



Case Report

Management of Class II division 2 patient treated with Carriere motion appliance

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Abstract

Class II division 2 malocclusion is often challenging to treat, and orthodontists usually find it difficult to make the correct treatment decision. Distalization is one of the treatment modalities. Recently, Luis Carriere presented the Carriere Motion appliance to overcome the unwanted side effect of anchor loss and non-compliance by the patient. Also, based on the severity of the malocclusion, there may be an overlapping of the retroclined central incisors by the lateral incisors or retroclined central and lateral incisors by the canines which leads to compromised micro esthetics. Successful management of such cases need special attention towards the micro esthetics of the patient.

Keywords: Class II division 2, Carriere Motion appliance, Molar distalization, Microesthetics.

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1. Introduction

Class II division 2 malocclusion is typically identified by a severe, traumatic deep overbite and palatally inclined maxillary incisors.¹ The Class II division 2 malocclusion exhibits various characteristics that deviate from the commonly accepted standards of esthetic perfection.² Multiple studies have observed that having a well aligned and symmetrical set of anterior teeth is considered esthetically appealing.³

Treatment for Class II division 2 malocclusion is typically difficult and prone to relapse.⁴ Growth modification is commonly used to treat Class II malocclusion in teenagers. Functional appliances can limit maxillary growth while promoting mandibular growth.^{4,5}

In recent years, non-compliance therapy and non-extraction treatment have gained popularity for the correction of Class II malocclusions. Treatment of Class II cases often involve distalization of maxillary molars to establish Class I molar-canine relationship. However, mesial movement of

molars will happen if adequate anchorage is not established during alignment.⁶

A number of unpleasant side effects reduce the therapeutic efficacy of these distalization methods, including anchor loss (distal molar crown tipping or distal rotation of molar crowns). Although these complications are usually present with maxillary molar distalization, they may manifest differently depending on the treatment or appliance used.⁷

In 2004, Luis Carriere presented a new appliance that had his name and was referred to as the Carriere Motion appliance.⁸ This appliance is specifically designed to transform a Class II molar relationship into a Class I relation by distalizing the whole posterior segment. The ball and socket joint that is constructed into the posterior pad includes built-in brakes that prevent the tipping of the molars during distalization, which is an undesirable outcome.⁹

The orthodontic diagnosis involves the evaluation of three esthetic categories; Macroesthetics, Miniesthetics and Microesthetics. To achieve an attractive social smile, visibility of the maxillary crown should be at least 75%.

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However, display of gingiva upto 4 mm and coverage of lip of the incisor crown is acceptable.¹⁰ For an appealing smile, the upper lip should be equal in height as the gingival margin of the upper central incisor.¹¹ The golden proportion states that the lateral incisor's apparent width should be 62% of the central incisor's width, the canine's apparent width should be 62% of the lateral incisor's, and the first premolar's apparent width should be 62% of the canine's for an aesthetically pleasing smile.

Having a proportional gingival height is essential for achieving an aesthetically pleasing profile. In general, the gingival margins of the central incisor and canine are aligned, however the edge of the lateral incisor is positioned 1.5 mm lower.¹⁰ The gingival shape of maxillary central incisors and canines is elliptical, with the zenith located distal to the tooth's long axis. Maxillary lateral incisors should have a symmetric half-oval/half-circular form, with the gingival zenith aligned with the tooth's long axis. Gingival contouring by removing excess gingiva is performed through periodontal procedures like gingivectomy or crown lengthening, while gingival recession is commonly addressed with tissue grafts or guided tissue regeneration, and in rare circumstances, nonsurgical orthodontic extrusion.¹²

This case report presented below describes the successful management of Class II division 2 malocclusion with Carriere motion appliance.

