Carriere Motion Appliance – An Innovative Tool In Class II Management – A Case Report

Dr. Ragini Ogale[1], Dr. Yash Goenka[2], Dr. Ravindra Manerikar[3], Dr. N. G. Toshniwal[4], Dr.Shubhangi Mani[5], Dr. Sumeet Mishra[6]

Department of Orthodontics and Dentofacial Orthopaedics, Rural Dental College, Loni, Maharashtra

[1]2nd Year MDS PG

[2]3rd Year MDS PG

[3]Principal, Professor

[4]Professor & Head

[5]Professor

[6]Reader

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***Corresponding author**

E-mail address – raginiogale1907@gmail.com

Abstract

Molar distalization is indicated in a patient with mild to moderate dental protrusion of the upper arch or mild to moderate crowding when extractions would adversely affect facial esthetics. The Carriere Motion Appliance (CMA) is designed to convert a Class II molar relationship into a Class I by uprighting and rotating the upper first molar and distalizing the entire posterior segment from canine to first molar before brackets or other appliances are placed. To avoid protrusion of the lower incisors during activation of the appliance, an auxiliary such as a lingual arch or lower Essixretainer is recommended for anchorage. This article aims to demonstrate about the CMA's design and biomechanics, along with the case report of A 13-year-old female patient, presented with skeletal Class I anddental Class II relationship. Maxillary molar distalization was efficient in correcting the borderline Class II malocclusion. CMA appliance was more efficient than others because it is less frequent activation and minimum anchorage loss. Understanding of the clinical indications of this procedure so that undue side effects can be minimized along with better incorporation in the orthodontic patient care.

Keywords : Distalization, Elastics, Anchorage, Class II malocclusion, Non- extraction.

Introduction

Skeletal Class II malocclusion is widely recognized as the most possible dentofacial deformity seen in Dentofacial Orthopaedics. According to McNamara, retrognathic mandibles account for more than 80% of Class II malocclusions. Therefore, it comes as no surprise that the development of myofunctional therapy occurred while treating a similar form of malocclusion more than 125 years ago.[1]

The category of orthodontic therapy advised relies on a number of factors, including the patient's age, compliance, Class II malocclusion subtype, aetiology, and origin (skeletal or dental). It is advised to use functional orthodontic therapy if the cause is related to the lower jaw.[3,4,5] Although, if the upper molars are required to be moved distally, orthodontic headgear[7], conventional orthodontics with interarch elastics, a pendulum [8], and a distal slider [9] can be used in conjunction with molar distalization mechanics supported by absolute anchorage devices.

A non-extraction therapy option for patients with Class II malocclusion is molar distalization.. Dr. Luis Carrière created the carrière motion appliance (CMA) in 2004 as an intermaxillary, non-extraction Class II corrector [7]. In order to modify Class II malocclusion, this fixed intraoral functional intermaxillary appliance was created. As a preliminary step in treatment, intermaxillary elastics are combined with CMA to institute a Class I connector by employing the adequate anchorage in the opposite arch. Following the completion of the CMA first phase of treatment, the particular teeth can be aligned individually using conventional orthodontics or clear aligner therapy [8].

Appliance design and biomechanics

Design

The composition of CMA comprises of nickel-free stainless steel. The cuspid attachment features a hook to which Class II elastics can be attached, permitting the molar to proceed distally without tipping. The cuspid attachment is the anterior end of the device that gently curves to cross the upper premolars [Fig. 1; Fig. 2]. The articulating ball in the socket of the posterior pad permits controlled and unrestricted movement, which helps the molar to straighten and derotate into the correct position. The maxillary first molar is immediately linked to the posterior pad.

