Republic of Iraq
Ministry of Higher Education
and Scientific Research
University of Baghdad
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Carrière Motion Appliance (Review Study)

A Project Submitted to

The College of Dentistry, University of Baghdad, Department of Orthodontics in Partial Fulfillment for the Bachelor Degree of Dental Surgery

By

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May, 2022 A.D 1443 A.H

Certification of the Supervisor

I certify that this project entitled ”Carrière Motion 3D” was prepared by fifth years student **Nadia Fawzy Abdulwahab** under my supervision at the College of Dentistry/University of Baghdad, in partial fulfillment of the graduation requirements for the Bachelor degree in dentistry.

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Date

Dedication

I dedicate this project first to God, the One above, who blesses me abundantly every day.

To my family for their patience, support and efforts who without them I wouldn't have reached where I am today.

To our seniors and doctors for sharing their time and knowledge with us for the last 5 years.

Nadia Fawzy

Acknowledgement

First and for most, I would like to say, ‘‘thank you’’ ALLAH almighty for inspiring me with strength and patience to undertake and finally complete this work.

My deepest gratitude and sincere appreciation to my supervisor, **Assist. Prof. Mustafa M. Al-Khatieeb** for his advice, support and guidance throughout the work.

My sincere appreciation and thankfulness to **Assist. Prof. Dr. Yassir Abdulkadhim Yassir**, Head of the Orthodontic Dentistry Department, and all professors snd seniors in the department for their pleasant cooperation.

My sincere appreciation goes to **Prof. Raghad Al-Hashimi**, Dean of the College of Dentistry for providing the opportunity to pursue my study.

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List of abbreviations

Symbol	Abbreviation
CMA	Carrière Motion Appliance
FFRD	Forsus Fatigue Resistant Device
3D	Three-dimensional
Fig	Figure

Inroduction

"Do we need to extract teeth or may the necessary space be created without extractions?" is the common question that orthodontists encounter when planning treatment for a patient's malocclusion. Because there is no clinically significant bone growth in adult patients **(Karad, 2015),** alternative solutions to obtain space in which the teeth can be moved in order to correct the malocclusion must be identified. The "Father of Modern Orthodontics," Edward Angle, established a non-extraction tone to treatment. He believed that when teeth could be corrected by other means, extraction of teeth for orthodontic purpose seemed particularly inappropriate and unacceptable **(Little *et al.*, 1990).**

Patients must cooperate with the headgear or elastics in traditional upper molar distalization techniques. Several intraoral methods have recently been created to reduce the need for patient cooperation **(Bolya *et al.*, 2015).**

Non-compliance therapy involves the use of appliances that reduce the requirement for such cooperation while also attempting to increase the predictability of results **(Kinzinger *et al.*, 2008).** The Carrière motion appliance is one of these "non-compliance therapy" techniques.

The CMA(Carrière Motion Appliance) is a fixed appliance designed by Luis Carrière for non-extraction class II and class III correction by moving the class II and class III buccal segments as a block unit in a class I occlusion. It was created with the goal of creating a class I molar and canine relationship as the initial phase of treatment, then after that the case can be finished with any technique preferred by the orthodontist **(Marghalani, 2016).**

Aims of the study

The goal of this project was to review and describe a new intraoral fixed device termed as Carrière Motion Appliance for maxillary and mandibular molars distalization. The study illuminates the appliance's biomechanics, as well as its advantages, disadvantages, and design. It also explains the different indications, contraindications, and how to choose the right appliance for each patient.

Chapter One: Review of Literature

1.1. Definition

CMA is a new simple and efficient fixed appliance fixed in the mouth for treatment of class II and class III cases without extraction. Developed by the author with advanced computer technology **(Carrière, 2004).** It can also be used in treatment of many cases of class I with mesially positioned maxillary molars and in cases of premaxillary hypoplasia. It is fixed, intraoral functional intermaxillary appliance designed to change Class II and Class III cases to Class I molar and canine relationship. Intermaxillary elastics is used in combination with CMA to creat a Class I relation as a first phase of treatment by using appropriate anchorage in the opposing arch. Alignment of the individual teeth with fixed appliances or clear aligner therapy can be intiated after the finishing of the first phase treatment with CMA **(Marghalani, 2016).**

1.2. History of the appliance

CMA was Developed by Dr. Luis Carrière in 2004 with the most advanced three-dimensional computer technologies **(Carrière, 2004).**

Dr. Luis Carrière designed and invented the appliances as part of the soft-lander project, a 12-year research and development program that used 3D software. It was developed in 1995 to demonstrate the treatment process by visualizing different malocclusions in motion while they were treated with a library of appliances designed with high-resolution Virtual Reality programs **(Carrière, 2006).** Carrière obtained his dental degree from the University Complutense in Madrid in 1991. He then went on to the University of Barcelona, where he got his Master of Science in Orthodontics in 1994 after completing his orthodontic training.

