particular case because of the following advantages 1) Precise control over the anterior and posterior anchorage. 2) The tooth will move only to the limit to which the loop is activated. 3) Differential tooth movement is possible.⁴ Retraction loops or springs offer more controlled tooth movement than in friction mechanics.⁷ Halazonetis designed a software program to predict the moment to force ratio produced in various loops by taking into account the loop design as well as different activations to produce a specific tooth movement. This computer software has special features which computes the neutral position of the loop in addition to the shape of the preactivated loop.^{8,9} In **Fig. 2** computer program wizard shows a neutral Keyhole loop having an alpha and beta arm. The Beta arm is preactivated by 20⁰ and the alpha arm preactivated by 10⁰. Later this loop is activated by 2 mm, 1 mm and 0.5 mm.

In case report 2 discussed in our article, the powerscope is used to correct class II malocclusion by forward displacement of lower jaw along with distal directed force on upper jaw. A common dentoalveolar side effect seen is the proclination of lower anteriors which was prevented by adopting the following measures 1) cinching back of mandibular archwire 2) figure of eight consolidation of lower arch and 3) incorporation of lingual crown torque irt 31, 32, 41, 42.¹⁰⁻¹⁵

Class II treatment plan should be carried out cautiously as the chances of root resorption is more in these cases. Kaley et al. has recently reported that the risk of resorption is 20 times greater than usual when the maxillary incisor roots are torqued against the lingual cortical plate, a movement that is particularly associated with maximum retraction of protruding incisors in patients with Class II malocclusions.

While choosing between surgical option and camouflage, various studies have suggested camouflage treatment as most effective in patients who have reasonably good facial esthetics initially as in our case.

The more severe the mandibular deficiency and the greater the overjet (and poorer the facial esthetics), the more likely it is that the patient would benefit enough from surgery to make it worthwhile.⁴

Conclusion

With the large number of options available to us as a clinician to treat a class II malocclusion case, it becomes the clinician's duty to opt for the best modality fitting for a specific case.

While treating the class II case by following an extraction modality, frictionless mechanics (TAD assisted double keyhole loop) gave us the advantage of better torque and vertical control along with quicker space closure over friction mechanics.

Class II conditions caused due to a retruded mandible, can be corrected without extraction with the help of fixed functional appliances.

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