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Case Report

Dentistry Section

Advancing Mandibular Growth and Aesthetic Harmony in Post-pubertal Class-II Malocclusion, a Non Extraction Treatment with AdvanSync™ 2: A Case Report

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ABSTRACT

Skeletal Class-II malocclusion is a prevalent type of malocclusion characterised by either a retrognathic mandible, a prognathic maxilla, or both. The present orthodontic case study describes a 15-year-old female patient with a Class II malocclusion and a retrognathic mandible, accompanied by rotated teeth, increased overjet and overbite. The patient presented with a pronounced mentolabial sulcus, a steep nasolabial angle and a convex facial profile. Cephalometric examination revealed a Class II skeletal base and limited growth potential, indicated by Cervical Vertebral Maturation Index (CVMI) Stage V. The treatment employed a non extraction, non surgical strategy using 0.022-inch McLaughlin, Bennett, and Trevisi (MBT) self-ligating brackets and the AdvanSync™ 2 hybrid Fixed Functional Appliance (FFA). This approach improved the mandible and arch alignment to correct skeletal and dental discrepancies. Treatment resulted in the establishment of a Class I canine and molar relationship, correction of rotations and expansion of the dental arches. Cephalometric analysis revealed a decrease in the A point, Nasion, B point (ANB) angle, an increase in the Sella-Nasion-B (SNB) angle and an increased mandibular length, reflecting significant skeletal advancement. The case demonstrates the effectiveness of the AdvanSync™ 2 appliance in post-pubertal patients when growth is no longer a significant factor in treatment. It underscores the value of integrating FFAs with self-ligating systems to achieve predictable and efficient skeletal and dental corrections, emphasising patient comfort and non surgical intervention in managing skeletal Class-II malocclusions.

Keywords: Class-II molar-to-molar appliance, Fixed functional appliances, Mandibular advancement, Retrognathic mandible, Self-ligating brackets

CASE REPORT

A 15-year-old female patient presented to the Department of Orthodontics with the chief complaint of protrusion of the upper anterior teeth. On extraoral examination, the patient displayed a convex facial profile with posterior facial divergence, a mesoprosopic facial form and a defined head form. Additional findings included a steep nasolabial angle, a pronounced mentolabial sulcus and competent lips. During the detailed case history assessment, the patient and her parents were asked about parafunctional oral habits, such as thumb sucking or nail biting, which are known to affect occlusal development during childhood. However, they reported no such habits, indicating that the existing occlusal features were unlikely to be influenced by habit-related factors. Smile analysis revealed a symmetrical smile with more than 95% incisal display during smiling and no incisal display at rest. A positive clinical Visual Treatment Objective (VTO) was observed, indicating potential for aesthetic improvement [Table/Fig-1a-d].

A bilateral Class II canine and molar relationship was discovered during intraoral evaluation, accompanied by increased overjet and overbite. Rotations of several teeth—13, 14, 15, 24, 25, 35 and 44—were noted in both arches, with mild crowding in the lower arch. Model analysis confirmed proclination of the upper incisors, mild crowding in the lower arch, constricted upper and lower arches and a scissor bite in the right first premolar region [Table/Fig-2a-e].

The cephalometric study identified a Class II skeletal base with a retrognathic jaw, greater proclination of the upper and lower

[Table/Fig-1]: Pretreatment extraoral records and Visual Treatment Objective (VTO): a) Frontal view; b) Frontal smiling view; c) Lateral view (right profile); d) Visual Treatment Objective (VTO).

