CASE REPORT

"Sagittal First" Approach Using Carriere Motion 3D Appliance: A Case Report

Shruthi D P[1], Nausheer Ahmed[2], Haritha Urukalan[3], Sharddha Suryavanshi[4], Rithika Joseph[5], Nikhil P M[6]

Abstract

Aim: To present a case with skeletal class II malocclusion and mandibular retrusion treated using Carriere Motion Appliance (CMA).

Background: Management of class II malocclusion in adolescent patients by growth modulation is one of the most debated topics in orthodontics. Fixed functional appliances are generally used in the patients who are at the end of the postpubertal growth spurt. However, most of the fixed functional appliances are placed only after the initial alignment and leveling, which takes up considerable duration of time. The Carriere Motion 3D is an efficient and effective way of correcting the sagittal component of class II malocclusion within the first half year of treatment followed by comprehensive therapy using fixed appliances.

Case description: A 15-year-old male patient reported with the chief compliant of forwardly placed upper front teeth and functional jaw retrusion. It was treated initially with CMA and class II elastics for mandibular advancement. Simultaneously, lower arch was bonded with MBT 0.022" prescription for alignment and leveling. After 6 months, class I molar and canine relationship was achieved before proceeding with full orthodontic treatment. After 12 months of fixed orthodontics, the treatment goals were achieved.

Conclusion: Carriere Distalizer appears to be more comfortable, offer a more positive overall experience, and has fewer side effects. The changes were mainly dentoalveolar in nature, but there were some skeletal changes, particularly in the sagittal and vertical dimensions.

Clinical significance: A significant forward displacement of the mandible was the principal element for successful correction of class II malocclusion. CMA provides the best results for class II management, enabling us to treat such cases with a nonextraction approach rather than contemplating extractions.

Keywords: Case report, Carriere Motion 3D, Class II malocclusion, Fixed functional appliance.

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Background

In one-third of the population, the most common malocclusion occurs in the sagittal plane—class II malocclusion.[1] Class II malocclusion is associated with various characteristics, so proper diagnosis is important in selecting an appropriate treatment plan. Mandibular retrognathism is considered a dominant one among these malocclusions. In this respect, functional appliances are widely used to treat retrognathic mandible in growing patients.[2] Frankel, bionator, activator, and twin block are the removable appliances used to correct mandibular retrognathism in individuals with growth potential. If the patient presents after the pubertal growth spurt or at the end phases of puberty, fixed functional appliances like the Eureka spring, Ritto appliance, universal bite jumper, Forsus fatigue resistant device, and fixed twin block would be the better options.[3]

[1–3,5,6]Department of Orthodontics, Government Dental College and Research Institute, Bengaluru, Karnataka, India

[4]Department of Orthodontics and Dentofacial Orthopedics, DA Pandu Memorial RV Dental College, Bengaluru, Karnataka, India

Corresponding Author: Shruthi D P, Department of Orthodontics, Government Dental College and Research Institute, Bengaluru, Karnataka, India, Phone: +91 9900705819, e-mail: shruthiprithvi@gmail.com

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Carriere Motion 3D Appliance

Over the past 10 years, the Carriere Motion Appliance (CMA) has gained attention as a dynamic three-dimensional (3D) appliance to correct class II malocclusion. Individual alignment of teeth with fixed appliances and forward movement of the mandible class I relationship is established, which sets the basis of the clinical principle of class II correction using CMA.

Luis Carriere, originally unveiled the CMA appliance as the Carriere Distalizer, later known as Carriere Motion 3D appliance, in 2004. It consists of two stiff bars that are bilaterally attached to the first molars and maxillary canines. The anterior third of the clinical crown is attached to the canine pad, which has a hook attachment for attaching intermaxillary elastics (Fig. 1).