He received his Doctorate in Orthodontics from the University of Barcelona in 2006. Dr. Luis Carrière is the inventor of the internationally Carrière SLX bracket and the Carrière Motion Appliance. At the 2005 International M/P Design Competition, he wins the "AWARD OF DISTINCTION". Princeton, New Jersey, USA **(Carrière, 2006).**

Fig.1: Dr Luis Carrière, the inventor of Carrière Motion Appliance (Carrière, 2014)

1.3. Appliance Design

The CMA class II is available in both right and left side designs. On the right appliance, there are two color dots on the bar, however on the left appliance, there is only one color dot. Another feature that distinguishes the right and left appliances is a small "R" and "L" on the gingival edge of the molar piece. Unlike CMA class II, CMA class III is a Universal (L/R) appliance that comes in six sizes and is color-coded for easy inventory and identification **(Henry Schein Orthodontics, 2019).**

1.3.1. Carrière Motion appliance ''Class II design'' (Sandifer *et al.*, 2014)

The CMA is made of mold-injected, nickel-free stainless steel. It is bonded to the canine and First molar as follows:

The canine pad provides a hook for attaching Class II elastics, this pad allowing distal movement of the canine along the alveolar ridge without tipping. The canine pad is the mesial end of an arm that extends in a modest curve across the upper premolars **(carrier, 2004).** The Posterior Pad is bonded directly to the maxillary 1st molar and houses an articulating ball in a socket to allow for free but controlled movement, allowing the molar to travel directly to the appropriate position after derotating and uprighting it **(Sandifer *et al.*, 2014).** The ball and socket joint offers a maximum freedom of movement that allows molars to travel directly to the desired position **(carrier, 2004).**

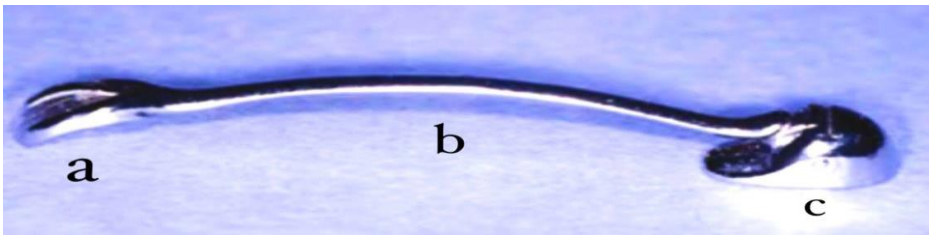

Fig. 2: Design of CMA class II. a) Fixed canine pad. b) Rounded arm C) The posterior pad (Carrière, 2004).

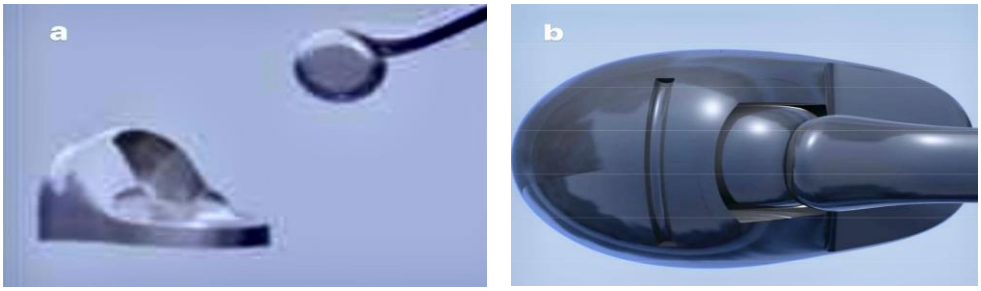

Fig. 3: (a) and (b) the ball and socket joint of CMA class II (Carrière, 2004).

1.3.2. Carrière Motion appliance ''Class III design''

CMA Cl III was designed as the CMA Cl II using the same principles of respect for human biology and the concepts of simplicity **(De Bono, 1999),** biomimetics **(Benyus, 2002),** and bio-minimalisms **(Carrière, 2015).** The pad of the anterior segment is bonded directly to the mandibular canine, with a hook for attaching Class III elastics.With a slight curve following the contours of the dental arch, The arm extends distally over the two lower premolars and is bonded to the lower first molar by means of a distal pad. This rigid, halfround arm controls the lower canines while directing movement longitudinally. It diminishes in size between the second premolar and the first molar, forming an offset with a bayonet bend and toe-in angle, designed to produce a mild 10º distal rotation of the first molar. The bayonet bend features multilateral flexion to meet the anatomical anatomy of the patient and make rotation easier. To avoid interfering with maxillary teeth or brackets, the posterior portion is flat (Carrière, 2016).

Fig. 4: Design of CMA class III www.henryscheinortho.com

1.4. Biomechanics

According to research, mesial rotation of the maxillary first molars is seen in 83% of maloccluded patients with class II div I **(Henry, 1956).**

The CMA is designed to create a Class I molar and canine relationship, also known as a Class I Platform of occlusion, which allows the orthodontist to finish the

case using whichever technique he or she prefers, including aligner treatment **(Mompell and Bowman, 2020).**

1.4.1. The biomechanical objectives of Class II Carrière Motion appliance are as follows:

• Molar derotation: cause the maxillary first molars to rotate distally around their palatal roots **(Areepong *et al.*, 2020).**

• The appliance is designed with a predetermined rotation of the molars to avoid molar excess rotation, the appliance's ball member meets the receptacle member, preventing over rotation **(Carrière, 2020).**