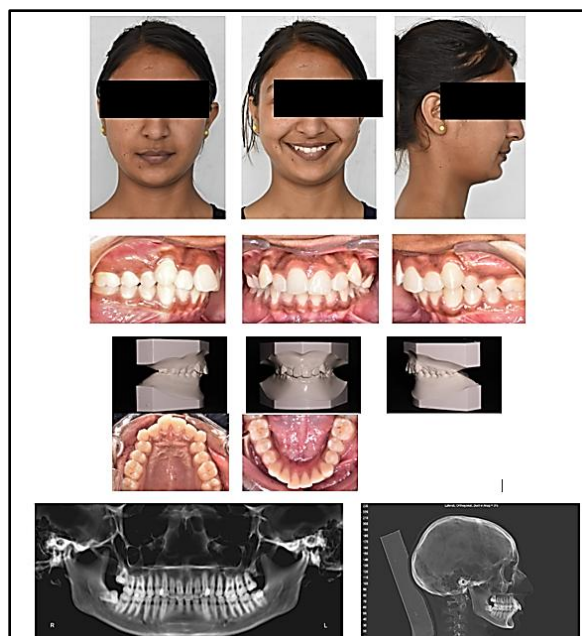


Figure 1: 18-year-old female patient with dental and skeletal Class II malocclusion



Figure 2: Carriere motion appliance of 23mm activated with Class II elastics and lower arch bonded

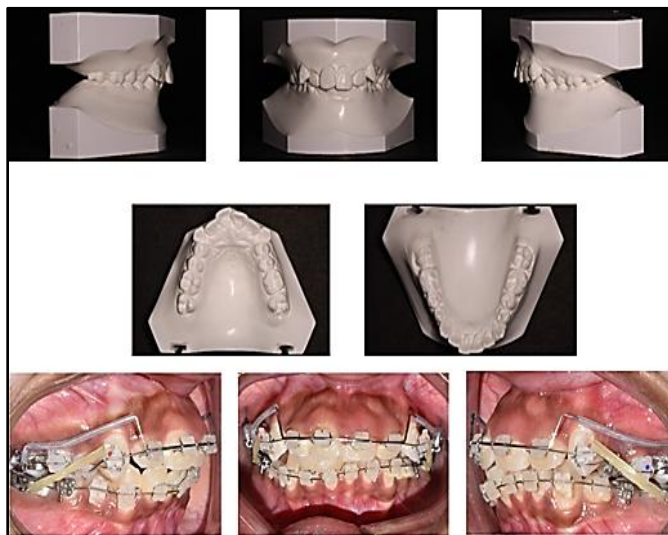


Figure 3: Upper arch bonding with 0.012" NiTi archwire and Utility arch with minimal gable bend to prevent the mesial migration of the molars



Figure 4: Interproximal reduction was performed in the upper anterior region on 0.017" x 0.025" stainless steel wire, along with continuous elastomeric chain



Figure 5: Gingivectomy was done in maxillary anterior region along with settling elastics