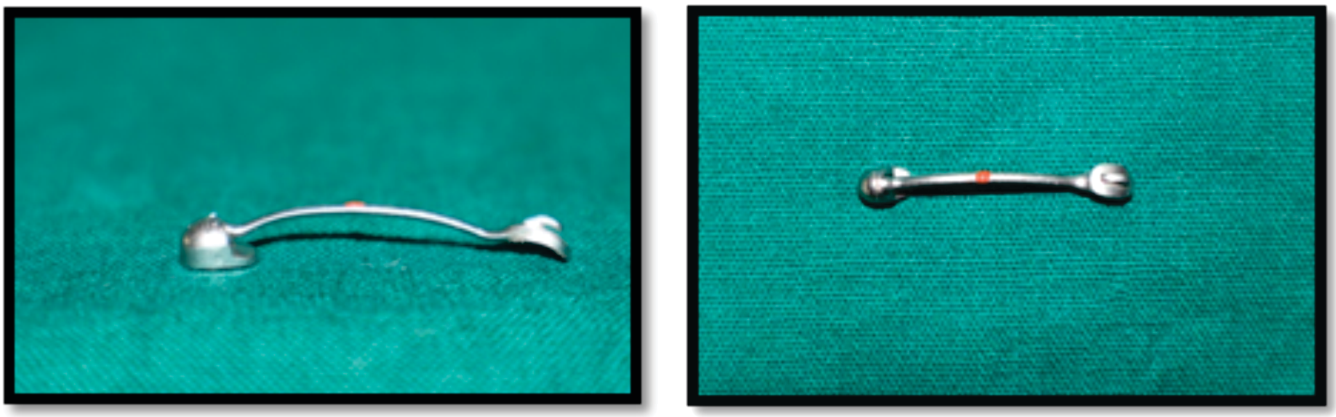

Fig.1. Class II Carriere Motion appliance showing ball and socket joint

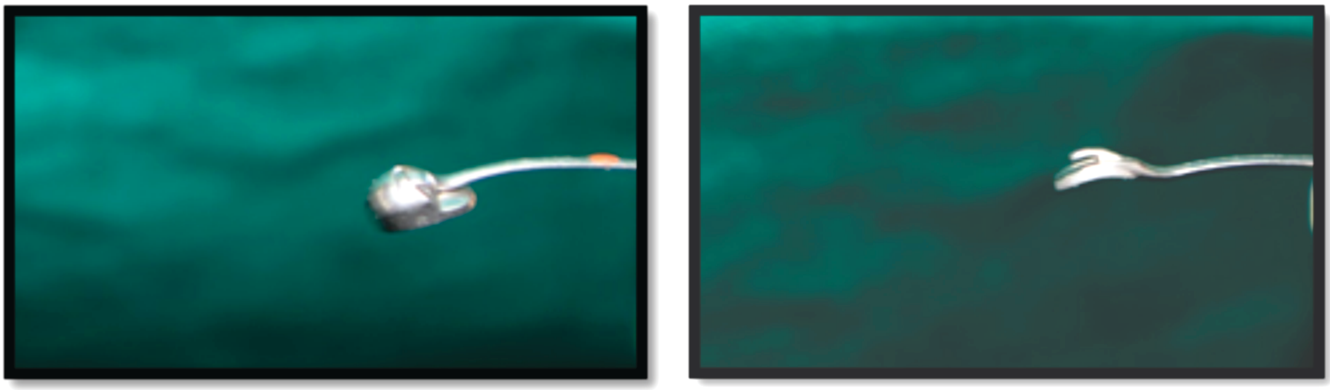

Fig.2: The ball and socket joint of Carriere Motion appliance

Biomechanics[8-11]

* Upper molar distorotation around their palatal roots.
* The maxillary first molar is uprighted using the CMA.
* The appliance's ball and socket joint, prevents the overrotation.
* Molar distalization: concurrently generates a force that is constant during the movement of the distal molar.
* The canine body moving at an angle determined by inclination along the alveolar ridge's longitudinal axis.
* Proceed from the canine to the molar, moving each posterior segment independently.