There are three different sizes available for the CMA appliance: 23, 25, and 27 mm. Using a caliper or dentometer, measure the distance between the midpoint of the maxillary canine crown and the midpoint of the maxillary first molar buccal surface to determine the proper size.[4,5]

The unique feature of the CMA appliance is that it works efficiently even when the patient has crossed the pubertal growth spurt. Carriere Motion 3D appliance uses patients postpubertal growth spurt for the correction of mandibular retrognathism is presented in this case report.

Fig. 1: Carriere Distalizer

Case Description

A 15-year-old male patient reported to the department of orthodontics and dentofacial orthopedics with a chief complaint of forwardly positioned upper front teeth. On an extraoral examination, the patient revealed a mesomorphic face, convex profile, posterior divergence, recessive chin, and potentially incompetent lips (Fig. 2). During the intraoral examination, the patient had bilateral class II molar relation, end-on canine relation, an overjet of 11 mm, and an overbite of 6 mm. The tooth 21 was endodontically treated without any periapical lesion (Fig. 3).

Upon functional examination, the temporomandibular joint showed normal functioning with a backward path of closure. Furthermore, the patient exhibited positive clinical visual treatment objective (VTO) (Fig. 4).

His growth status was skeletal maturity indicator (SMI) stage 10 and cervical vertebral maturation index (CVMI)

Fig. 2: Extraoral pretreatment photographs

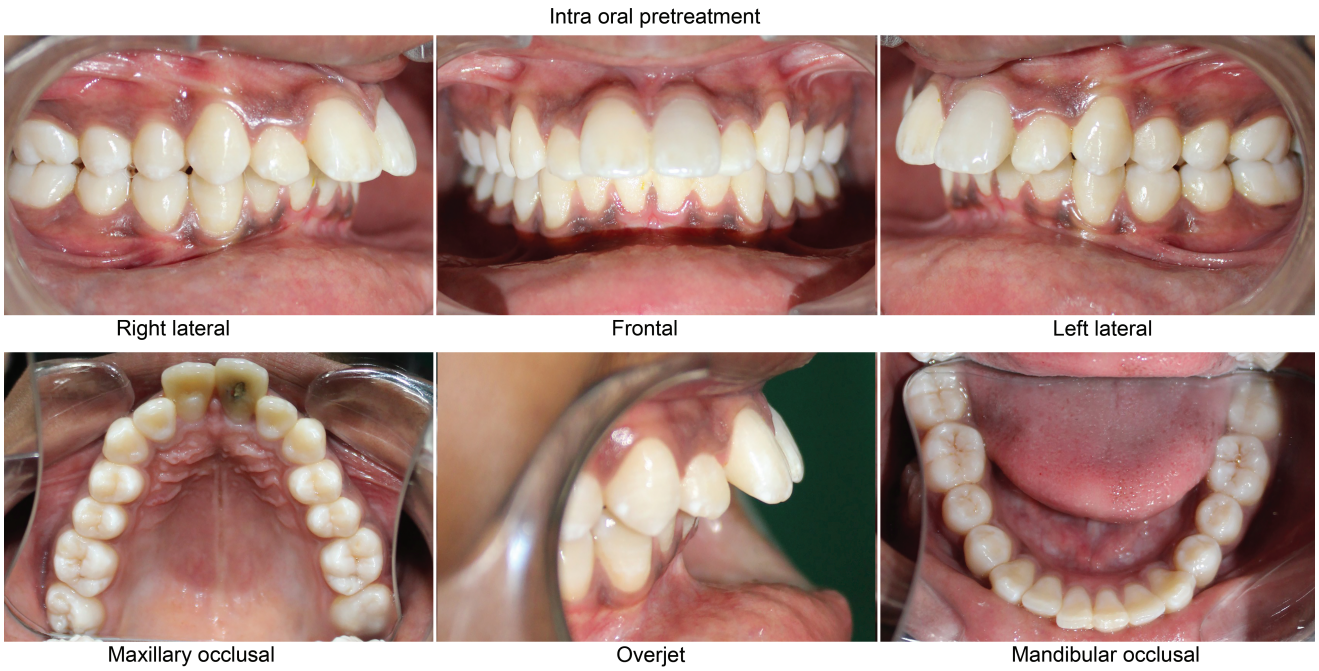

Fig. 3: Intraoral pretreatment photographs

stage 4, which indicates that 10–25% of adolescent growth is remaining. A convex skeletal profile with a 5° A point, Nasion, B point (ANB) angle, an orthognathic maxilla, a retrognathic mandible, a horizontal growth pattern, and proclined upper incisors suggestive of a class II skeletal base were revealed by cephalometric analysis (Fig. 5).