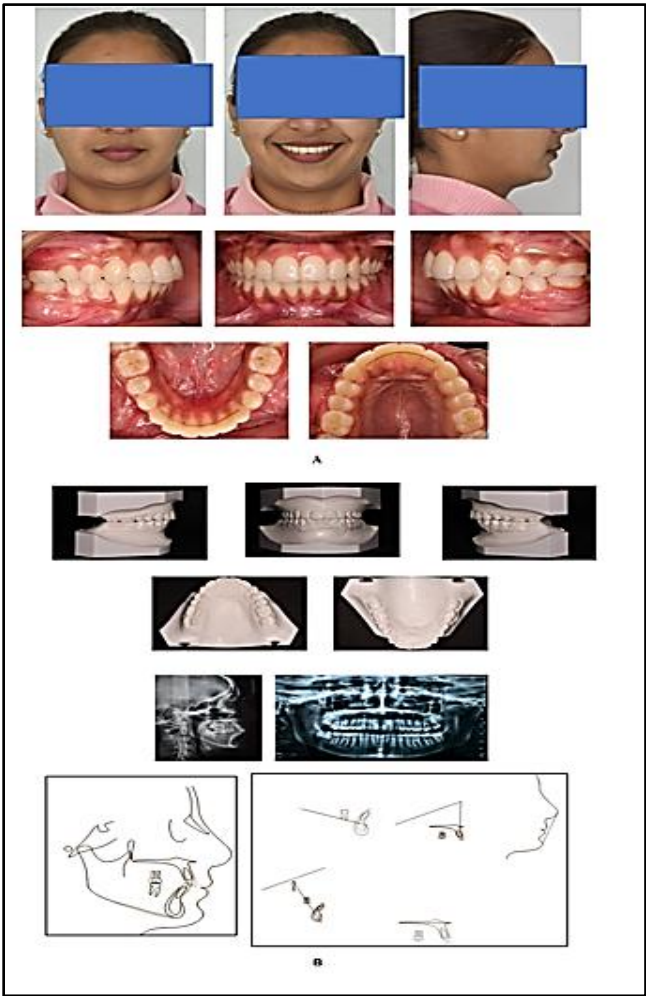


Figure 6: (A) Patient after 20 months of treatment **(B)** Superimposition of pre- (Black) and post- treatment (Red).

Table 1: Cephalometric analysis

Sl. no	Measurements	Range	Actual	
			Pre-treat ment	Post-treat ment
Skeletal				
1	SNA	82°	84°	83°
2	SNB	80°	78°	79°
3	ANB	2°	6°	4°
4	N perpendicular to point A ($N \perp$ Pt A)	0-1 mm	2mm	1.5mm
5	N perpendicular to Pogonion ($N \perp$ Pog)	-4 to 0 mm	-8mm	-7mm
6	Mandibular plane angle (SN-Go-Me)	32°	30°	32°
7	Angle of inclination (Pal.plane to $Pn \perp$)	85°	92°	92°
8	Y-axis {S-N to S-Gn (outer angle)}	66°	65°	67°
9	Facial axis angle {B-Na to Ptm-Gn (Inner angle)}	90°	90°	89°
10	Bjork sum (sum of posterior angle)	394° ± 6°	390°	393°
Dental				
11	U I to N-A(mm)	4mm	1mm	3mm
12	U I to N-A(angle)	22°	18°	25°
13	L I to N-B (mm)	4mm	5mm	6mm
14	L I to N-B (angle)	25°	23°	28°
15	U I to LI (Interincisal -angle)	131°	162°	127°
16	Upper incisor to S-N plane	102° ± 8°	85°	105°

17	Upper molar to Ptv	Age + 3mm	20mm	16mm
18	U1 to point A distance	4- 6 mm	0mm	4mm
19	IMPA (Incisor mandibular plane angle)	90°	87°	95°
Soft tissue				
20	S line to Upper lip	0-2 mm	2mm	0mm
21	S line to Lower lip	0-2 mm	1mm	0mm
22	H angle	7° 15°	21°	15°
23	Nasolabial angle	94° 110°	95°	108°
24	Mentolabial sulcus	5mm± 2	7mm	5mm

2. Diagnosis and Treatment Planning

A female patient aged 18-years had reported to department with chief complaint of irregularly placed upper teeth and visibility of gums while smiling. She had bimaxillary retrusive profile that are the hallmarks of a Class II, division 2 malocclusion. This was accentuated by a pronounced mentolabial sulcus, a prominent chin and thin lips. Intraorally, the patient had Class II molar and end-on canine relationship bilaterally with an overbite of 4mm and overjet of 2mm. She had crowding in the anterior region of upper and lower arch (**Figure 1**). Panoramic radiograph and lateral cephalogram were extracted from CBCT scan. Panoramic radiograph revealed the presence of all the permanent teeth including third molars. There was no deviation from centric occlusion and no signs of TMD were noted. Cephalometric analysis (**Table 1**) indicated that the patient had a convex profile and a skeletal Class II pattern (ANB = 6°). The patient also had proclined upper and lower incisors (UI- NA= 18° and UI- NB=23°). There was an arch length discrepancy of 6mm in the upper arch and 3.5mm in the lower arch. There was a Bolton's discrepancy with anterior maxillary excess of 2.5mm.

2.1. Treatment objectives

1. Achieve ideal leveling and alignment in the upper and lower arches.
2. Establish Class I molar and canine relationship bilaterally.
3. Achieve an esthetically pleasing soft tissue profile.

2.2. Treatment options

These were several treatment options given to the patient:

1. Extraction of both the upper first premolar along with leveling and alignment of the lower dentition and finally ending up in Class II molar and Class I canine relationship. This option was considered because of the crowding that was present in the patient. Most of the space loss will be utilized to correct the crowding and molar relationship. However, this option was eliminated.
2. Extraction of the lower first premolar along with leveling and alignment of upper arch along with retraction to gain overjet followed by BSSO

advancement and finally ending up in Class III molar and Class I canine relationship. This option was denied by the patient as it required surgery.