• The CMA is used to upright the maxillary first molar **(Yin *et al., 2019).***

•Molar distalization: creates a uniform force for distal molar movement at the same time **(Carrière, 2018).**

• Canine bodily movement along the alveolar ridge's angle with inclination control of its longitudinal axis **(Carrière, 2018).**

• Move each posterior segment as a unit, from canine to molar, independently **(Carrière, 2004).**

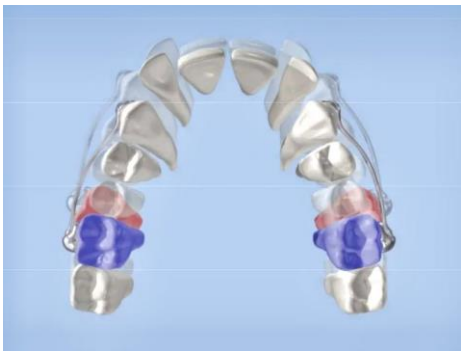

Fig. 5: CMA Independently move each posterior segment, from canine to molar, as a unit (Carrière, 2004).

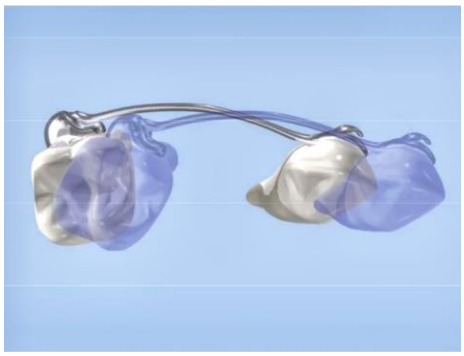

Fig. 6: Molar derotation around its palatal root and canine bodily movement (Carrière, 2004).

Fig. 7: The ball member of the appliance touches the receptacle member and prevent over rotation (Carrière, 2018).

1.4.2. The biomechanical objectives of class III Carrière Motion appliance are as follows (Carrière, 2016):

• Molar distal rotation: the posterior pad, which is bonded to the lower first molar produce a distalization force on the tooth by means of class III elastics attached to the hook in the anterior canine pad.

• Cuspid bodily movement: to achieve a class I canine relationship, mandibular canines are distalized.

Fig. 8: The Carrière Motion translates the maxillary cuspid and buccal segment as a unit after derotating and uprighting the maxillary first molar, providing a platform for the cuspid and buccal segment to occlude in Class I Platform (Carrière, 2018).

1.5. Source of anchorage

1.5.1. Source of anchorage for CMA class II

1.5.1.1. Passive lingual arch

A passive lingual arch is particularly suited for patients with strong musculature. It is one means of preparing anchorage for the CMA in which to sustain class II elastic traction. It must run passively from first molar to first molar (second molars) if they have erupted with completely adapted to the mandibular dental anatomy **(carriere, 2014).**

For the attachment of the elastics, **Carrière (2004), Rodrguez (2012), and Hashem (2014)** suggested the use of passive 0.036 lower lingual arch wire with band containing hooks on the lower first molars or second (if present). However, because the lingual arch is related to some degree of lower incisor proclination, it may be unfavorable in some cases with proclined lower incisors **(Sandifer *et al.*, 2014).** In cases when there is no crowding in the arch, it is preferable **(Carrière, 2018).**

1.5.1.2. Hamula lingual arch

Hamula First Fit molar bands, which comes with mesial and distal occlusal stops, are attached to this.045" round stainless-steel lingual wire. After the bands have been cemented, two segments of wire are soldered occlusally to the stops and bonded to the occlusal surfaces of the premolars and molars, the edgewise wire rests freely on the occlusal surfaces **(Carrière, 2004).**

Fig. 9: Hamula Lingual Arch (Carrière, 2004)

1.5.1.3. Full mandibular fixed appliance

It is suitable for nonextraction case with a deep curve of spee or mild crowding in lower arch **(Carrière, 2004).**

1.5.1.4. lower Essix appliance

It is another option for elastic attachment **(Carrière, 2004)** to avoid mandibular incisor protrusion during appliance activation **(Rodrguez, 2012, Pardo et al., 2006, Schupp et al., 2010).** When compared to 0.75-mm thickness material, 0.040/1mm Essix type A should be utilized because it has a lower fracture rate (**Zhu et al., 2017).** To achieve optimum stability of the elastic and mechanical retention, the appliance should be fabricated with small composite wedges bonded to the buccal surfaces of the appliance of the lower posterior teeth **(Carrière, 2004).**

Fig. 10 The Essix appliance (before and after distalizing treatment) (Carrière, 2018).