Treatment Objectives

- Improve facial profile by accentuating mandibular growth.
- Restrict maxillary growth in the sagittal plane.
- To achieve class I molar and canine relation.
- To achieve a clinically acceptable overjet and overbite.
- To correct upper incisor proclination.
- To achieve lip competency.

Treatment Plan

Considering the growth status of the patient, CMA was the appliance of choice as it advances the mandible and establish class I molar and canine relationship at the beginning of the treatment. Fixed mechanotherapy (MBT 0.022 slot) was then used to align individual teeth.

Fig. 4: Visual treatment objective photographs

Treatment Progress

Carriere Motion Appliance was bonded in the maxillary arch, between the cupsid and first molar on both sides, at the beginning of the treatment. Simultaneously, 0.022″ MBT brackets and CMA appliance were bonded to the mandibular arch (Fig. 6). From the mandibular molar tube to the appliance on both canines, the patient was directed to wear the elastics full time. Full arch consolidation, cinching the wire distal to the molars, and a 3° labial root torque were applied to the mandibular archwire to prevent the lower incisors from flaring as a side effect of class II elastics. The class I molar and canine relation was established on both sides after 6 months. Superimposition tracing and post-Carriere radiographs demonstrate the mandibular progress (Figs 7 and 8). The CMA was then removed to establish a functional overjet and overbite, align the upper and lower incisors, and obtain a full cusp class I relationship on both sides. 0.022″ MBT brackets were bonded to the maxillary arch (Figs 9 and 10). The desired treatment results were achieved after 12 months.

Treatment Results

Class I molar and canine relation were obtained on both sides at the end of the treatment, with an acceptable overjet and overbite. Lip competency and patient's facial profile improved after 12 months (Figs 11 and 12).

When the cephalometric results were compared, favorable improvements in skeletal and dental parameters were observed with significant sagittal changes (Table 1). At the end of the treatment Sella-Nasion-A point (SNA) angle increased from 81 to 82°, Sella-Nasion-B point (SNB) angle increased from 75 to 78° and ANB angle decreased by 2° which indicates mandibular advancement.

After 12 months, maxillary incisors retroclined by 5 mm linear and 10° angular. As force is centered in the lower anterior arch, there is a slight increase in the angulation of mandibular incisors by 2 mm linear and 6° angular. MBT brackets with 3° torque in the lower incisors, molar to molar consolidation in both arches, and cinching off the lower archwire, we were able to decrease the protrusive effect on the mandibular incisors. It was determined that an interincisal angle was nearly normal.

The basal dentoalveolar and anterioposterior jaw relationships improved as shown in a cephalometric radiograph. Root parallelism was acceptable, and there were no indications of