Source of anchorage

Lower Essix appliance

When the device is activated, the elastic attachment with lower Essix retainer prevents the protrusion of the mandibular incisor. 0.040/1mm Essix type A has a lower fracture rate and should be used instead of 0.75-mm thick material

Case report

This case treated features a 13-year-old female patient who is growing (CVMI stage 4)and has skeletal class I but dental class II relationship, treated with CMA in phase I.

Diagnosis and treatment plan

A 13-year-old girl came in with the concern about her prominent upper front teeth. She presented with a convex profile and lips that were competent. She has strong chin and deep mentolabial sulcus (Fig.3). The patient had a Class I skeletal pattern, a deep curve of spee, and molars and cuspids in a Class II relationship on both sides. The upper arch was narrow and showed moderate discrepancy. There was mild crowding in the lower arch. She had scissor bite with respect to 24 and 34 (Fig.4). It was determined to begin treatment in

Fig.3: Pretreatment Extraoral Photographs

Fig.4: Pretreatment Intraoral Photographs

two stages, taking into account the patient's potential for growth. Phase 1 would involve functional appliance therapy to achieve Class I molar and canine relation, and Phase 2 would involve a full fixed orthodontic appliance to correct proclination, crowding as well as midline correction.Going through case reports on Carriere motion appliance and its biomechanics, we decided to go for distalizaion with the same appliance and we also wanted some Class II correction which is an additive effect of Class II elastics.

Treatment progress

The first step in the treatment was to bond the CMA in the upper arch, which is located between both sides' cuspids and first molars. For the purpose of engaging elastics and anchoring, buccal tubes were welded to the lower molar bands and cemented to the lower first molars; an Essix retainer was provided for the lower arch to stop the incisors from further proclinating (Fig. 5). The elastics were to be

Fig.5: Intraoral photograph of Carriere Motion appliance delivery

worn by the patient all the time. For the first 3 months of treatment, 6 oz, ¼" Class II elastics were used; after that, 8 oz, 3/16" Class II elastics were recommended. Class I dental relationship (on left side) was achieved in a period of 4months, while on the right side it was achieved in 6 monthsThere was midline diastema seen at the end of the phase 1 treatment (Fig.6,7). The CMA was debonded after 6 months of active treatment. Later, phase 2 i.e the fixed orthodontic therapy was started and is still in progress.

Fig.6 : Extraoral Photographs Post Class II correction by Carriere Motion appliance

Fig.7 : Intraoral Photographs Post Class II correction by Carriere Motion appliance

Treatment Results

The cephalometric observations at the end of Phase 1 revealed a significant decrease in the ANB angle and Wits appraisal following 7 months of CMA treatment. The maxilla's sagittal position did not change significantly when the cephalometric variables were compared, but mandibular advancement did, as indicated by an increase in SNB and N perpendicular to pog measures. There was no discernible change in the upper incisors' inclination. Nonetheless, the lower incisors significantly protruded as a result of CMA. Additionally, we noticed that the canines and upper molars had significantly distalized. (Table 1).

Table 1: Pre-treatment and post-treatment cephalometric values

Cephalometric variables	Pre-treatment	Post-treatment	Difference
Maxillary/Mandibular			
ANB (°)	4	1	3
Wits (mm)	3	1	2
Maxillary skeletal			
SNA (°)	79	79	0
N perpendicular to pt. A	-4	-4	0
Mandibular skeletal			
SNB (°)	75	80	4
N perpendicular to pog	-5	0	5
Maxillary dental			
U1-SN (°)	116	116	0
U1-NA	35	35	0
U1-NA (mm)	6	6	0
Mandibular skeletal			
IMPA (°)	110	115	5
L1-NB (°)	27	30	3
L1-NB (mm)	3	5	2
Growth pattern			
FMPA (°)	19	20	1
GoGn-SN (°)	18	20	2
Facial axis (°)	92	93	1
Ptm -U6 (mm)	16	10	6

At the conclusion of CMA treatment, the clinical results demonstrated a bilateral Class 1 molar and canine connection, which was a combination of upper molar distalization and modest mesialization of lower molars. Due to its distal movement of upper molars, spaces opened mesially to the cuspids on both sides. There was midline diastema formation at the end of phase 1. There was a slight improvement of the profile. (Fig. 6)

Discussion

There was a molar super Class I association at the end of the CMA phase. According to reports, using elastics to cure Class II malocclusion necessitated using them for 10.0 +/- 6.0 months.10 In this instance, the length of the CMA therapy was five months, which was shorter than the seven months that Kim-Berman et al.[13] recorded utilising force 1 (6¼ oz) and force 2 elastic (8 oz of 3/16 size).