3. Molar distalization using Carriere motion appliance and ending up with Class I molar and canine relationship. The appliance was chosen due to its sleek and comfortable design which caused less gingival inflammation. Also, it allowed the movement of each posterior segment as a unit from canine to molar.

3. Treatment Progress

After the appropriate oral prophylaxis, the measurements for Carriere motion appliance was taken. The patient was asked to get the third molar extracted to which she refused.

The measurement is taken from the buccal surface midpoint of the maxillary first molar to the maxillary cuspid crown.⁸ In cases with an inaccessible high cuspid the measurement can be taken from the buccal surface midpoint of the first molar to the buccal surface midpoint of the first bicuspid. The appliance can then be bonded to these teeth so that the posterior teeth can be distalized to provide space for the blocked-out cuspid. The measurement was used to choose the appropriate size appliance. When the measurement is between two sizes (e.g., between 24 mm and 25 mm), the appliance size can be selected based on the amount of rotation desired. For more rotation, select the smaller size and for less rotation, select the larger size.

Carriere motion appliance of 23mm was selected. Bonding was done by placing posterior pad first followed by the anterior pad. The vertical line engraved on the posterior pad was used as a reference in aligning the pad coincident with the longitudinal axis of the first maxillary molar and anterior pad on the mesial third of the buccal surface of the crown of the maxillary cuspid. Activation was initiated immediately after bonding the appliance in place. Anchorage was provided using a passive mandibular lingual arch.⁸

For the first month, 6 oz, 1/4" elastics were used for 24 hours a day except for meals. After the first month, force was changed to 8 oz, 3/16" for 24 hours a day except for meals for 5 months. The patient was advised to change the elastics after every meal.⁸

Class I molar and canine relationship was achieved within 6 months. Simultaneously, lower arch was bonded with pre-adjusted edgewise appliance (0.022" x 0.028" slot MBT prescription, 3M Unitek) for leveling and alignment. The patient was advised to continue wearing Class II elastics (6 oz, 1/4") bilaterally (**Figure 2**).

After 6 months, as the Carriere motion appliance was removed, bonding was done for the posterior segment of upper arch using 0.022" x 0.028" slot MBT prescription, 3M Unitek. Leveling and alignment was started with 0.012" Nickel Titanium (NiTi) (3M Unitek nitinol super elastic, USA) archwire. Utility arch with minimal gable bend was given in upper arch to prevent the mesial migration of the molars (**Figure 3**).

During the course of treatment, due to breakage, some of the ceramic brackets were replaced with metal brackets. After 7 months of leveling and alignment, as the patient reached 0.017" x 0.025" stainless steel wire, interproximal reduction was performed in the upper anterior region for the management of Bolton's discrepancy along with continuous elastomeric chain (**Figure 4**). After 16 months of active treatment, finishing was initiated.

Gingivectomy was done in maxillary anterior region for the correction of uneven gingival margin. Along with it, the patient was given settling elastics for 4 months (**Figure 5**).

After 20 months of complete treatment, the patient was debonded. Upper 2-2 retainer and lower 3-3 fixed retainer were placed (**Figure 6**).

3.1. Treatment result

All the treatment objectives were achieved and patient's smile was improved to a great extent. Class I molar and canine relationships were achieved, with normal overjet and overbite. The upper and lower midlines were coincident with each other and with facial midline.

4. Discussion

In adults, the treatment of malocclusion of the Class II, division 2 is quite difficult. A plethora of treatment options are available. Camouflage treatment may be possible if the first premolars can be extracted without a detrimental effect on facial esthetics. The satisfaction of a patient who receives such camouflage treatment has been found to be similar to that of a patient who undergoes mandibular advancement surgery.¹³ In order to produce predictable results with minimal adverse effects, the most reliable method is to implement the mechanics plan by applying basic biomechanical principles.^{13,14}

In this case, non-extraction therapy seemed more favorable than extraction treatment due to many factors. Due to the patient's convex and retrusive facial profile and an obtuse nasolabial angle, the removal of the upper first

premolars and the retraction of the upper labial segment might potentially lead to an unpleasant facial profile.