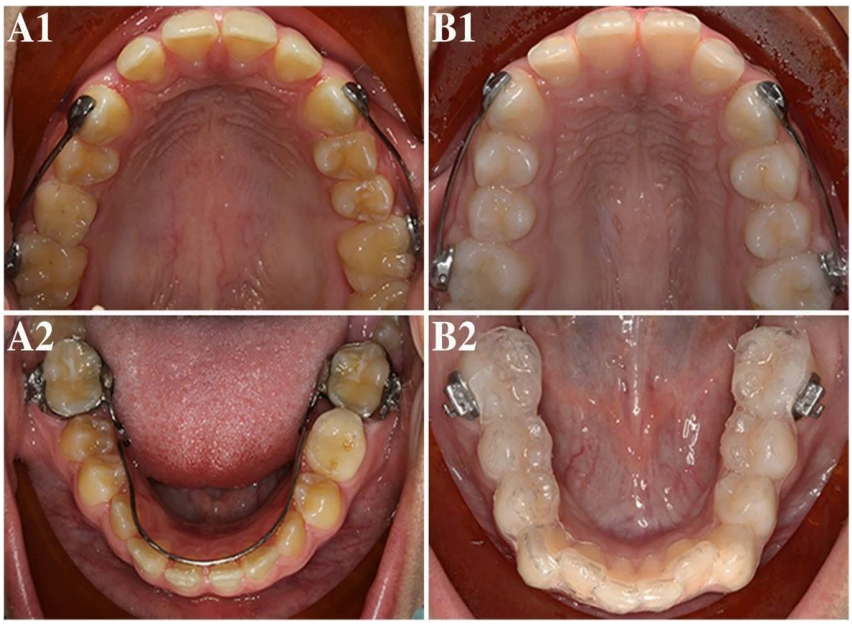

Fig. 11: Carrière distalizer and appliance used for the lower arch. Carrière distalizer functions to distalize the posterior segment as a unit (A1 and B1). The lower arch, either banded with a lower lingual holding arch (A2) or held together with a clear retainer (B2), serves as the main anchorage source for Class II correction (Yin *et al.*, 2019).

1.5.1.5. Temporary Anchorage Devices (TADs)

This is the most reliable and efficient method of achieving distal movement **(Proffit *et al.*, 2019).** Miniscrew anchorage with an elastic chain applied from the skeletal anchor unit to the appliance's canine hook provides an additional, more horizontal vector of force for distal movement of the buccal posterior segments, reducing the side effects of class II elastics such as lower molar extrusion and lower anterior proclination **(Mompell and Bowman, 2020).** Molar distalization occurs without distal tipping and/or rotation of molar crowns, as well as mesial movement and proclination of the anterior teeth, when this technique for anchorage is used **(Papadopoulos, 2014).**

Using a Carrière distalizer in the upper arch and a mini-screw in the lower arch in the molar or retromolar area, Class II correction can be accelerated. After that, a Class II elastic is worn 24 hours a day, and a correction to Class I molar and canine can usually be expected in 12 weeks **(Graber *et al.*, 2011).**

The infrazygomatic crest, which is higher and lateral to the first and second molar region, is the preferable site for bone screw implantation in the maxilla **(Ghosh, 2018).**

1.5.2. Source of anchorage for CMA class III

1.5.2.1. Full bonded appliance

In the upper arch, a full bonded maxillary fixed appliance can be utilized to level and align the upper teeth as well as receive class III elastics in the area of the first or second molar **(Cantor, 2018).**

1.5.2.2. Upper Essix appliance

Upper essix retainer with a direct bonded buccal tube in the upper second or first molars for attaching class III elastics **(Carrière, 2016).** When the goal is to maintain the patient's soft tissue features (angle, fullness, etc.), this option is preferable since the clear aligner prevents increased protrusion of the upper lips and surrounding soft tissues **(Carrière System, 2020).**

1.5.2.3. Temporary anchorage device

Anchorage systems for molar distalization of the lower arch can include miniplates, mini-implants, and miniscrews. The miniplates should be positioned lateral to the third molar area on the external oblique ridge. Mini-implants can be inserted between the second premolar and the first molar, but they must be replaced on a regular basis to avoid interfering with roots of the teeth during distalization **(Hakami *et al.*, 2018).**

Nucera *et al.* (2017) and Elshebiny *et al.* (2018) described a site buccal to the distal root of the second lower molar, between 4 and 8 mm from the cementoenamel junction, as the ideal location for fixing to avoid interference with the anteroposterior movement of the surrounding teeth.

1.6. Appliance measurement and selection (Henry Schein Orthodontics, 2018)

1. Use the disposable CMA ruler provided with the appliance. Measure from the mesial 1/3 of the maxillary cuspid to the middle of the maxillary first molar. Most popular sizes are 23 mm, 25 mm or 27 mm.

2. If the cuspid is unerupted or severly rotated measure from the middle of the maxillary fist bicuspid to the middle of the maxillary second molar.