The major changes that were observed in this case was in the position of maxillary molars, which showed marked distalization during the course of treatment. These results were similar to that obtained by in the research done by Schmid-Herrmannet al[11], significant distalization, particularly a distal tipping of the upper first molar, was demonstrated by Kaifeng et al.[12].The architecture of the appliance (ball-and-socket design) and the usage of Class II elastics are the primary causes of the derotation of the upper first molar in CMA. The canine moves distally as a result of the upper first molar and canine acting as a single unit connected by the CMA.

Regarding the length of CMA therapy, our findings aligned with those of Areepong et al.[16] who used 8 oz 3/16 elastics. Based on these findings, it appears that, at least for children in this age range, 8 oz of elastics was adequate to treat Class II malocclusion without lengthening the duration of treatment. The maxilla-mandibular ratios were comparable in both groups with respect to the sagittal alterations, but not as similar as those reported by Kim-Berman et al.[13]. The ANB angle and Wits index values fell by 2 mm and 3 degrees, respectively, in our investigation; whereas, in Kim-Berman et al. study[13], they decreased by 2.1 mm and 0.8 degrees, respectively.[13]

The upper jaw and, specifically, the values of the SNA angle are another area where our study and those of Kim-Berman et al. are similar. In our investigation, the values of the former did not differ considerably from our case's outcome.

The FMA, GoGn-SN, and facial axis angle increased, according to our analysis of vertical measures, as reported by Kir-Berman at al.[11] and Areepong et al.[16]. But our findings do appear to be consistent with those of Tomblyn et al.[18] and Janson et al.[12]'s systematic review, which found that Class II elastics are linked to a decrease in upper jaw growth, a more prominent development of the lower jaw, and an increase in the vertical growth pattern, which rotates clockwise.Giuntini et al. have also described a comparable rotation pertaining to the operation of the twin-block appliance.[14] In a study of Herbst and Pendulum appliances, Taylor et al.[19] also noted some minor vertical shifts.

As a result, there are skeletal alterations that are statistically significant but not clinically noticeable. These changes can be either way. This is probably because elastics have a short lifespan and apply less force; this theory is supported by a review by Janson et al.[14]. Dentoalveolar morphologies exhibit the most notable clinical and cephalometric alterations. The incisor inclinations we measured using the CMA device were similar to those from earlier research by Taylor et al. using the Herbst appliance[19]. The Herbst appliance[14] produced a similar effect in our case when 8 oz elastics were used in conjunction with the lower Essix retainer.

Even though the essix retainer was placed in the lower arch as a source of anchorage and to prevent futherproclination of the lower incisor, but the results of our case at the end the CMA treatment showed increased IMPA as well as increased L1-NB, indicating that the anterior component of force generated by Class II elastics is greater in magnitude, hence requires better source of anchorage such as bone supported anchorage.

The midline diastema formation at the end of phase 1, may be attributed to the transseptal fibres running inter-dentally between the teeth and connecting all the teeth in the arch. The distalization forcesmight have transmitted through these fibres leading to diastema formation in the upper arch.

Conclusion

The only removable parts of the CMA are the elastics and the Essix retainer; otherwise, it is primarily a fixed appliance. Elastics are supposed to be worn with good compliance throughout the early phase of treatment, when cooperation is at its peak. It is well-tolerated by patients. After the treatment, the Class II correction is completed in six months, at which point ordinary orthodontic dental correction can be completed in a comparatively short amount of time.

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