The OPG and the lateral cephalogram of the patient was extracted from the CBCT that was done priorly to check for the root orientation as the patient wanted an aligner treatment. However, she later refused for the same due to treatment cost.

In order to attain Class I molar and canine relationship, both upper posterior segments were distalized. The distal migration of maxillary teeth was traditionally accomplished using headgear.¹⁵⁻¹⁷ Patients often refuse to wear headgear due to social and aesthetic concerns.¹⁸

To overcome the challenges of headgear usage and rely on patient cooperation, several researchers have developed innovative intraoral devices and procedures for distal movement of molars.⁶

The use of magnets for molar distalization was documented in 1978 by Blechman and Smiley¹⁹, 1988 by Gianelly et al.²⁰, and 1992 and 1994 by Bondemark and Kurol.^{21,22}

For the distal movement of maxillary molars, Gianelly et al. employed super-elastic Ni-Ti coil springs in 1991.²³ Hilgers created the pendulum appliance in 1992.²⁴ To fix the Class II molar relationship, Erverdi and Koyutürk utilized magnets and Ni-Ti coil springs in 1997.²⁵

A number of unpleasant side effects reduce the therapeutic efficacy of these non-compliance distalization methods, including anchor loss.⁷ Although these complications are usually present with maxillary molar distalization, they may manifest differently depending on the treatment or appliance used, such as patient discomfort and pain while engaging the stub of a pendulum appliance in a lingual sheath; tissue reaction beneath the palatal button in a pendulum appliance and a distal jet appliance; gingiva laceration with K-Loop and the cost factor in a Beneslider, as well as mini-implant failure.

Treatment was done using Carriere Motion Appliance during the first phase of therapy. This appliance has following advantages:

1. Move each posterior segment as a unit, from canine to molar.
2. Eliminate wire modifications and hence the distorting collateral pressures that arise with each wire activation in previous approaches.⁸
3. Less soft tissue inflammation in comparison to other appliance due to its sleek design.²⁶

The type of anchorage must be carefully chosen based on the patient's skeletal and neuromuscular patterns. Various sources of anchorage like Passive lingual arch, hamula lingual arch, mandibular essix appliance, miniscrews and full mandibular fixed appliance can be used.⁸

In this case, passive lingual arch was used for the anchorage to prevent reciprocal movement of the mandibular teeth. It must also properly match the length of the arch and be anatomically fitted to prevent anchorage loss. The lingual arch has high patient acceptability since it is invisible, pleasant, requires little patient maintenance, and is hygienic.^{8,27}

Molars that have been moved distally have a marked tendency to return mesially, especially when the second molars are present. Andreasen and Naessig have observed that the molar distal movement caused by headgears is highly unstable. They found that 90% of this movement is lost within one week after removing the headgear, without any attempt to maintain the molar positions.^{28,29} Utility arch with minimal gable bend was given in upper arch to prevent the mesial migration of the molars during the levelling and aligning stage as anchor loss occurs at this stage.³⁰

During the finishing, interproximal reduction was done in maxillary anteriors for the management of Bolton's discrepancy along with residual overjet. The philosophy of smile design can be categorized into different aspects: facial aesthetics, gingival aesthetics, macro aesthetics, micro aesthetics, and mini aesthetics. Gingival height of contour, tooth shade embrasure spaces incisal and gingival to the contact area are the parameters which are taken into consideration in microesthetics.^{31,32} In this case, gingival contouring by gingivectomy was also done keeping in mind the microesthetic aspect of smile designing.

5. Conclusion

A Class II division 2 patient with a retrusive profile was managed utilizing the Carriere Motion Appliance. It is simple to select and use, resulting in less soft tissue reaction, increased patient comfort, and improved oral hygiene, all of which leads to higher patient acceptance.

Microesthetics was achieved through gingival recontouring of maxillary anterior teeth to create an attractive smile.

6. Ethical Approval

No institutional ethical committee approval was needed for this study.

7. Informed Consent

Informed consent was obtained from the patient.

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