The canine pad is bonded on the midpoint of the labial surface of the upper canine, and the posterior pad is bonded on the buccal groove of the buccal surface of the

maxillary first molar, as shown in Fig. 13 B for the class II distalizer **(Pardo and Cobo, 2006; Hashem, 2014; Hashem, 2019).**

The shorty model (Fig. 13 D) can be employed in cases when the upper cuspid is blocked out or impacted. It is ran from the upper first premolar to the upper first molar instead of canine **(Rodrguez, 2011; Wilson, 2018; Kim-Berman *et al.*, 2019).**

The appliance bonded from the labial surface of the mandibular canine to the buccal surface of the lower first molar in the class III CMA **(Cantor, 2018).**

Dentometer (Fig. 12), which is supplied with the appliance to determine the appropriate size **(Carrière, 2004; Hashem, 2014).**

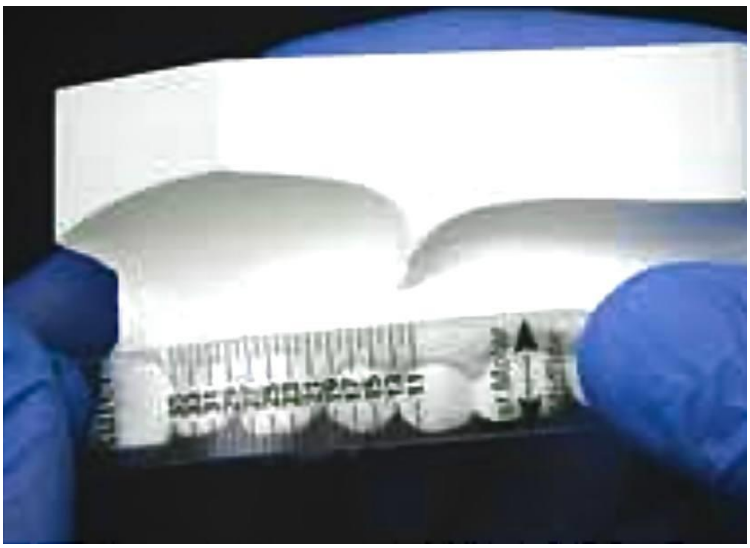

Fig. 12: Dentometer to measure the distance between the teeth for the appropriate selection of the appliance (Carrière, 2018).

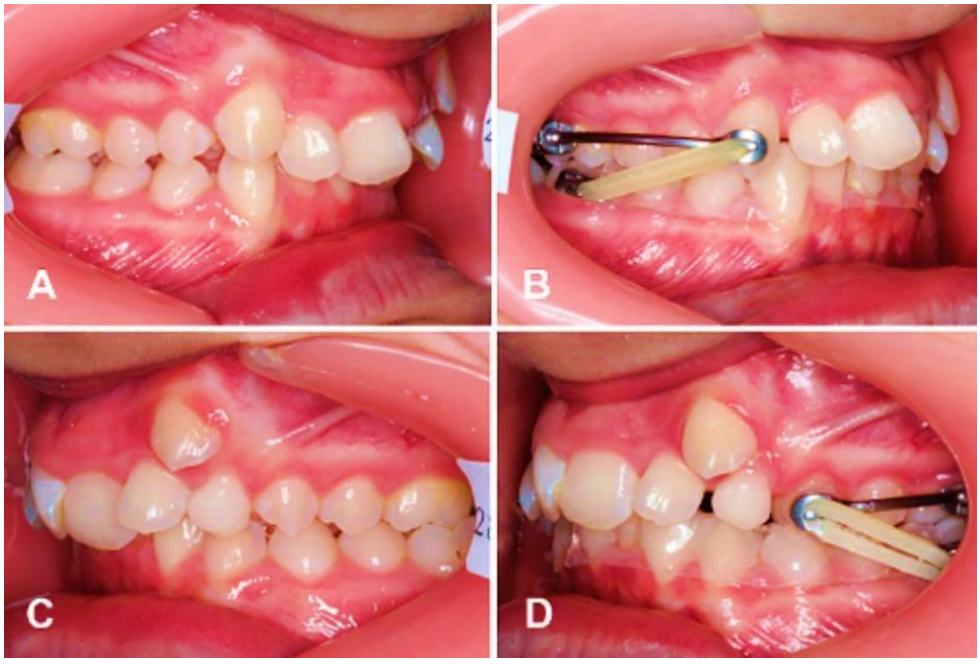

Fig. 13: Intraoral views of the CMA. (A, C) Intraoral photographs before treatment. (B) Intraoral view of the typical CMA after Class II correction. (D) the shorty CMA version used when canine is impacted or blocked out (Kim-Berman *et al.*, 2019).

1.7. Indications

1.7.1. Indications of CMA class II

• Class II molar distalization (unilateral and bilateral) **(Carrière, 2006; Hashem, 2014; Areepong *et al.*, 2020).**

• Mixed dentition Class II malocclusions **(Carrière, 2004).**

• Cl II in adult patients **(Carrière, 2006).**

• Class II Division 1 malocclusion **(Marghalani, 2016; Attia *et al.*, 2019; Rodríguez, 2019).**

• Both maxillary canines with highly placed and blocked out in a Class II Division 1 malocclusion with crowded upper and lower anteriors **(Singh *et al.*, 2017).**

• Class II molar with midline deviation and crowding in the upper and lower anterior regions **(Schupp *et al.*, 2010).**

• Class II, division 2 malocclusion in adult patients **(Pardo and Cobo, 2006; Carrière,2018).**

• In a patient with facial characteristics that necessitated a non-extraction method, Unilateral space opening **(Rodríguez, 2011).**

• Cl II severe cases **(Bowman *et al.*, 2015).**

• Class II dentoskeletal **(Quinzi *et al.*, 2020).**

• Mild Class II skeletal relationship **(Rodríguez, 2012; Hashem, 2014).**

• Mesially positioned maxillary molars in Pseudo Class I cases **(Carrière, 2004; Colville, 2012; Bowman *et al.*, 2015).**