[Table/Fig-2]: a-e) Pretreatment intraoral records.

incisors and a horizontal growth pattern. The CVMI is essential for determining the most favourable time for Class II malocclusion treatment since it provides information on the growth potential of the patient. During the early stages (CVMI 1–3), which include the pubertal growth spurt, skeletal changes are most efficacious. Functional appliances, including the Herbst, Twin Block, or Forsus appliance, capitalise on natural mandibular growth to effect positive skeletal changes. As a patient matures beyond CVMI 4 and the growth process slows down, compensatory dentoalveolar changes predominate and Fixed Functional Appliances (FFAs) are a more prudent choice. From stages CVMI 5 through CVMI 6, the potential for skeletal change is negligible and treatment relies increasingly on camouflage mechanics, extractions, or perhaps surgery for very severe cases. Knowledge of the CVMI enables orthodontists to plan their intervention with maximum precision regarding skeletal benefit and minimal complexity in treatment. CVMI analysis from the lateral cephalogram indicated a maturation stage (Stage V), signifying limited growth potential. The cephalometric analysis reported ANB= -3°, SNB=75°, mandibular length = 93 mm, with the details summarised in [Table/Fig-3]. Soft-tissue examination revealed a steep nasolabial angle and a pronounced mentolabial sulcus. All permanent teeth with developing third molar buds were present in all four quadrants on the Orthopantomogram (OPG) [Table/Fig-4a,b].

Measurement	Mean value	Pretreatment	Post-appliance
SNA	82°	780	780
SNB	80°	750	770
ANB	2°	30	10
Go-Gn to SN	32°	200	210
Effective mandibular length	120±3.4 mm	93 mm	97 mm
Effective maxillary length	92.7±2.3 mm	77 mm	77 mm
1 to NA	22°	430	330
1 to NB	25°	160	340
IMPA	90°	950	1020

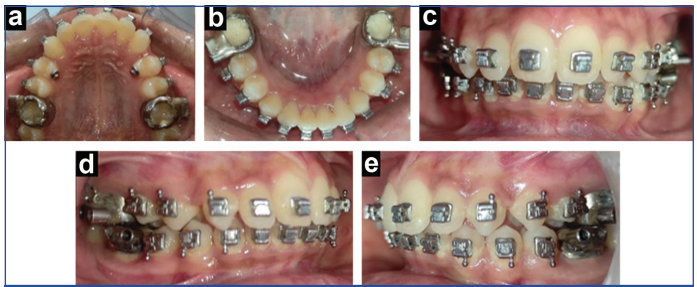
[Table/Fig-3]: Pretreatment and post-treatment cephalometric readings.
SNA: Sella-Nasion-A point Angle; SNB: Sella-Nasion-B point Angle; SN: Sella-Nasion Plane; Go: Gonion; Gn: Gnathion; NA: Nasion-A Point; NB: Nasion-B Point; IMPA: Incisor mandibular plane angle

[Table/Fig-4]: a,b) Pretreatment OPG and lateral cephalograph.

Treatment plan: After a comprehensive analysis and diagnosis, a detailed treatment plan was devised and thoroughly explained to the patient. Pretreatment records, including extraoral and intraoral photographs and impressions, were taken after prophylaxis of both arches. The treatment employed a 0.22 MBT slot-prescription self-ligating bracket system (North American Braces Selfy Passive Self-Ligating Bracket System) with Type A anchorage preparation. The AdvanSync™ 2 appliance (AdvanSync™ 2, Ormco Corporation), a rigid Fixed Functional Appliance (FFA), was used to address the retrognathic mandible for skeletal correction [Table/Fig-5a-c] [1]. Simultaneously, both arches were bonded for dental alignment. Rotational forces were applied to rotated teeth (14 and 24) using lingual buttons attached to the palatal surfaces. Alignment and levelling of the arches were achieved using a sequential wire progression, including 0.014" Copper, Nickel, and Titanium (CuNiTi), 0.014"×0.025" CuNiTi, 0.018"×0.025" CuNiTi and 0.019"×0.025" CuNiTi. Activation of the appliance with spacers facilitated mandibular advancement. Space closure was achieved through retraction in both arches. Post-appliance results demonstrated significant skeletal and dental corrections [Table/Fig-6a-c]. Clinical and cephalometric evaluations confirmed the advancement of the retrognathic mandible, leading to the establishment of Class I molar and canine relationships, a normal overjet and overbite and well-aligned dental arches. Correction of rotations and expansion of the arches further emphasised the treatment's effectiveness [Table/Fig-7a-e]. Cephalometric analysis showed an increase in SNB by two degrees, an increase in mandibular length by 4 mm and no change in SNA [Table/Fig-3]. The total treatment duration was 14 months. After completing the alignment phase, the finishing and detailing phases began and permanent retainers were planned for both arches. Post-treatment results are presented in [Table/Fig-8-10].