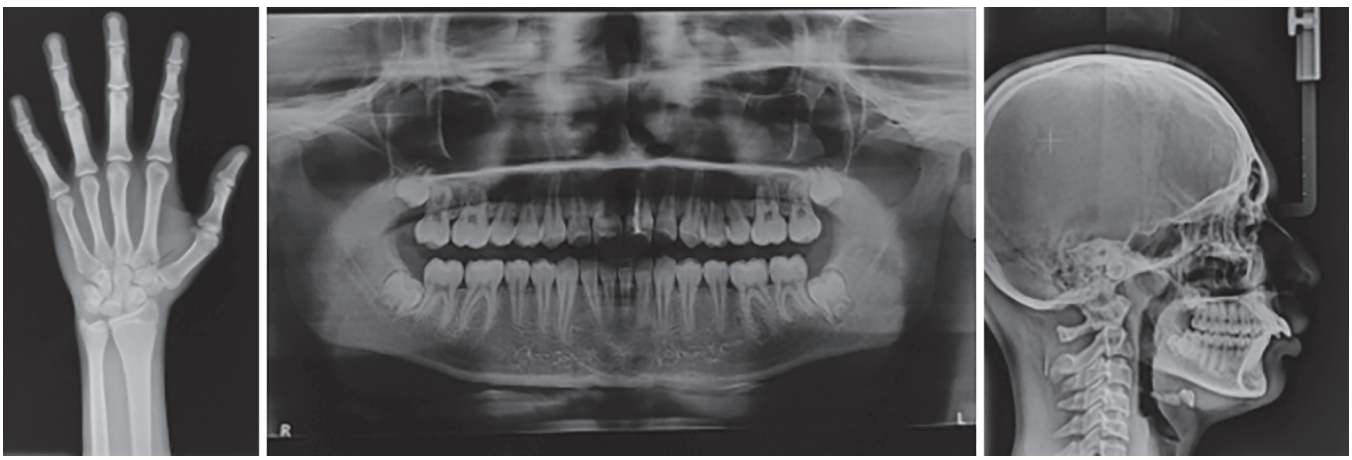

Fig. 5: Pretreatment radiographs

root resorption on panoramic radiography (Fig. 13). Mandibular advancement is evident when pre- and postradiographs are superimposed (Fig. 14).

Discussion

For patients who refuse to wear headgear or receive mini-implants for distalization, the noncompliance intramolar distalization approach has proven to be an excellent choice.[6] In the first 6 months of treatment, the sagittal component of class II maloclussion can be effectively corrected with the Carriere Motion 3D. Comprehensive therapy with fixed appliances is then used to complete the treatment.[7]

With CMA, the maxillary molars and canine are distalized as a unit along the alveolar ridge without tipping. Additionally, the maxillary first molar rotates distally along its palatal roots. Since mesiopalatal rotation of the upper first molar crowns occur in the majority of class II malocclusions, this condition exacerbates the class II relationship by locking the mandible in a retrusive position.[8]

Fig. 8: Superimposition of pretreatment (black) and post-Carriere (blue) treatment radiographs