• Class I cases with premaxillary hypoplasia **(Carrière, 2004).**

• Improving facial esthetics in Class I cases with hypoplastic maxilla **(Rodríguez, 2012).**

• Unilateral maxillary asymmetries **(Colville, 2012).**

• Crowding in the maxillary anterior segments in Class I cases **(Rodríguez, 2012).**

• It is indicated as a starter of a case in phase one treatment to obtain a Class I Platform **(Carrière, 2018).**

• In Class II and Class I with 4 extractions proposal, in which extractions in the maxilla might have a negative impact in the nasolabial angle with a retruded upper lip, extractions can be avoided in the maxilla to accomplish a more aesthetic facial result **(Carrière, 2018).**

• Class II subdivision malocclusion, a 3mm open bite **(Rodríguez, 2012).**

1.7.2. Indications of CMA class III

• Phase one Nonsurgical Correction Severe Skeletal Class III Malocclusion **(Carrière, 2016).**

• Class III dental malocclusion **(Carrière, 2016, Cantor, 2018).**

• Class III deep bite **(Carrière, 2016).**

1.8. Contraindications of Carrière Motion Appliance

• Excessive lower facial height (wedging effect) or a high mandibular plane angle **(Singhal *et al.*, 2013; Agarwal *et al.*, 2018; Naidu and Suresh, 2018; Vijeta *et al.*, 2019).**

• Patients with a severe arch length discrepancy **(Singhal *et al.*, 2013; Naidu and Suresh, 2018).**

• Patients with class I molar relation **(Agarwal *et al.*, 2018).**

• Skeletal open bite **(Agarwal *et al*, 2018; Vijeta *et al.*, 2019).**

• Unfavorable or vertical growth pattern **(Chandra *et al.*, 2012).**

• Maxillary or mandibular first molar distally inclined **(Premkumar, 2015).**

• Severe Class II skeletal pattern **(Premkumar, 2015).**

• Dental open bite **(Singhal *et al.*, 2013; Premkumar, 2015; Agarwal *et al.*, 2018).** Convex profile **(Sfondrini *et al.*, 2002; Premkumar, 2015).**

• When the distance between distal surface of the upper first molar to PTV line is less than normal. This may contraindicate distalization of the molars as there's no sufficient space for distalization and extraction may be necessary **(Karad, 2015; Premkumar, 2015).**

1.9. Advantages

• It is easy to perform oral hygiene procedures because it's only bound to the molars and canines, leaving the premolars free **(Carrière, 2004).**

• It's a nickel-free appliance, which makes it a good choice for nickel-allergic patients, and it's sometimes made from Ceramic **(Pardo and Cobo, 2006).**

• Because it is small and comfortable, patients are more likely to accept it **(Pardo and Cobo, 2006).**

• Another advantage of this appliance is that the patient's profile stays less challenged. It provides a simple, noninvasive Class II therapy with automatic movement that does not require wire replacements or regular activations **(Carrière, 2006).**

• When traction is used in conjunction with fixed appliance treatment, Sagittal first reduces competing force vectors that are present in traditional methodologies **(Rodrguez, 2011).**

• The CMA is also more effective than an open-coil spring at controlling first molar derotation. It rotates the maxillary first molar around its palatal root while producing bodily distal movement, prior to the placement of any other appliances that could potentially slow treatment due to competing forces **(Rodríguez, 2011).**

• When compared to Forsus Fatigue Resistant Device, it is more comfortable, provides a more positive overall experience, and has less negative comfort-related side effects **(Hamilton *et al.*, 2013).**

• It has an intrusive effect on the maxillary molars **(Hashem, 2014).**

• Its simplicity in bonding and activation without the need for laboratory procedures **(Hashem, 2014).**

• It has a high level of patient acceptance **(Hashem, 2014).**

• The lack of need to make regular appliance activations and leaving the upper incisors free without bonding **(Hashem, 2014).**

• Dividing the treatment objectives is the ability to treat malocclusion in two periods. Sagittal correction can be achieved in Phase I, and dental discrepancies can be addressed in Phase II using fixed appliances **(Rodrguez, 2019).**

• Sagittal stability after treatment for at least five years **(Rodrguez, 2019).**

• The shortened period of elastic wear and overall treatment time were two major advantages of CMA treatment **(Kim-Berman *et al.*, 2019).**

• Schoolwork and relationships with family and friends were unaffected by the appliances. Both musical and sporting activities were unaffected by the appliances **(Quinzi *et al.*, 2020).**

• After treatment, the masseter and temporalis muscles activity improves **(Ahmed *et al.*, 2020).**

• When compared to Invisalign treatment alone, the combination of distalizer pretreatment and Invisalign therapy reduced treatment time **(Schupp *et al.*, 2010).**

1.10. Effect of Carrière Motion Appliance on airway diameter

Mandibular deficit, which is observed in patients with class II skeletal malocclusion, may be a factor in reduced oropharyngeal airway dimensions and subsequent altered respiratory function **(Murat zbek *et al.*, 1998).**