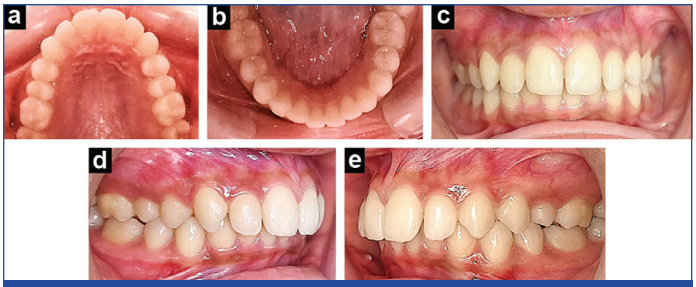
[Table/Fig-5]: a-c) Intraoral records during treatment.

[Table/Fig-6]: a-c) Post-appliance extraoral stage records.

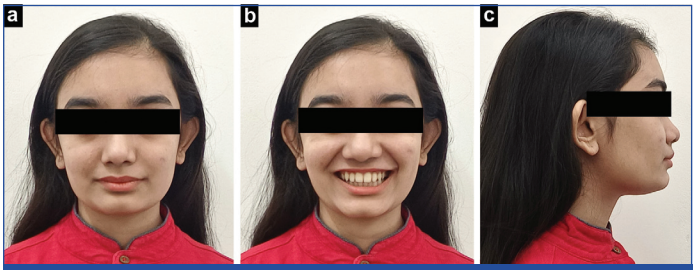


[Table/Fig-7]: a-e) Post-appliance intraoral stage records.

[Table/Fig-8]: a,b) Post-appliance radiographic records.



[Table/Fig-9]: a-e) Intraoral follow-up images.



[Table/Fig-10]: a-c) Extraoral follow-up images.

DISCUSSION

The prevalence of Class II malocclusion among Indian children varies across studies, but systematic reviews suggest it contributes significantly to the overall malocclusion prevalence of 35.40% in this population [2]. It is multifactorial, often involving a retrognathic mandible, a prognathic maxilla, or a combination of both, proclined maxillary incisors and soft-tissue disharmony [3]. The present case highlights the effective management of such a malocclusion in a post-pubertal patient using the AdvanSync™ 2 appliance and a self-ligating bracket system to achieve skeletal, dental and soft-tissue corrections with a non extraction approach. The AdvanSync™ appliance stands out among fixed functional appliances because it is used at the start of fixed mechanotherapy. This makes it possible for both Class II correction and dental alignment to take place concurrently, thus likely shortening the overall treatment duration. Additionally, AdvanSync's™ design minimises reliance on patient compliance and enhances comfort. According to Pangrazio-Kulbersh V et al., functional appliances, whether removable or fixed, induce sagittal and vertical skeletal changes, leading to both orthopaedic and orthodontic corrections [4]. While removable appliances depend heavily on patient compliance, fixed appliances like AdvanSync™ 2 eliminate this reliance [5]. FFAs provide biomechanical advantages by enabling controlled mandibular advancement and reducing treatment complexity [6].

The study by Thomas E et al., found that both the Herbst and AdvanSync™ 2 appliances were effective in treating Class II malocclusion, with comparable skeletal, dental and soft-tissue effects. However, AdvanSync™ 2 demonstrated better skeletal maxillary restriction, while the Herbst appliance showed superior sagittal skeletal changes, making the choice of appliance dependent on specific treatment goals [7].