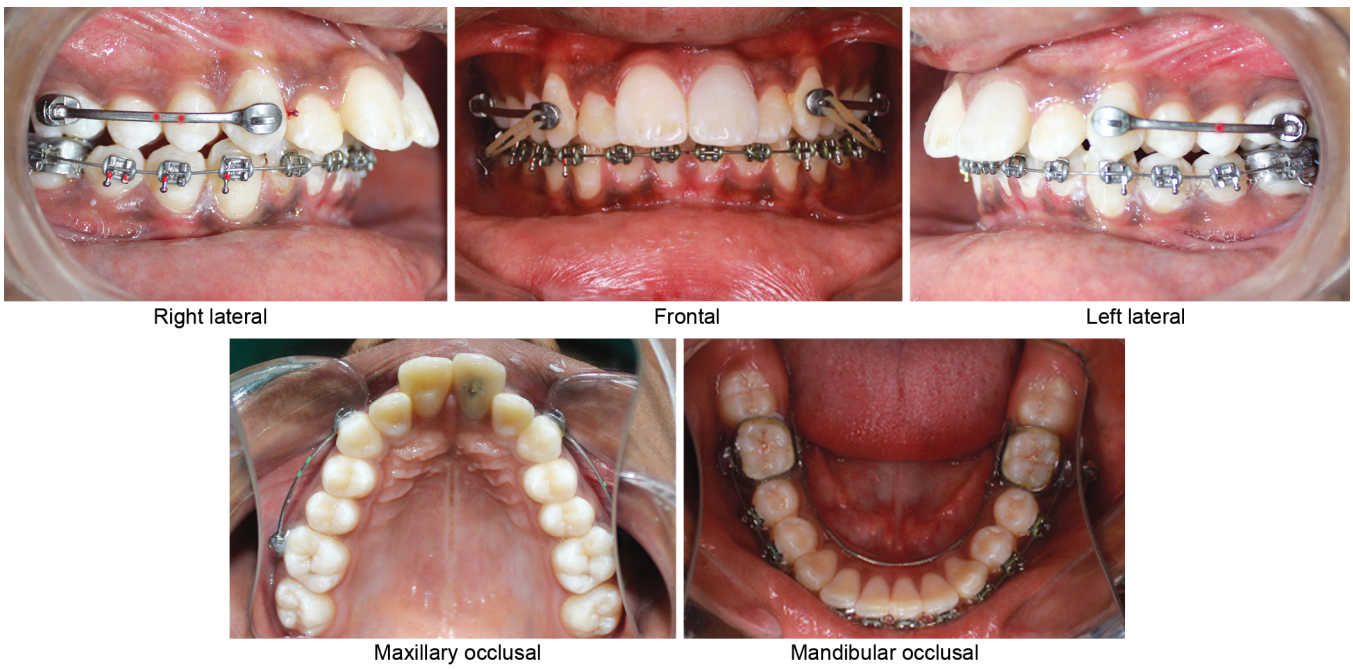

Fig. 6: Carriere Motion 3D appliance installation photographs

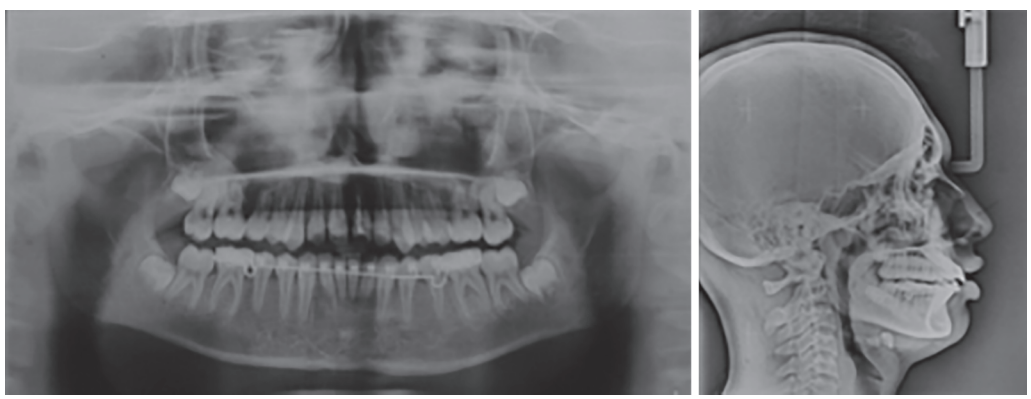

Fig. 7: Post-Carriere radiographs

Fig. 9: Extraoral photographs post-Carriere

Fig. 10: Intraoral strap up photographs post-Carriere

Fig. 11: Extraoral posttreatment photographs

Table 1: Comparison of pretreatment, post-Carriere, and posttreatment cephalometric values

Parameters	*Pretreatment*	*Post-Carriere*	*Posttreatment*
SNA	81°	82°	82°
SNB	75°	78°	78°
ANB	6°	4°	4°
Mandibular angle (FH-GO-ME)	23°	23°	25°
U1-NA (linear)	9 mm	6 mm	4 mm
U1-NA (angle)	38°	35°	28°
L1-NB (linear)	4 mm	7 mm	6 mm
L1-NB (angle)	27°	37°	33°
U1-SN	118°	116°	110°
L1-MP	110°	117°	112°
Basal plane angle	24°	24°	23°
Nasolabial angle	93°	94°	94°

Fig. 14: Superimposition of pretreatment (black) and posttreatment (red) radiographs