Patients with a Class II malocclusion had a narrower oropharyngeal and hypopharyngeal space than patients with a Class I first molar relationship. In children with Class II malocclusion without retrognathia, cervical headgear treatment enhances retropalatal airway space but has little effect on the rest of the oropharynx or hypopharynx **(Kirjavainen *et al.*, 2007).**

According to studies, extraction with maximum anchoring reduces the effect

on the middle and inferior airway diameters (**Germec-Cakan *et al.*, 2011).**
When compared to children with a class I occlusion, children with a class III occlusion have larger oropharyngeal airways **(Iwasaki *et al.*, 2009).**

The cross-sectional areas of the lower part of the pharyngeal airway and the volume of the upper part of the pharyngeal airway were greater in skeletal Class III malocclusion patients than in Class I malocclusion **(Hong *et al.*, 2011).** CMA class II produces an increase in the total airway volume due to forward mandibular repositioning action, which may be beneficial in treating sleep apnea that associated with class II patients **(Attia *et al.*, 2019).**

In skeletal Class III malocclusion patients, the cross-sectional areas of the lower part of the pharyngeal airway and the volume of the upper part of the pharyngeal airway were greater than in Class I malocclusion patients **(Hong *et al.*, 2011).** CMA class II causes an increase in total airway volume due to forward mandibular repositioning action, which may be advantageous in treating sleep apnea in class II patients **(Attia *et al.*, 2019).**

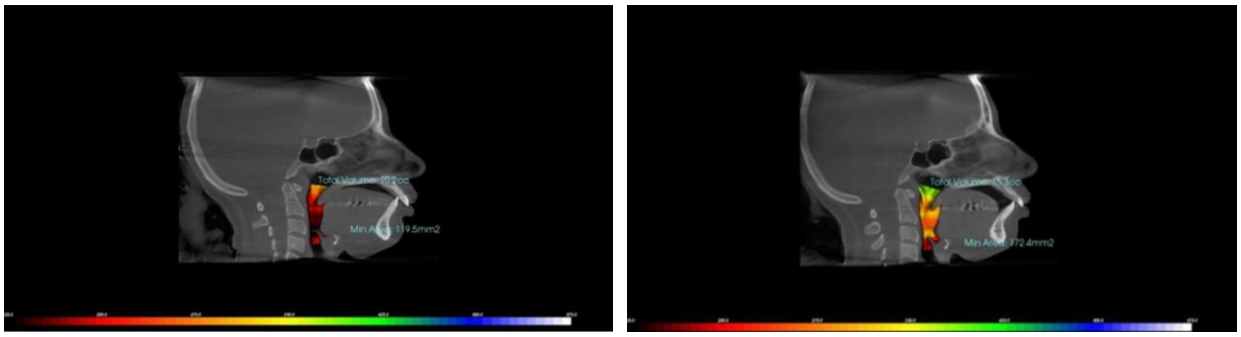

Fig. 14: Computed tomography evaluation of airway volume changes before and after treatment with Carrière motion II appliance (Attia *et al.*, 2019).

1.11. Disadvantages

• Although class II and class III elastics are a type of non-compliance therapy, they still rely on patient compliance **(Zaher and Kassem, 2014; Hashem, 2014; Cobourne and DiBiase, 2016).**

• Toothache, wide opening difficulties, aching jaws, difficulty keeping the device clean, and soreness on the lip/cheek from rubbing against the device are all possible side effects **(Quinzi *et al.*, 2020).**

• The most common side effect is difficulty in eating, which gets better with time **(Hamilton *et al.*, 2013).**

• Unless an absolute skeletal anchoring is applied, loss of anchorage is indicated by lower molar mesialization and lower incisors proclination **(Hashem, 2014; Quinzi *et al.*, 2020).**

• Extrusion of the lower incisors and upper molars is caused by Class III elastics, which results in an increase in the patient's lower facial height and a shallow overbite, which may be esthetically unacceptable in patients with proclined upper incisors and a dolichofacial pattern **(Chung *et al.*, 2005).**

1.12. Elastic protocol and Patient instructions

1.12.1. Elastic protocol of CMA Class II (Carrière, 2019)

Force 1 elastics (6 oz, 1/4) should be used during the first month when the appliance is bound to the first molar and canine, and Force 2 elastics (8 oz, 3/16) should be used after the first month for the standard protocol. When the appliance is bonded on the upper 4 and 6 and the buccal tube is bonded to the lower 7, the recommended protocol is to use Force 1 elastics (6 oz, 14) for the first month and then Force 2 elastics (8 oz, 3/16) after that if the canine is blocked out, high, or buccally displaced. We should utilize Force 2 elastics (8 oz, 3/16) throughout the

first month and even after that if the buccal tube is bonded to the lower 6.

We use 2 oz, 1/4 for the first month, 4 oz, 1/4 for the third and fourth months, and 4 oz, 1/4 or 6 oz, 1/4 for the fifth and sixth months in mixed dentition cases where 2/3 of the deciduous canine's root must be available. If there is no movement after three months of following the standard protocol in Class II Division II high-bone density patients, double up Force 1 and Force 2 elastics (6 oz, 1/4 & 8 oz, 3/16) in the first month-night. Single wear of Force 2 elastics (8 oz, 3/16) should be done on the first month's day, and single wear of Force 2 elastics (8 oz, 3/16) should be done on the second month's day, and so on, until the case is finished.