AdvanSync™ 2 is especially indicated for post-pubertal patients, in whom skeletal growth potential is already diminished [8]. The works of Ruf S and Pancherz H provide substantial evidence for remarkable mandibular advancements as well as skeletal corrections achieved with AdvanSync™ 2 in such post-pubertal cases [9]. From the onset of treatment, this appliance allows orthodontic as well as orthopaedic correction [10]. In this case, it facilitated mandibular advancement while correcting the skeletal Class II base and improving dental alignment and soft-tissue contours [10]. Post-treatment records showed reduced ANB, increased SNB and enhanced effective mandibular length, substantiating skeletal corrections. The efficacy of the treatment was demonstrated by the establishment of Class I molar and canine relations as well as a normal overjet and overbite.

The inclusion of a self-ligating bracket system enhanced treatment efficiency [11]. Sequential archwire progression addressed dental malalignments, expanded constricted arches and corrected the scissors bite in the premolar region. This approach avoided premolar extractions and ensured harmonious occlusion with the correction of a Class II malocclusion. The combined use of AdvanSync™ 2 and the self-ligating system optimised skeletal and dental outcomes while prioritising patient comfort and treatment efficiency. When it comes to treating Class II malocclusions, timing is crucial. While early intervention during the pubertal growth spurt frequently produces the best outcomes, this case demonstrates the potential for successful outcomes in post-pubertal patients through precise appliance selection and treatment planning [8]. Studies by Konik M et al., and Kinzinger G and Diedrich P have corroborated the efficacy of FFAs in achieving significant skeletal and dental corrections in post-pubertal individuals [12,13].

Biomechanically, AdvanSync™ 2 exerts a dual mechanism that restricts maxillary growth (headgear effect) and promotes forward mandibular displacement. This dual effect is pivotal in addressing skeletal imbalances [6]. The appliance's robust design, compact framework and reduced bulkiness enhance patient comfort and minimise breakage, ultimately reducing treatment time [14]. As seen in this case, the improved facial profile with a better nasolabial angle and mentolabial sulcus further supports the appliance's efficacy.

Despite the advantages, the ability of AdvanSync™ 2 to retrocline the maxillary incisors and procline the mandibular incisors should be taken into account, with ongoing assessment of its influence to preclude overly aggressive dental compensations. It can incorporate lingual crown torque in the wire on the lower anterior teeth to control excessive forward tipping. Figure-eight ligature lacing from molar to molar can enhance arch stability and reduce incisor flaring [10,15]. Periodic surveillance is needed to maintain the skeletal and dental balance, with some diagnostic criteria leading to later intervention. The present case illustrates the change in approach for treating Class II malocclusions, especially in late adolescents or adults. When functional appliances such as AdvanSync™ 2 are used along with self-ligating brackets, it presents a non invasive, extraction-free and predictable treatment alternative for complicated malocclusion cases. The results of the present case align with those reported by Ruf S and Pancherz H and Pancherz H [16,17], Konik M et al., and other independent researchers [12]. These findings further confirm the effectiveness of FFAs in promoting mandibular lengthening both before and after the onset of the pubertal growth spurt.

CONCLUSION(S)

Management of Class II malocclusion in non growing patients with skeletal, dental and soft-tissue discrepancies requires a comprehensive, interdisciplinary plan. The present case report demonstrated successful management of a Class II skeletal pattern with dental malalignments by the application of AdvanSync™ 2 along with a self-ligating bracket system. In the present case, the authors have demonstrated how a non surgical option for post-pubertal Class II treatment with this appliance can accomplish skeletal remodeling, dentoalveolar alignment and balance. The fixed nature of AdvanSync™ 2 reduced patient compliance concerns and guaranteed predictable mandibular advancement with effective skeletal treatments. Working in tandem with a self-ligating system, the treatment highlighted functional efficiency, aesthetic enhancement and patient comfort. With advancements in mechanics, diagnosis and treatment planning, the present case illustrates how the treatment philosophy has changed to address Class II malocclusions. It also shows that the appliance is still a great tool for achieving appropriate and aesthetically pleasing changes in the patient's teeth during orthodontic treatment.

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