Fig. 12: Intraoral posttreatment photographs

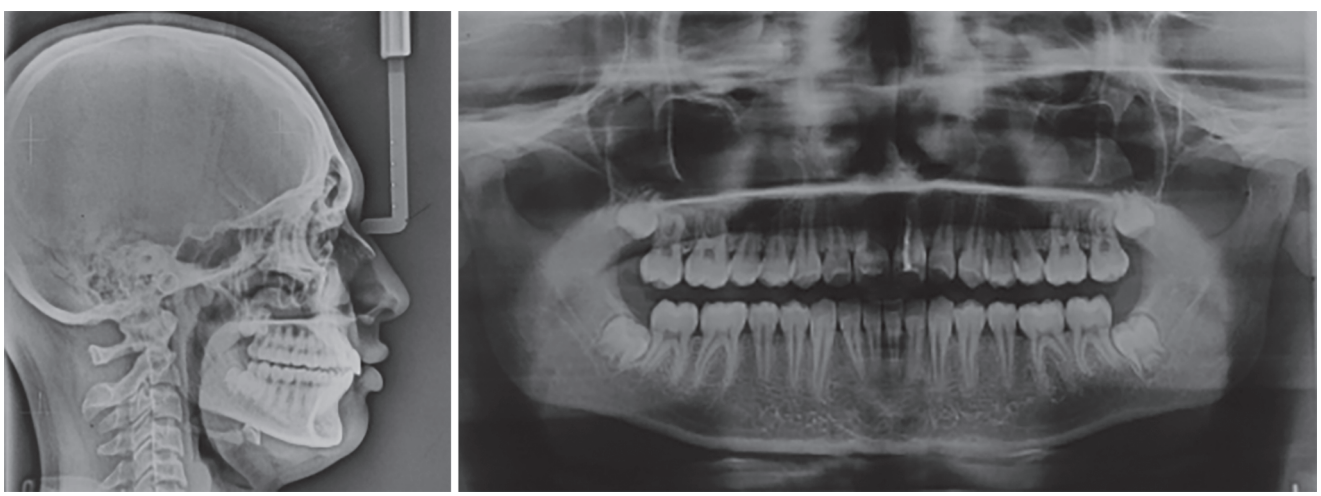

Fig. 13: Posttreatment radiographs

Carriere Motion Appliance derotate the maxillary first molar root, thus advancing the mandible, altering the occlusal plane, and reducing the overjet. Several studies, on the contrary, revealed that the CMA achieves class II correction only by dentoalveolar correction rather than by advancing the mandible.[9]

A study comparing the dental and skeletal effects of CMA was conducted by Kim-Berman et al. They concluded that, in comparison to the control group, there is a significant restriction of maxillary growth (Co-A, 1.0 mm). The SNA angle (1.88°) and point A to nasion perpendicular (1.7 mm) between the treated and control groups were statically and clinically significant. The favorable intermaxillary changes were mostly explained by maxillary adaptation, as seen by a significant decrease in wits appraisal (2.0 mm) and ANB angle (0.98).[4]

When treating class II malocclusion without extractions, this appliance works effectively. Compared to brachyfacial patterns, dolichofacial patterns are less responsive to treatment. This appliance can also be used to correct number of class I cases with mesially positioned maxillary molars.[5]

In patients who have inherent growth potential, this appliance effectively induces the intended skeletal and dental changes. In mixed dentition, first phase treatment is appropriate for class II cases with fully erupted first molars. It allows simple class II correction when no other mechanic interfere and compliance is optimal, prior to orthodontics (fixed or clear aligners). Compared to the other fixed functional appliances, the carriere distalizer seems to be more comfortable, provides a good overall experience, and has fewer negative side effects.[5,8,9]

Clinical Significance

Class II malocclusion due to functional retrusion extraction treatment should be avoided as it may negatively impact the patient's soft tissue profile. The only removable components of the CMA are the elastics, making it essentially a fixed appliance. Since the elastics are only worn during the first phase of treatment, patients tolerate the appliance well and good compliance is expected. After achieving class II correction in first half of the treatment, conventional orthodontic correction can be achieved in a short period.[10]

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