1.12.2. Elastic protocol of CMA Class III (Carrière, 2019)

Use 6 oz, 1/4 (Force 1) elastic throughout the treatment when the appliance is bonded to the lower first molar and lower canine in the usual procedure. The elastic will run from the 1st Lower premolar to the upper first or second molar in shorty cases.

Use 8 oz, 3/16 (Force 2) elastic throughout the treatment for CMA on lower 4 to 6 with buccal tube on upper 6, and 6 oz, 1/4 (Force 1) elastic throughout the treatment for Motion Lower 4 to 6 with buccal tube on Upper 7 **(Carrière, 2019).**

1.12.3. Patient Instructions

Class II and class III elastics when used with CMA should be worn 24 hours a day, except during meals, in low-angle cases with good perioral muscular strength. Elastic wear can be limited to 14 hours a day, including sleeping hours, in high-angle cases with lighter perioral musculature. The elastics should not be worn while chewing because of the vertical force vector produced by these movements **(Carrière, 2004, Singh *et al.*, 2017).**

Some patients may experience mild discomfort for the first three to five days

after initial elastic activation. Once the initial discomfort subsides, however, it should not return. The patient may be instructed to use chewing gum for the least amount of time to relief soreness associated with orthodontic treatment **(Benson *et al.*, 2012, Ireland *et al.*, 2016).**

Some clinicians recommend mild anti-inflammatory medications, but rarely **(Ngan *et al.*, 1994).** The patient should be instructed not to use the tongue to interfere with the distalizer's horizontal arm, because this could result in a lingual inclination of the upper premolars. Another habit to avoid is placing the tip of the tongue in the spaces created between the upper lateral incisors and canines during distalization. This will be indicated by a mild redness at the mesiogingival border of the upper canines. The patient's morale is boosted by the immediate appearance of a diastema between the upper incisors, showing the progress of distalization.

Avoidance of premolar extractions is a good bargain for a few months of cooperation with elastic wear **(Carrière, 2004).**

Chapter two: Discussion/Comments

Dr. Luis Carrière first invented the Carrière Motion appliance in 2004, with the goal of distalizing the whole posterior segment from the canine to the first molar using Class II and Class III intermaxillary elastics **(Carrière, 2004, Carrière, 2016).**

To correct Class II and Class III malocclusions, several treatment approaches have been tried, one of which is to distalize the maxillary or mandibular 1st molars without extraction.

The appliance is an advancement of the modular segmented arch technology. Although the Carrière distalizer has demonstrated impressive clinical effects, little scientific research has been performed to date to show the indications, contraindications, and biomechanics of CMA.

When compared to other intraoral distalizers like FFRD, the Carrière distalizer appears to be more comfortable, provides a more good overall experience, and has fewer negative side effects **(Hamilton *et al.*, 2013).**

This review discusses CMA's biomechanics, design, indications, contraindications, advantages and disadvantages.

This study also shows that CMA class II has an effect on airway dimensions by increasing total pharyngeal airway volume **(Attia *et al.*, 2019).**

Also, the review indicates the advantage of CMA class II in improving masseter and temporalis muscles activity after treatment **(Ahmed *et al.*, 2020).**

CMA allows for straight forward Class II correction prior to orthodontics (fixed or clear aligners) at a time when no other mechanics interfere, and compliance is at its best **(Rodríguez, 2011).**

Chapter Three: Conclusions and Suggestions

3.1. Conclusions

The following conclusions are reached based on the data analyzed:

- CMA developed by Luis Carrière in 2004, is an intraoral, small , fixed appliance used for treatment of class II and class III cases without extraction by moving the class II and class III buccal segment as a block unit into a class I occlusion.
- To eliminate undesirable tooth motions caused by the elastic traction, it requires anchorage in the opposing arch.
- Because of the extrusion induced by elastic traction, CMA is contraindicated in individuals with a high mandibular plane angle or excessive lower face height.
- One of the advantages of this CMA is small and comfortable and easy for bonding and activation without laboratory steps.
- CMA class II produces an increase in the total airway volume due to forward mandibular repositioning action, which might be beneficial in treating sleep apnea that associated with class II patients.
- One of the disadvantages of CMA are wide opening difficulties, toothache, aching jaws and difficulty in eating which improved over time.
- To avoid the vertical force vector created by these movements, Class II and Class III elastics should be worn 24 hours a day, except during meals.

3.2. Suggestions

- Previous studies have shown that the molar distalization technique is contraindicated for patients with dental open bite malocclusion because molar extrusion causes an increase in lower facial height. CMA class II, on the other hand, can be employed in open bite cases, according to **Rodrguez (2012).** To assess whether CMA is a beneficial method for open bite cases, more research and clinical trials are recommended.
- Make a research to compare CMA to other intraoral molar distalization appliances to see how easy it is to complete oral hygiene treatments when CMA is utilized, and to evaluate the differences between the appliances.

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